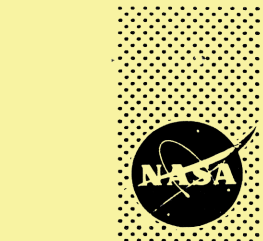
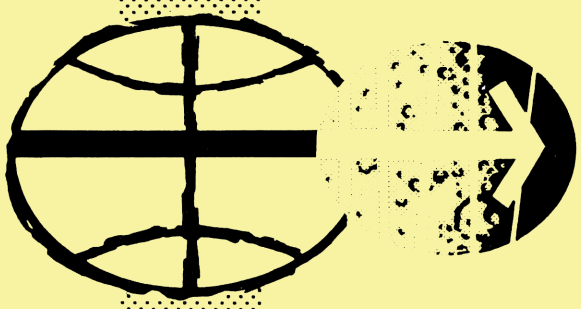


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APOLLO 13 MISSION COMMENTARY



MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

APRIL, 1970

APOLLO 13 MISSION COMMENTARY, 4-11-70, 11:43 a.m. CST 1/1

This is Apollo/Saturn launch control we're T minus 1 hour 29 minutes 57 seconds and counting. Finishing up at this time is the checks of the emergency detection system. Skip Shovan the test supervisor now also making some ... he's spacecraft test supervisor, making some checks with the various members of the launch crew inside the spacecraft. The boost protective cover has now come closed. This is the cover which will protect the spacecraft hatch both from the jettisoning of the launch escape system and also as it develops some friction as it goes up through the heavy earth atmosphere. The crew now as they prepare the boost protective cover will also be going around the white room doing what's called breaking up the white room or generally preparing it for retraction. Once the close-out crew departs the white room area that white room will be retracted to a stand-by position. It will remain in that stand-by position down through the countdown to the T minus 5 minute mark, at which time it will come back to the fully retracted position. Now T minus 1 hour 28 minutes 52 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo Saturn Launch Control, T minus 1 hour, 19 minutes, 58 seconds and counting. At this time the closeout crew has reported from the white room that they are in the last stages of clearing out the white room and making it ready for its retracted position. Also going on at this time are some computer checks with the launch vehicle, these computer checks will be run continuously throughout the final portion of the countdown to insure that the ground computers are communicating properly with the corputers aboard the space vehicle. The launch crew has been having some problems with a vent valve in the first stage of the liquid oxygen tank as mentioned earlier, the liquid oxygen as it does boil off, is vented to the atmosphere. One of these vent valves appeared to be sticking; that problem now does appear to be solved and it has been brought closed. Now at T minus 1 hour, 19 minutes, 8 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo/Saturn Launch Control T minus 1 hour 9 minutes 59 seconds and counting. At this time in the command module, Odyssey, the three crewmen, spacecraft commander Jim Lovell, command module pilot Jack Swigert, and lunar module pilot Fred Haise are very busy. The spacecraft commander and command module pilot are configuring the stabilazation and control system for liftoff and alining that system with the guidance platform aboard the spacecraft. Also going on at this time is a check of the large propulsion system engine below the service module. This engine can be gimbaled in response to commands. This is done in two ways and these systems are being checked out at this time. There is a thumb-wheel control which can set the engine to a preset position for certain maneuvers and also a rotational hand controller which can be used for the actual flight of a maneuver. These checks are being made now, the engine being gimbaled as spacecraft commander Jim Lovell indicating the position that he is putting these to and readouts are being made to insure that the engine is gimbaling a proper response. Also at this time a final checkout by the crew of the entry monitoring system, also a final setting of this system. Our countdown proceeding well at this time, T minus 1 hour 8 minutes 40 seconds, this is Kennedy Launch Control.

END OF TAPE

APOLLO 13 STATUS REPORT, 4/11/70, 12:13 PM, CST MC 4

This is Apollo Saturn Launch Control. We're just passing the 1 hour mark in our countdown. Now in the final hour of the countdown toward the launch of Apollo 13. The close-out crew has now left the white room area. They'll be standing by for the retraction to the 12 degree position of swingarm number 9. We've received word from the distinguished guest site that the stands over there are near capacity with some 4500 guests in the area. The Vice President of the United States, Spiro Agnew and Chancellor Willie Brandt, his special guest, have arrived in the area, although they are not at the stands yet. Out on the causeway, on a guest site, we have 7000. This is the largest guest number that we have ever had on our causeway site. To recap our countdown, which has gone - preceded very well today - we resumed the count after a 9 hour and 13 minute hold at 4:13 A.M. this morning. At that time the cryogentic loading began. This is loading aboard the extremely cold liquid oxygen and liquid hydrogen. Liquid hydrogen is a fuel for the second and third stage, liquid oxygen the oxidizer used on all 3 stages. RP or rocket perpellant number 1 is the fuel used in the first stage. It is a kerosene type fuel and was loaded before the countdown demonstration test back in mid March. The cryogenic loading went well. There is over 800 000 gallons of cryogenics loaded aboard the Saturn V vehicle at this time. We entered a 1 hour build in hold, this is a planned hold at the T-minus 3 hour and 30 minute mark. The crew was alerted this morning shortly before 9:00 A.M. by Colonel Tom Stafford, Chief of the Astronaut office. They then proceeded for a short but brief medical examination by Dr. John Teegen and Dr. Alan Harter. They were pronounced in good shape and ready for their flight. They then had the traditional breakfast of steak and eggs, tenderloin steak, eggs, orange juice, coffee, jelly and toast. After a brief mission briefing, they donned their space suits and took the 8 mile trip in a transfer van to the pad area. They have now been in the spacecraft going through a variety of tests and checks, going over all their switch lists and so on. Our weather at this time is better than had been predicted earlier. We're still looking for some clouds to move into the area and will be expecting a temperature of approximately 80 degrees at our launch time. We continue counting down toward a launch time of 2:13 P.M. EST. Now at T-minus 57 minutes 15 seconds and counting this is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo/Saturn Launch Control T minus 55 minutes and counting, T minus 55 minutes and counting and the countdown continues to go well here at the Kennedy Space Center. The closeout crew has now left the white room, we are standing by for the retraction of the swing arm, swing arm number 9. That's actually scheduled to come at the 43 minute mark in the countdown. However, the closeout crew did leave somewhat early so that event could come a little bit earlier than scheduled. Now we'll go to the Manned Spacecraft Center in Houston, Texas for a status.

MCC This is Mission Control, Houston. At the present time the flight controllers here in Mission Control are monitoring the countdown and the status of the crew, the launch vehicle, and the spacecraft. The world-wide manned space flight network is up ad ready to supportthe launch. We do have a problem with the Vanguard tracking ship down in the Mid-Atlantic. A tracking data processor, we understand, is down on the Vanguard and we will not get high speed radar tracking unless this problem is cleared up. The Vanguard is a desirable element of the tracking network, but is not essential, and we ar GO to continue the launch with that problem. Just a few minutes ago, Ken Mattingly, who until a few days ago was the prime command module pilot for Apollo 13, arrived in Mission Control and Ken will be assisting at the CAPCOM console and he's joined astronaut John Young and astronaut Joe Kerwin on the CAPCOM console. As he arrived in Mission Control, Flight Director Milton Windler greeted him and said, "Sorry to see you here, Ken." This is Mission Control, Houston, at T minus 53 minutes and 20 seconds.

END OF TAPE

This is Apollo/Saturn launch control. T minus 49 minutes 58 seconds and counting. At this time we're making some preparations for rain safety command system checks. The checks of the system aboard the launch vehicle which could be used by the rain safety officers to destroy the vehicle should it stray off it's intended course. The destruct actions of course would not be taken until the astronaut crew had been advised and were safely away from the vehicle. We're also standing by to wait for swing arm 9 to retract. That should be happening within the next 5 or 10 minutes. The countdown continuing to move along nicely in the last hour now T minus 49 minutes 20 seconds and counting. This is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo/Saturn Launch Control T minus 45 minutes and counting, T minus 45 minutes and counting. Steps are now underway for moving the swing arm back to the 12 degree or park position. Launch site recovery forces have called in at this point and have indicated they are on station and ready to support the launch of Apollo 13. The prime crew inside the spacecraft at this time, left the Manned Spacecraft Operations Building at Kennedy Space Center at 11:07 AM EST this morning on their way out to the pad. They took the 8 mile trip in the transfer van, went up to the white room level where spacecraft commander Jim Lovell was the first one to board the spacecraft at 11:32 AM. He was followed by the lunar module pilot who moved in, Fred Haise moved into the right-hand seat at 11:32. The command module pilot stood by in the elevator with a suit technician, was the last one to come aboard. He came aboard at 11:44 AM EST. We are now standing by for retraction of the white room. That should occur in approximately 47 seconds. When it comes back, it will come back in a 12 degree or standby position. From this position it cam be quickly brought back to the command module if there is a need for the crew to egress or if we need to get a team in to the crew. At the T minus 5 minute mark in the countdown, the swing arm number 9 will come back to the fully retract position and it will then stay in the fully retract position throughout the launch. Once the white room has been moved back to the 12 degree position, the launch escape tower above the command module will be armed. Now standing by for the movement of the swing arm 9, some 5 seconds from this time. T minus 43 minutes and counting, and swing arm 9 should be coming back. Swing arm 9 moving back now to the 12 degree position is about some 10 feet now from the spacecraft. We now have word that the Vice-President, Spiro Agnew, and the Chancellor of West Germany, Willy Brandt, have arrived at the distinguished guest site. At T minus 42 minutes 31 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo Saturn Launch Control at T minus 39 minutes, 57 seconds and counting. At this time the command destruct system tests are now underway with the launch vehicle team. The launch escape system above the command module has now been armed and that escape system now would be capable of lifting the command module free of the launch vehicle should a problem arise. A correction to the last announcement - the Lunar Moudle Pilot Fred Haise entered the spacecraft at 11:38 AM Eastern Standard Time this morning. Our countdown proceeding at this time, T minus 39 minutes, 24 seconds and counting. This is Kennedy Launch Control.

END OF TAPE

This is Apollo Saturn Launch Control at T-minus 34 minutes 58 seconds and counting. At this time the rain safety command checks have just been completed. Preparations are now under way for the power transfer tests. This is a critical test to insure that the power can be transferred from the external source, which we have been using to conserve on batteries, to insure that the power can be successfully transferred to the batteries aboard the space vehicle and that the systems are go on the space vehicle batteries. Now at T-minus 34 minutes 30 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo Saturn Launch Control as we move into the final half hour of our countdown - T minus 29 minutes, 56 seconds and counting. The Brevard Sheriff's Department of Brevard County, Florida has reported that along route 1, the closest major highway to Kennedy Space Center, there are some 100 000 people and some 25 000 cars parked watching for the launch of Apollo 13. Along the Indian and Banana Rivers it is reported that the - both rivers are literally filled with boats and spectators standing by to watch the launch. A private airport in Brevard County also reports some 500 private planes have landed and are parked at the airport. Our countdown continuing now, the power transfer test under-way, T minus 29 minutes, 13 seconds and counting - this is Kennedy Launch Control.

END OF TAPE

This Apollo/Saturn launch control we're at T minus 25 minutes and counting, T minus 25 minutes and counting. And that critical launch vehicle power transfer test has been successfully completed. The lunar module will remain on internal power for approximately 10 minutes while the lunar module is thoroughly checked out. It will then be deactivated and won't be reactivated again until the men enter the lunar module on their trip to the moon. As the Apollo/Saturn V sits on the pad at this time it's two hundred and fourteen thousand three hundred and sixty nine nautical miles from its destination - from their destination, the moon. Now T minus 24 minutes 20 seconds and counting, this is Kennedy launch control.

END OF TAPE

PAO This is Apollo/Saturn Launch Control at T minus 19 minutes 59 seconds and counting. Now passing the 20 minute mark in our countdown and the spacecraft test supervisor has indicated they are running just slightly ahead of that in their countdown. The command module pilot, Jack Swigert, is now pressurizing the service module reaction control system. This is the system on the service module which consists of 4 quadrants with 4 engines each. Each one of these developes 100 pounds of thrust. He is arming these systems by letting the hypergolic fuels, these are monomethyl hydrazine and nitrogen tetroxide, flow down through the system, down to the final valve. Hypergolic fuels ignite on contact, so once those final valves are open they would ignite and the system would be activated. Swigert also reading out the temperatures and pressures of that system. The countdown moving along well at this time, T minus 19 minutes 4 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

This is Apollo Saturn Launch Control passing the 15 minute mark, T-minus 14 minutes 57 seconds and counting. Chill down of the second stage or F2 stage start tanks is in progress. This is necessary to prepare those start tanks for the flow of the liquid hydrogen and liquid oxygen. The S2 or second stage will ignite at some 2 minutes 42 seconds into the mission if all goes as planned. The crew has been relatively quiet answering the spacecraft test conductor Skip Shauvin in terse business like manner as he questions them on certain switches and checks. In the distinguished guest site, the Vice President Spiro Agnew, the Chancellor of West Germany Willie Brandt and a Secretary of State Rogers, all with a large crowd over there awaiting the launch of Apollo 13. Our countdown continuing to go well at this time. The spacecraft is now going to full internal power where up to this point it's been sharing it's power load with the fuel cells aboard the spacecraft with an external power source. Also being carried out at this time is a astrocomm launch circuit check. This is the circuit that is used by the astronauts. The spacecraft test conductor and launch operations manager and the CAPCOM Stoney or Paul White here during the launch phase of the mission. Now T-minus 13 minutes 33 seconds and counting. This is Kennedy Launch Control.

END OF TAPE

PAO This is Apollo Saturn Launch Control at T minus 9 minutes, 58 seconds and counting. The third stage start tanks are now beginning their chill down. Third stage scheduled to ignite at 9 minutes, 22 seconds into the mission. Also going on at this time is one of the computer checks which are carried out throughout the final portion of the launch. This particular one is a checkout of the launch vehicle digital computer to ensure that it is ready for launch. A final check of the weather indicates that earlier worries about the weather have come to naught, weather looks good and is satisfactory; presents no constraint to our launch. Now at T minus 9 minutes, 25 seconds and counting, this is Kennedy Launch Control.

END OF TAPE

This is Apollo/Saturn launch control T minus 5 minutes 27 seconds and counting. Now as we move in to the final phase of the countdown we're receiving GO/NO GO checks from various elements of the launch team. The spacecraft test conductor Skip Shauvin gave the test supervisor a spacecraft ready. At that time on our large status board here in the firing room the green light came on behind the spacecraft. The green light now is also on behind the emergency detection system. Now standing by for more checks the mission director Chet Lee from the Manned Spacecraft Center in Houston says we are go for launch and the range indicates that the range is ready to support. Chill down of the SIV-B stage being completed at this time. SIV-B will ignite into the mission at 9 minutes 22 seconds. Swing arm number 9 now is retracting to the full retract position. Swing arm number 9 coming back to the full retract position. And the director of launch operations Walt Kapryan has given Apollo 13 a go for launch. We are now approaching the four minute mark. At the T minus 4 minute mark we'll be standing by for Jack Baltar the launch vehicle test conductor to say that his launch vehicle team is ready to carry out the final phase here of the countdown. At the T minus 3 minute 7 seconds mark we will get the ignition sequence start. This will put us on an automatic sequencer and the remainder of the count from that time will be on automatic. The sequencer can check out literally hundreds of items in the space vehicle at the same time the team here in the launch control center will be monitoring redline values. These are such things as temperatures and pressures which we do not want to either go above or below. A final communications check now. The astronauts on the astrocomm circuit and launch operations manager Paul Donnelly during his final check said, "Good luck, head for the hills. " He was referring to the Fra Mauro, hilly Fra Mauro region of the moon. As we come up on the T minus 3 minute mark at 3 minutes, the capsule communicator Paul White will begin reading out the minus times to the crew. Looking up at our status board now, we can see that the spacecraft ... or the first stage preparations are now complete. The firing command has now been initiated. This is the automatic sequencer and we have a confirmation on our status board that the launch sequence has started. We're now in our final 3 minutes of the countdown. Two minutes 56 seconds and Apollo 13 continues to be go. The astronauts still reporting back from the spacecraft Odyssey. Spacecraft commander Jim Lovell says Odyssey is GO. He will be the last one to perform a function here during the countdown at the T minus 45 second mark the commander Jim Lovell will set the final alignment of the spacecraft guidance and that's

the last crew action before the liftoff of Apollo 13. We continue to aim for a lift off at 2:13 p.m. EST. Now T minus 2 minutes 18 seconds and counting. And our count continues to look good. Our weather is no constraint to launch today. Earlier fears about the weather seem to have dissipated. A stationary front over the Florida-Georgia border has not sent down the predicted bad weather that we had feared. We just passed the two minute mark - just passed the two minute mark in the countdown and the pressurization now of the vehicle tank is beginning. The third stage liquid oxygen tank has now been pressurized and the second stage liquid oxygen tank has been pressurized. We'll be making our final transfer from external power source, that is from the external power source at the pad to the launch vehicle batteries at T minus 50 seconds mark. So we'll be keeping an eye on that power transfer at T minus 50 seconds. The SIV-B propellants now all pressurized. SIV-B propellants, that's the third stage of the Saturn V pressurized. One minute 15 seconds and counting. The spacecraft equipment now is on it's own internal cooling. It's been sharing it's cooling from ... getting it's cooling from an external power source up til this time. We're now approaching the T minus 1 minute mark. T minus 1 minute, T minus 1 minute and counting. Now in the final minute of our countdown. At the 36 second mark, swing arm number 1 will retract. T minus 50 seconds as we pass the T minus 50 second mark power transfer takes place. First stage, second stage, third stage and the instrument unit going to internal power. T minus 37 seconds and our count continues to go well. We'll be looking for an ignition of those five first stage engines at the T minus 8 point (garbled) second mark. And counting ...

END OF TAPE

PAO - five first stage engines at the T minus 8.9 second mark. We have passed T minus 30. T minus 25 seconds and counting and Apollo 13 is GO. T minus 20 seconds. T minus 20 seconds and counting. 17 - Guidance Release - 15, 14, 13, 12, 11, 10, 9, 8, Ignition sequence has started - 6, 5, 4, 3, 2, 1, zero - we have commit and we have liftoff - at 2:13. The Saturn V building up to 7.6 million pounds of thrust and it has cleared the tower.

PAO This is Mission Control Houston. We appear to have a good first stage at this point. Flight Dynamics Officer says the trajectory looks good; we show a one half mile in altitude at this time.

CAPCOM 13, Houston. GO at 30 seconds.

SC Roll complete and we are pitching.

CAPCOM Roger that. Standby for Mode 1 Bravo.

CAPCOM Mark - 1 Bravo.

SC That's right; just come in.

PAO Altitude 1.2 miles; velocity 1500 feet per second.

CAPCOM 13, Houston. Go at 1; we show the cabin relieving.

SC Thank you; roger.

PAO And at 1 minute 10 seconds we show an altitude of 4.1 nautical miles; downrange 1 mile. All sources continue to report that we are GO; the trajectory on our plot board is right on the preplanned line. And the booster engineer reports we are now through the region of maximum dynamic pressure and we're GO.

CAPCOM 13, Houston. Stand by for Mode 1 Charlie.

CAPCOM Mark, you're 1 Charlie.

SC Mark - 1 Charlie.

CAPCOM And 13 - you are GO for staging.

SC Go for staging. Roger, we're EVS manual.

PAO Altitude now 17 miles, coming up on staging.

SC Inboard.

PAO Jim Lovell reports that the inboard engine has shutdown as scheduled.

CAPCOM We confirm inboard out 13 - you're looking good.

SC Roger.

PAO Coming up on 30 miles altitude.

SC S2 ignition.

CAPCOM Roger.

CAPCOM 13, Houston. Trajectory is good; thrust is good.

SC Roger.

PAO Capcomm Joe Kerwin confirming to the crew that the second stage looks good at this point; we are now 46 miles high, 70 miles - 78 miles downrange.

SC Power Jet.
CAPCOM We confirm skirt sep. Roger tower sep; mode 2 Jim, looking good.
SC Mode 2.
PAO Launch vehicle -
SC (static)
PAO And Lovell reports that the Guidance System is correcting the small errors.
CAPCOM 13, Houston. Guidance is good and the CMC is GO.
SC Okay, thank you. 13 Roger.
PAO Coming up now on 4 minutes. We are now at an altitude of 63 miles. At 4 minutes, 15 seconds, the trajectory -
CAPCOM 13, Houston; you are GO in 4 minutes, so the little red lines are right on the little white lines down here.
SC Sounds good.

END OF TAPE

PAO Velocity now up to 11000 feet per second. That's about 36 percent of the amount needed for a minimum orbit. We're now 75 miles in altitude.

PAO 222 miles downrange now. The E COMM reports -

CAPCOM - 5 minutes, you're looking perfect. Over.

SC 13, Roger.

PAO And E COMM reports that cabin pressure is sealed at 6.1 pound, which is normal. We are now 250 miles downrange, altitude 81 nautical miles.

PAO And at 5 minutes 30 seconds into the launch we continue to look very good on the second stage. Jim Lovell just reported the inboard engine has shut down as scheduled.

CAPCOM 13, Houston. Stand by for S-IVB to COI capability.

SC S-IVB to COI, roger.

CAPCOM Roger, you've got it now, Jim.

SC We've got S-IVB to COI.

PAO That booster reports that the inboard engine shutdown was a bit early. We are continuing to burn on the 4 outboard engines.

CAPCOM 13.

SC Go to third.

SC And Houston, what's the story on engine 5?

CAPCOM Jim, Houston. We don't have the story on why the inboard out was early, but the other engines are GO and you are GO.

SC Roger.

PAO At 6 minutes 40 seconds -

CAPCOM Still looking good, your gimbals are good, trim is good.

SC Roger.

CAPCOM 13, Houston. Level sense arm time 8 plus 38 nominal, S2 cutoff time 9 plus 48. Over.

SC Roger, nominal on the level sense arm, 948 on the S2 cutoff.

CAPCOM That's affirmative, and standby for S-IVB to orbit. MARK. You have S-IVB to orbit, Jim.

SC Roger, we have S-IVB to orbit.

PAO We still have 4 good engines on the Saturn second stage. We show an altitude of 96 nautical miles, 545 downrange.

PAO And at 7 minutes 45 seconds booster reports we are GO, all 4 engines remaining are looking good.

PAO the early shutdown on the center engine would cause no problem. We would burn a little bit longer than normally scheduled -

CAPCOM - Houston, looking good at 8 minutes.

SC 13, roger.

PAO And at 8 minutes 17 seconds we show a velocity of 18 000 feet per second, that's about 71 percent of the amount needed for minimum orbit.

PAO At 8 minutes 35 seconds continuing to burn on the second stage, all 4 remaining engines looking good at this point.

CAPCOM Apollo 13, Houston, mark level sense arm.

SC Mark level sense arm, roger.

CAPCOM Apollo 13, Houston. At 9 minutes you are GO, The CMC is GO.

SC Okay, Joe.

SC 13, Roger.

PAO Our predicted shutdown time on the second stage is 9 minutes 48 seconds. Flight Director Milton Windler getting a staging status now from his flight controller.

END OF TAPE

PAO 48 seconds, Flight Director Milton Windler, getting a staging status now from his Flight Controllers.

CAPCOM 13, Houston. You are go for staging.

SC 13 Roger. Go for staging.

CAPCOM Apollo 13, Houston. Standby for mode 4 capability. Mark. You have mode 4, Jim.

SC Mode 4, Roger.

SC Staging

PAO And Lovell reports staging.

SC And S4 ignition, Houston.

CAPCOM Roger. That GM thrust looks good.

SC Roger.

CAPCOM 13, Houston. You're looking good. Trajectory guidance CMC are all GO.

SC Thank you Joe.

PAO And at 10 minutes 30 seconds, we are now at an altitude of 1080 miles down range.

CAPCOM 13, Houston. At 11 minutes you're GO. Predicted cutoff on the S4B is 12 plus 34. Over.

CAPCOM Apollo 13, Houston. You're GO at 11-1/2 and predicted cutoff time is 12 plus 34. Over

SC Understand.12 plus 34 predicted cutoff time.

CAPCOM That's affirm.

PAO Coming up on 12 minutes. Still looking good.

PAO We're standing by for a crew report on the third stage shutdown.

SC SECO

CAPCOM Copy. SECO, Jim. We're looking at the DSKY.

SC Roger.

PAO And the Flight Dynamics officer says at first glance we look good on the orbit.

CAPCOM Apollo 13, Houston. You have a GO orbit, all sources and the booster is safe. Over.

SC GO orbit and the booster is safe. Thank you Joe.

CAPCOM Don't mention it.

CAPCOM 13, Houston. We copy your NOUN 44.

SC Okay, Joe.

PAO The booster engineer reports at this time that the S4B third stage looks good. Being configured now for orbital operations. We're standing by for a confirmation from the Flights Dynamics Officer about our preliminary orbit.

END OF TAPE

CAPCOM Apollo 13, Houston. Your preliminary orbit down here is 102. 5 times 123 and everything is looking good.

SC Roger Houston, and it looks good to be up here again.

CAPCOM I'll bet.

CAPCOM 13, Houston, I have your Z torquing angles; you ready?

SC Ready to copy.

CAPCOM Okay, its plus decimal 26; over.

SC Okay, Joe, plus .26.

CAPCOM That's roger.

PAO This is Mission Control at 17 minutes. We have had loss of signal with the spacecraft. We'll be reacquiring shortly through the Canary Island Tracking Station, The total burn duration on the 3rd stage was about 45 seconds longer than planned; we would not expect at this point that this would have any serious effect on the translunar injection. The fact that we did consume a bit more propellant out of the third stage than was originally planned. We are standing by now for acquisition of signal through the Canary Island Station. We should be reacquiring radio contact with the spacecraft shortly.

PAO This is Apollo Control; we are still standing by for any conversation with the spacecraft over Canary Islands. The booster systems engineer reports that at this point he has no explanation for the early shutdown of the S2 - Saturn second stage - center engine.

SC Go ahead Houston.

CAPCOM Okay, couple minutes to LOS Jim; everything is looking real good. Your AOS time at Canarvon will be 52:36, and we don't have too much of a handle on why the inboard cut off early except that it apparently was an engine problem and not a switch select function. But we are certain that you'll be able to make TLI based on what we are looking at now.

SC Roger (garble) launch.

CAPCOM That's right. Apollo 13, Houston. Canary LOS at 30 seconds, request coming in RESET please.

SC Roger. Canary (garble)

CAPCOM Thank you.

CAPCOM Apollo 13, Houston. Request low bit rate please, over.

SC Low bit rate.

PAO This is Apollo Control; we have had LOS now with the spacecraft at the Canary Island Tracking Station; we won't reqcquire again until the spacecraft reaches the tracking station at Canarvon Australia. That will be at a ground elapsed time of 52 minutes, 36 seconds. Recapping -

PAO at the time we lost contact with the spacecraft through Canary Islands, we looked to be in very good shape for the Translunar Injection Burn, with the Saturn 3rd stage. The second stage center engine shut down about 2 minutes early; the total overburn time on the third stage was about 10 seconds, but we don't expect that this will have any affect on the translunar injection. At 25 mintues, 20 seconds, this is Mission Control Houston.

PAO Firing Room 1 at the Launch Control Center at Kennedy Space Center; the Vice President of the United States and Chancellor Willie Brant are now entering the firing room; they are making their way up to the management level of the firing room where they will be greeted here by the senior members of the launch team. Dr. Kurt H. Debus, the Director of Kennedy Space Center now shaking hands with the Chancellor; behind Dr. Debus is NASA Administrator Dr. Thomas O. Paine. Dr. Thomas O. Paine now taking the microphone and he - is going to hand that - it looks like - to the Vice President. He first is going to address the team here at the control center.

PAINE Ladies and Gentlemen: Ladies and Gentlemen: Can you hear me back there all right? (much static)

END OF TAPE

AGNEW and the culmination of the efforts of man to improve his destiny is probably greater in this program than anything we've ever turned our national attention to, and I can assure you that we appreciate that very much. Again, it's a pleasure to be with you and congratulations again on your outstanding accomplishments.

KING May I now introduce his excellency, the Chancellor of West Germany.

BRANDT Thank you very much. Mr. President, I just wanted to say that I feel honored and deeply grateful to have been invited to the launching of Apollo 13 and to have this opportunity not only to extend my personal good wishes for the successful journey to the astronauts, but also to congratulate all those of you, those who are here and many others in this great country who have prepared and are actively involved in this project. This is already the fifth time that men are about to leave, or have left as a matter of fact, for the moon. For that no less daring an undertaking and no less exciting to anyone who had the privilege of watching it. In Germany, and I'm surein all of Europe, people will follow this trip with the same keen interest and the same emotion as everybody in the United States. You here, gentlemen, together with all your colleagues, indeed are going in peace for all mankind and on behalf of all my countrymen, I wish that this not only will be a successful trip and a safe return, but further progress for mankind. Thank you very much.

KING Your Excellency, we in the American space program very much appreciate your kind words. We would like to give you a memento of your visit to Cape Kennedy to witness the launch of Apollo 13. We thought that a Saturn V rocket would be the appropriate memento, but it was too large to get into your airplane, so we have a somewhat smaller version here which we hope that you will take with you as a reminder of the successful launch of Apollo 13.

PAO This is Mission Control Houston at 52 minutes. We'e standing by now for acquisition of signal and network controller reports we've just reacquired the spacecraft over the Carnarvon station.

SC Houston, how do you read 13?

CAPCOM 13, Houston, loud and clear.

SC Okay, Joe. Everything's going good. We're proceeding on the timeline in good fashion. I've got a P52 done. I can give you the torquing angles.

CAPCOM I'm ready for them, Jack.

SC Okay. Use NOUN 26, or star 26 and 33. The star angle difference was all balls, NOUN 93 minus 067 minus all balls, plus .162. The time of torquing was 45 minutes 35 seconds.

CAPCOM All well, that sounds marginally acceptable.

SC For a new CMP that had to do it.

CAPCOM Yes. Okay, 13, we've got nothing for you

CAPCOM at the moment. Everything's looking good, we're looking at your data now.

PAO This is Mission Control at 57 minutes 15 seconds. Not much conversation with the crew on this pass over the Carnarvon tracking station. Jack Swigert reported that the platform had been alined as called for in the flight plan. There is not a great deal of activity scheduled in the flight plan at this time. Flight Director Milton Windler has checked the status with his flight controllers and Capcom Joe Kerwin will be passing that up to the crew shortly.

END OF TAPE

CAPCOM Apollo 13, Houston. LOS Carnarvon in about 30 seconds. Honeysuckle on the hour and verify your S-band is up for Honeysuckle. Over.

SC That's verified.

CAPCOM Roger.

SC And Houston. We're beginning to see a beautiful sunrise here.

CAPCOM Roger that, Jim.

PAO We've had loss of signal now with the spacecraft through Carnarvon. Apollo 13 will be coming within range of the tracking antennas at the Honeysuckle Creek, Australia station in less then a minute. We'll stand by for reacquiring. And at 1 hour 10 minutes into the flight of Apollo 13, we should be reacquiring radio contact with the spacecraft through Honeysuckle Creek momentarily. Recapping briefly the situation during launch. We had a normal first stage burn. The second staging ignition was normal up through 5 minutes and 30 seconds at which time the inboard engine, engine no 5 shut down early. The center engine had been sceheduled to shut down at about 7 minutes 44 seconds ground elapsed time. The cutoff on the second stage was at about 9 minutes 48 seconds about 30 seconds early, and the total excess burn time on the third stage was about 10 seconds, Capsom Joe Kerwin has just put in a call to the crew. We've had acquissition of signal. We'll stand by for conversation with the spacecraft.

CAPCOM 13, Houston. Through Honeysuckle.

SC (garble) monitor.

CAPCOM Okay. S-band sounds good, Jim.

Go ahead 13.

SC Would it be okay if I crank up the FM (garble)

CAPCOM You're coming in weak. I didn't quite copy it.

SC Would it be okay, Joe, if we crank up the FM after we leave Honeysuckle?

CAPCOM Oh. Stand by on that one.

CAPCOM 13, Houston.

SC Go ahead Houston.

CAPCOM What TV was that?

CAPCOM Okay 13 -

SC Listen, Joe. I just wanted to put on the TV switch at Honeysuckle to tune her up there.

CAPCOM Roger. I'm being prompted, and you've got a GO for that. You can turn it on and go to TV and we'll see you that way over the states.

SC Okay.

CAPCOM Okay. 13, Houston. LOS Honeysuckle in about 30 seconds and we'll see you over the states at 1 plus 28 plus 43.

CAPCOM 13, Houston. Did you copy your AOS time?

PAO We've had loss of signal now from the spacecraft and at last look everything appeared to be normal with the spacecraft and the launch vehicle. We currently show an orbit of]03.2 nautical miles, actually, a correction on that,]02.6 by]06.3 and our current altitude is]03.2. We'll be reacquiring the spacecraft over the United States at ground elapsed time of] minute 28 seconds, 43 - 28 minutes 43 seconds at which time you heard the crew advise that they will be configured for the TV transmission which is scheduled to occur at about] hour 36 minutes over the Mila station. The Post Launch Press Conference is scheduled to begin shortly at Cape Kennedy. At 1 hour 7 minutes, this is Mission Control Houston.

END OF TAPE

PAO This is Apollo Control at 1 hour 28 minutes. We'll be reestablishing radio communications with Apollo 13 in about 40 seconds. As the spaceship comes within range of the Guaymas, Mexico tracking station. During the launch phase, the medic reports the following heart rates. These are maximum heart rates for the three crewmen. Commander Jim Lovell had a maximum heart rate during the launch of 116; the command module pilot Jack Swigert had a maximum heart rate of 102; and the lunar module pilot Fred Haise also had a maximum heart rate of 102. CAPCOM Joe Kerwin has just put in a call to the crew through Guaymas. We'll stand by.

CAPCOM Apollo 13, Houston through Guaymas. Over.

CAPCOM Apollo 13, Houston.

CAPCOM Apollo 13, Houston. Over. Apollo 13, Houston Over. Apollo 13, Houston. Over.

SC Go ahead.

CAPCOM Hello there. We thought you were still up there.

SC Yes, we're just coming up on Baja and I've got this TV on. You want it.

CAPCOM I don't think we require it just yet, Jack, but we'll command it when we're ready (garbled) the booster looks good, the spacecraft looks good and (garbled).

SC That sounds good.

SC Jim finally let me look out.

CAPCOM (Laughter) How'd you like it?

SC Chained me to the LEB down there stowing things and unstowing things and I finally got a hance to look out and see the world.

PAO That was Jack Swigert reporting, apparently his first view out the windows.

CAPCOM Apollo 13 Houston. I have the TLI plus 90, and liftoff plus 8 pads whenever you're ready.

SC Okay, go ahead with the TLI pad, Joe.

CAPCOM Okay. This is the TLI plus 90 pad. SPS G&N 63825 minus 154 plus 132 004 064553 minus 04917 plus 00001 plus 66340 180228 001 HA is N slash A. HP is plus 00179 66522 737 66265 261554 157. Bore sight star is Zeta Sagittarii UP 080 right 21. Minus 2281 minus 02500 11407 34087 0133214. Set stars are Arcturus, Denebola, roll 044 pitch 012 yaw 025. No ullage. Over.

SC Joe we had a dropout of signal there, midway or about a fifth of the start of your pad and Fred didn't get it. We'd like you to start over again, could you please.

CAPCOM Sure thing. You want the whole thing?

SC Yes I think you'd better.

CAPCOM Okay. TLI plus 90. SPS G&N. 63825 minus 15432

END OF TAPE

CAPCOM Minus 154, plus 132. 004 06 45 53 minus 04917 plus 00001 plus 66340 180 228001 N/A plus 00179 66522 737 66265 26 1554 157. Zeta Sagittarius UP 080, right 21, minus 2281, minus 02500, 11407 34087 0133214. Set stars are Arcturus, Denebola, roll 044, pitch 012, yaw 025, no ullage; over.

SC Okay, John its 63825 minus 154 plus 132. 004 06 45 53 minus 04917 plus 00001 plus 66340 -

CAPCOM Fred, Houston, over.

SC Go ahead.

CAPCOM That's correct. We would like you to go the S band TV switch to TV please.

SC Okay, its set to TV.

CAPCOM Okay - we're not getting a signal.

SC Okay, I'll go to transmit Joe.

CAPCOM Okay.

CAPCOM You can continue reading back.

SC Okay - roll 180, pitch 228, yaw 001, N/A plus 00179, 66522, 737, 66265, and mid sextant shaft trunnion - trunnion 157, Zeta Sagittarius and mid sextant shaft trunnion - trunnion 157, Zeta Sagittarius UP 080, roll 21, minus 2281, minus 00 - correction minus 02500, 11407, 34087, 013 32 14. Set stars are Arcturus, Denebola, roll line 044, pitch 012, yaw 025, no ullage.

CAPCOM Roger Fred; readback correct. The sextant star is 26 and the shaft is 1554. Over.

SC Okay. Sextant star 26 and 1554.

CAPCOM Roger and we have a picture now - however, its moving around quite a bit, if you could hold the camera a little steadier. And I have your -

SC Joe - they're nothing but clouds outside. And when we get some land down there coming up, I'll switch you back to the window, I thought I'd just show you Jim here, to make sure he's still here.

CAPCOM Okay, real fine. We had a good picture of Jim there for a minute; I have the liftoff plus 8 pad Fred, if you're ready.

SC Go ahead Joe.

CAPCOM Okay. GETI 00800 Delta VT 7835 longitude minus 165, GET 400 K, 02236; over.

SC Okay, 00800, 7835, minus 165, 02236.

CAPCOM Okay, and I have TLI pad for you.

SC -

END OF TAPE

CAPCOM Okay, that. And I have POI pad for you.
SC Okay. I'm ready.
CAPCOM TLI 22605 179 108 000 547 104169 35587 358 139 320 302 319 040. Ejection time 4 plus 01 plus 00. Over
SC Okay. TLI 2 plus 26 plus 05 179 108 000 5 plus 47 104169 35587 358 139 320 302 319 040 and ejection time 4 plus 01 plus 00.
CAPCOM Roger, Fred. Read back correct and we're getting a nice color TV picture now. If you have any commentary to go with it.
SC Okay, Joe. I'll tell you. I'm just trying to figure out where we are here.
CAPCOM That's your job not mine.
SC You know I've just been up out of the LEB for a short time here, and I'm trying to find out which country we're over. I have to keep telling Jack, the blue stuff down there is water.
CAPCOM I'll give you a hint. You're in the western hemisphere.
SC Okay, Joe. It appears like that we've crossed out into the Gulf of Mexico here and I've got a peninsula or an island that's down there. I don't know whether you can see it or not.
CAPCOM Roger, Jack. We see that. Of course there's a lot of cloud cover and you see it more clearly then we do, but it does look like the earth, not the moon.
CAPCOM Apollo 13, Houston. We've had LOS MILA now.
SC Thank you very much.
PAO Of the southern coast of the United States, but we'll stay with it and perhaps we'll get a picture in a moment or so.
CAPCOM Apollo 13, Houston. Request P00 and ACCEPT for a state vector. Over.
SC Roger, Houston. We're in P00 and ACCEPT.
CAPCOM Okay.
CAPCOM Apollo 13, Houston.
SC Go ahead Houston.
CAPCOM Okay. The computer is yours Jim.
SC Thank you.
CAPCOM And you are GO for TLI. Huntsville reports that you have a 6 second propellant pad which is 3 seconds more then the 3 sigma case so you're good on consumables. The IU is so good that we're not going to update it. The only change we have for you is in the TLI checklist. At 57 minutes where you slew the FDAI to 18 degrees, we recommend 20 degrees there and we recommend that you look for 8 degrees instead of 6 degrees at ignition. The S4B is riding on the top of its deadband.

SC Understand. And I just out of curiosity. Was that engine out of S4B fuel?

CAPCOM The engine out did cause you to use more S4B fuel. About a 10 second longer burn, but you're still GO.

CAPCOM And 13 Houston. We're ready to support pyro arm and docking probe extension whenever you're ready.

SC Okay, Houston. Docking probe has been extended and all indications are nominal. We're down to pyro arm now and we're getting ready.

CAPCOM Okay Jim.

SC Okay, Houston. My circuit breaker arms are closed, essential logic 2 on and up and stand by

END OF TAPE

SC - logic 2 out and UP and we are - stand by (static)

CAPCOM Okay 13; you are GO for PYRO ARM.

PAO We have LOS now with the spacecraft with the Vanguard Tracking Ship; we will be reacquiring at the Canary Islands in just a few minutes.

SC (garble)

CAPCOM Roger 13; go ahead.

SC Roger - we have our residual circuit breakers in and our sequential logic 2 ON and UP and waiting for your confirmation for a GO.

CAPCOM Sorry 13 - you are GO for PYRO ARM; over.

SC Okay, fine, thank you.

CAPCOM Apollo 13, Houston.

SC Go ahead Houston.

CAPCOM About 2 and a half minutes to LOS Jim, and your AOS at Carnarvon will be 2 plus 25 plus 50; over.

SC Roger. We'll acquire Carnarvon 2 plus 25 plus 50.

CAPCOM That's affirm. Apollo 13, Houston, LOS in about 1 minute; had LOS light come in, reset and then normal.

SC Roger.

PAO We have lost contact now with the spacecraft through the Canary Island Tracking Station. We will be reacquiring in a little less than 30 minutes, at a ground elapsed time of 2 hours, 26 minutes, when the spacecraft comes within range of the tracking antennas at Carnarvon Australia. During the pass over the United States, out over the Atlantic, Cap Com Joe Kerwin gave the crew a preliminary go ahead for translunar injection. We have adequate propellant margins on the Saturn 3rd stage, and despite the some 10 seconds of additional burn getting into orbit due to the early shut down of the 2nd stage center engine. It is not expected that the somewhat later injection time will have any significant affect on the flight plan; the preliminary time for the beginning of the translunar injection burn is 2 hours, 35 minutes, 27 seconds - the Flight Dynamics Officer is in the process now of updating that time but we don't expect a significant change. At 1 hours, 57 minutes, 55 seconds, this is Mission Control Houston.

END OF TAPE

PAO This is Apollo Control at 2 hours and 25 minutes. Apollo 13 is now about 10 minutes away from the scheduled ignition of the S-IVB engine to start the spacecraft on its way to the moon. The Flight Dynamics officer advises that the planned time for the beginning of that burn will be 2 hours and 35 minutes, 44 seconds ground elapsed time. Our network controller reports that we've just had acquisition of signal with the spacecraft from Carnarvon and during this pass flight controllers will be looking at the spacecraft and the launch vehicle, the S-IVB one last time before translunar injection.

SC Joe, read you loud and clear. We are sitting here monitoring Timebase 6. On the countdown, we're 20 seconds away.

CAPCOM Okay. We're just starting to get data and everything still looks good to us.

SC Hey, Joe, at 2 hours and 12 minutes the 02 flow highlight came on and it's been pegged high every since, so it's been on about 14 minutes now.

CAPCOM Roger, 13. We're looking at it.

SC Timebase 6.

CAPCOM Copy. Timebase 6.

CAPCOM Okay. Apollo 13, Houston, you have a GO for all systems and the 02 flow high check is nominal with the waste tank vent open at this time and no sweat.

SC Okay. Just wanted you to check it for me.

CAPCOM Okay. We did.

SC Thank you.

PAO The crew is rather quiet at this time preparing for that translunar injection burn. The burn again scheduled to begin at 2 hours, 35 minutes, 44 seconds. The predicted duration of the burn is 5 minutes, 47 seconds and we expect that the spacecraft and S-IVB will accelerate some 10,417 feet per second as a result of that maneuver. We will not get data from the burn and we'll be out of acquisition with the spacecraft at the time the maneuver occurs at three Aria aircraft, Apollo range instrumented aircraft, are stationed in the ground track off the coast of Australia underneath the point on earth where translunar injection burn will be occurring. They will be recording data from it which we could play back somewhat later if necessary. The booster engineers just reported that the S-IVB chilldown in preparation for the burn has begun.

CAPCOM Apollo 13, Houston, we will be losing data from Carnarvon in about one minute. We'll probably hear voice through Aria. Everything is honkey-dory and we will be listening for you .to tell us how the burn goes.

SC Okay, this is 13, we are standing by, too.

CAPCOM Okay, Jim, it's not the best but we are reading you.

SC Roger.

PAO We expect communications will be somewhat noisey during the time that conversation from the spacecraft is being relayed through the Aria aircraft. As mentioned before, we will not see the telemetry data on the burn and we do hope to get voice reports on the progress of the maneuver from the crew. We are now just a little more than one minute away from the scheduled beginning of that burn.

END OF TAPE

SC Ignition, Houston.
CAPCOM Copy that Jim, good deal.
SC Copy that Jim. Good deal.
PAO Jim Lovell reports that we have ignition.
PAO Lovell's report would indicate we had a very close to ontime ignition. A total burn duration should be about 5 minutes, 47 seconds.
SC Okay so far.
CAPCOM Houston, Roger.
PAO Jim Lovell just reported that everything looks good with that burn. We're still about 7 minutes away from reacquiring the spacecraft through the station in Hawaii at which time we'll get our first good look at the trajectory as a result of this burn.
SC They're off at 38.
PAO We're now 3 and 1/2 minutes into the translunar injection burn, some 2 minutes 17 seconds remaining in the maneuver which will start Apollo 13 on route to the moon.

END OF TAPE

SC We're getting a little vibration during this time.

CAPCOM Houston, roger.

PAO Now about 20 seconds away from the scheduled shut down time. Jim Lovell reported a few moments ago that they're experiencing a bit of vibration on the S-IVB. Previous crews have also reported similiar experience toward the end of the burn.

SC Engine off. Engine off.

CAPCOM Houston, copy. Engine off, engine off.

PAO Lovell's report of engine off, came about five or six seconds after the pre-planned time.

CAPCOM Hawaii in three minutes.

SC Roger, (garbled) Hawaii in three minutes.

PAO Our communications continuing to come to us as relayed through the Aria aircraft. Capcom Joe Kerwin, advised Mr. Lovell and the Apollo 13 crew that we will be reacquiring a little less that three minutes from now through Hawaii at which time we should get good solid S-band communications and also our first look at the trajectory of Apollo 13 following the burn.

PAO Our communications is getting quite noisy at this point through the ARIA relay. Lovell's reports of ignition and engine shutdown would indicate that the burn went at least fairly close to nominal. He reported engine shutdown at about six seconds following the time that the engine was scheduled to shut down. We will be reacquiring at Hawaii at about 45 seconds. We have had acquisition of signal at Hawaii, we'll stand by for a call to the crew.

CAPCOM Apollo 13, Houston, through Hawaii, over.

CAPCOM 13, Houston. You're weak but clear, it will probably get better in a second. We're standing by for the burn report.

SC Roger.

CAPCOM 13, Houston, the booster reports that everything looks good with the S-IV.

SC Sounds good Houston. The ride was very nominal. We a little vibration though during most of the run.

CAPCOM Okay, we copied your call on that Jim.

SC Okay, Joe. The DSKY read 35560 plus 04445 plus 01769 and Delta-VC was minus 3.0.

CAPCOM Roger, you can't ask for much better than that. How about the burn time. Did you notice.

SC Okay. On my trusty watch, I had about three and three quarter seconds long.

CAPCOM Okay. Copy that.

CAPCOM Apollo 13, Houston.

SC Roger, Houston, 13 here.

CAPCOM Okay. We have the S-IVB maneuver to sep attitude commencing at 2 plus 56 plus 37 duration of the maneuver four minutes SEP time 3 plus 06 plus 37, over.

SC Okay. If I heard those right Joe the S-IVB maneuver is 2 puls 56 plus 57 sep time is 3 plus 06 plus 27.

CAPCOM Correction on the seconds 2 plus 56 plus 3 and 3 plus 06 plus...

END OF TAPE

SC - plus 27.
CAPCOM Correction on the seconds 2 plus 56 plus 37, and 3 plus 06 plus 37.
SC Okay, 2 plus 56 plus 37 with the maneuver time, and the sep time 3 plus 06 plus 27?
CAPCOM That's plus 37 too, exactly 10 minutes later, Fred.
SC Okay, 37.
PAO This is Mission Control, we're now at 2 hours, 54 minutes with the crew, and preparing for the CSM separation from the S-IVB; the subsequent docking with the lunar module and the ejection of the LM and command module from the Saturn third stage. And the times of all those events are almost as precisely as indicated in the flight plan. The separation maneuver scheduled to occur at ground elapsed time of 3 hours, 6 minutes, 37 seconds; and the docking would come then with the LM at 3 hours, 16 minutes ground elapsed time. Our displays in Mission Control are showing the effects of the translunar injection burn, we currently show the spacecraft at an altitude of 1183 nautical miles, traveling at a velocity of 31 406 feet per second.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM We see th2 booster doing all the right things, and FIDO says your trajectory looks good, and it looks like we'll stick with a pretty close to nominal midcourse too, we'll have some numbers for you later.
SC Okay, and we concur, the S-IVB is (garble) at this time.
CAPCOM Roger.
CAPCOM And Apol13 13, Houston, we'd like OMNI Alfa, over.
SC OMNI Alfa, coming.
CAPCOM 13, Houston, now request Omni Charlie.
SC Roger.
CAPCOM And 13, w'2,'11 be doing a handover, now.
PAO And our booster engineer reports the S-IVB is nearly in the proper attitude. We're about 5-1/2 minutes from the scheduled time of separation, and we are expecting that the crew will have the television transmittor and camera on beginning at ground elapsed time of about 3 hours, 15 minutes, for television coverage of the docking.
CAPCOM Apollo 13, Houston. You are go for T&D.
SC Okay, Joe, thank you.
CAPCOM And 13, Houston. Check your NOUN 17 for extraction pitch attitude, it should be 319 degrees. Over.
SC Okay, we'll look at it.
SC Okay, Houston, 13. Do we have a go for pyro arm?
CAPCOM 13, Houston. Affirmative, you're go for pyro arm, and recommend you secure the cabin pressurization.

SC We did, we closed the - waste management vent valve on waste stowage valves.
CAPCOM Okay, we're reading 6 psi on the cabin, Jack.
SC Roger, Joe. Thank you very much.
PAO Telemetry data, I hear on the ground indicates that the spacecraft has separated from the S-IVB. Astronaut Jack Swigert at this time would be in the commander's couch, the left-hand couch, at the controls of the spacecraft during the transposition and docking maneuvers. And we should be getting television transmissions from the spacecraft, beginning at about 3 hours, 15 minutes ground elapsed time.
SC Yes, that's quite a bang, Joe. We've separated, and we've pitched around about 60 degrees now.
CAPCOM Roger, Jack, we see you pitching.
SC Okay, we got the SLA panels, one of them is out front now.
CAPCOM Ah so.
PAO Swigert reporting that the SLA panels on the S-IVB are coming into view.
SC Got the S-IVB. I guess we're about 80 feet.
CAPCOM Good deal.
SC Okay, I'm going to come on with the TV now, Joe.
SC Okay, Fred, we're waiting for it.

END OF TAPE

SC Good deal.
SC Okay, I'm going to come on with the TV (garble).
CAPCOM Okay Fred. We're waiting for it.
PAO The network controller reports we're getting television signals now from the spacecraft, a bit earlier than expected and the crew is apparently somewhat ahead of the timeline in the transposition and docking maneuver. We'll stand by for a television picture.
CAPCOM 13, Houston. We've got a groovy TV picture.
SC Sounds good.
PAO We're looking down the nose of the S-IVB minus its SLA panels at this time, the top view of the LM. That last report Swigert said they were 80 feet away from the S-IVB and that distance should be closing.
SC Is the focus good enough Joe that you can see all the glittering debris?
CAPCOM We see some debris, Fred. The booster itself is a little bit bright. What's your F stop?
SC Okay. I'm at 22
CAPCOM Why don't you go up a click and let us have a look at that.
SC Okay. You're at 44 now.
CAPCOM Okay. Let's stay there for now and I assume you're in peak.
SC Confirmed.
CAPCOM 13, Houston. Recommend rig 2 on (garble) next.
SC Thank you.
PAO Fred Haise is manipulating the TV camera. We haven't determined yet which window of the command module we're looking out of. Jack Swigert in the left hand couch maneuvering the spacecraft, the command module into position for the docking.
SC It's getting bigger.
SC As you might know Joe, I've got the center seat again and I can't see a thing.
SC Too bad.
SC I gave him the TV monitor.
PAO That was a view of the Saturn third stage and the lunar module is coming to us from about 5000 miles here on earth. The spacecraft and S-IVB travelling at a speed of about 22 900 feet per second at this time.
SC Jim will be moving the TV directly. I'm going to pull it out of this bracket here.
CAPCOM 13, Houston. Did you call?
SC All right. Jim will be moving the TV to get

SC -a better shot here. We're moving it out of this bracket.

CAPCOM Okay Fred. It's just beginning to cut off at the bottom but it's still a very good picture.

END OF TAPE

CAPCOM That's a good picture, Fred.
SC Yes, we are just about there. About 10 more feet now.
CAPCOM Roger.
SC Everything looks pretty good down in the S-IVB to shroud the buildup of the tank down there.
CAPCOM Good deal and there is really quite a bit of detail on this picture.
SC Okay, we've got two barber poles
CAPCOM Houston, roger.
SC You should be able to see down in the IMU right now, Joe.
CAPCOM Fred, Houston, we'd like to try going to average on the TV for a minute or so.
SC Hey, you've got average and a little yellow dust cap just floated by in front of us.
CAPCOM Yes. We see it at the top of the screen.
CAPCOM Fred, after a few minutes of this, at your convenience, we could use some interior shots if you get the time and if the lighting is good.
SC Okay.
CAPCOM And, 13, Houston, the S-IVB vent times are nominal as in the flight plan within a few seconds.
SC We're hard dart there, Houston.
CAPCOM Roger. Understand. Hard dart. Good deal. Fred, one more thing on the TV. If you could come to F-22 again -
SC Okay, you've got F-22 again.
SC And, Houston, Fred will handle the camera as we go to the post-docking checklist.
CAPCOM Okay, Jim, real good.
PAO Haise is apparently maneuvering the camera inside the spacecraft for an interior view at this point and we'll stand by to see if we've got enough light inside the spacecraft to get a useable picture.
SC Okay, Joe, I am pointing it over toward -

END OF TAPE

SC Okay, Joe I'm flying over toward Jack and it's pretty bright with the earth out the window. Is that sort of washing out the picture here?

CAPCOM No, Fred. It's a, it's not, we've got a bright spot where the window is, the rest of you are semi-silhouetted, it's a pretty impressive picture.

CAPCOM Apollo 13, Houston.

SC Go ahead Joe.

CAPCOM For Fred. The IOS has caught you with a fuel cell reactant value in latch again.

SC Touche.

CAPCOM And we have word that the propellant usage for T and D was nominal.

SC What is nominal, please?

CAPCOM Well I didn't ask that yet, Jack, stand by while I...

SC That's okay.

CAPCOM Fred, this is Houston over.

SC Go ahead.

CAPCOM Okay. With the direct sunlight from the window, how does the TV camera feel as it is now. We'd like you to open it up next stop or so and if convenient try to keep that bright spot out of the window.

SC Okay.

CAPCOM 13, Houston. I guess we could stand one more quick down on the F-stop.

SC Okay, Joe. He's going to do it.

CAPCOM That is we want you to open it up. Looks like a very interesting book your reading.

SC I have two of them.

END OF TAPE

CAPCOM Hey, that's pretty, Fred.
SC Okay. I hope you got more detail than I have on the monitor here.
CAPCOM No, we probably don't, but it's kind of a neat picture anyway.
SC Houston, we are now going to finish repressurizing the tunnel,
CAPCOM Houston, roger.
PAO This view is looking up into the docking tunnel of the command module with the tunnel light showing toward the top of the tunnel.

END OF TAPE

SC Probably here Joe, we're just finishing up, pumping up Acquarius here.

CAPCOM About all we see on this picture Fred are the brite spots with the lights around the tunnel area. The hatch itself is pretty dark.

CAPCOM 13, Houston. By the way we'd like to know how the high gain antenna lockup worked. Signal strength is a little bit lower than we thought it would be.

SC It looked just the way I expected it to, Joe. I enter sitting there in REACQ with the numbers cranked in and soon as we got pretty much through the rotation I just threw it down the high gain and it appeared to lock right up.

CAPCOM Okay. Good deal.

CAPCOM See that flashlight beam wandering around in there.

PAO At this point, we're getting a good view of Jack Swigert in the left hand seat of the command module.

SC Houston, 13.

CAPCOM 13, Houston. Go ahead.

SC We'd kind of like to hold off on the - start the venting again until we get the things - that pop hack up inside here. Wonder if you may give us a call remind us when to initiate that.

CAPCOM Okay 13. We'll do.

SC And we'll try to shift her up to look up into the tunnel here.

CAPCOM Okay. Real good.

END OF TAPE

CAPCOM Okay, 13, Houston. I think we could use an f-stop lower - What f-stop are you at now?
SC I'm about as low as you can go, Joe, I'm sitting on 4.4.
CAPCOM Okay.
SC What you're looking at Joe is the commander has removed the hatch, and is preceeding to stow it.
SC Houston.
SC Houston.
SC Houston.
CAPCOM Okay, 13, that's a pretty good picture, there.
SC The CDR is verifying the docking list.
CAPCOM Roger.
SC Hey, Joe, Jim reports that there's a slight you know, burnt smell up in the tunnel area, it's been reported on previous flights.
CAPCOM Okay, we copy that.
SC Okay, the commander reports all docking latches latched.
CAPCOM Houston, Roger.
SC Houston.
PAO Although we have a rather dim picture at this time we can see Jim Lovell working in the tunnel area, Lovell has removed the hatch cover, inspected the docking latches, and reported that everything was in order in the tunnel. He should be shortly attaching the umbilical to the lunar module which will provide power to the heaters and some of the critical LM guidance equipment. And on reinstalling the tunnel hatch.
CAPCOM 13, Houston, for your information, the S-IVB event is preceeding on schedule.
SC Okay, Joe.
SC Here Joe it - it's concurred with all the thousands of particles that we see going by outside, here.
CAPCOM Yes, I guess I didn't need to tell you.
CAPCOM 13, it looks like Jim is connecting the umbilical at this time, is that right?
SC Yes, that's affirm - affirm, Joe. Do you have any detail up in there at all on the monitor it looks like I can - I can make out the - drogue by drogue a little bit, but not much else.
CAPCOM We can see the probe pretty well, and we can see his hands quite well, there.
SC Okay, we're powering the LM, now, Joe.
CAPCOM Okay, Roger, that.
CAPCOM And the voltage looks good there, 13.
SC Roger.
SC Okay, we're going to take an outside view now, out the left side, Joe.
CAPCOM Okay, Fred, real good.

END OF TAPE

SC Okay, you make out the next picture out there, Joe?
CAPCOM Yes, that's the world?
CAPCOM Okay, Fred, that's a pretty nice looking picture. We'd like to know what settings you used to get that.
SC Okay. I think Jim is holding it now and - it should be in about F-22 infinity and I think 50 millimeter. And, Jim says he thinks he hit Baja in the picture now.
CAPCOM Okay, I think we can stand to go to F-44 on that. The clouds are pretty bright.
SC Okay, we are going to press on here, Joe, so we are back inside.
CAPCOM Okay. thanks a lot.
SC Okay, how's that picture looking back outside now, Joe? Getting ready for LM extraction
CAPCOM Okay. It looks pretty good, Fred.
SC Houston, this is 13. Do we have a GO for pyro arm?
CAPCOM 13, Houston, afirmative your GO for pyro arm.
SC Hey, Joe, when we went back up and rechecked the tunnel there, we found two latches that weren't caught and we reset them.
CAPCOM I'll Roger that check.
SC Joe, I've got a beautiful view out window 1. The window's came through in real good shape. Window 5 looks real clean so I am kind of hopeful that hycon stuff will be pretty good.
CAPCOM Good deal.
SC I'm at window 3, Joe.

END OF TAPE

SC I'm at window 3 too.
CAPCOM Okay, 13 Houston, you're go for LM SEP whenever your ready.
SC Roger.
CAPCOM Okay 13, Houston, correction on that you're go for LM SEP at the nominal time and/or later. We don't want it early.
SC Okay Joe, we'll do it at 40100.
CAPCOM Roger.
PAO We are now about two minutes away from the scheduled CSM LM ejection time. At that time, the crew will activate a switch which separates the, which fires pryotechnics separating the tie-down straps and the spring actuators at the attach points of the LM landing gear. It will eject the LM and the command and service module at a velocity of about eight-tenths of a foot a second. Now this will be coupled with a short burn with a reaction control system jets adding another 4/10th of a foot per second to the separation velocity, giving them a total separation velocity of 1.2 feet per second.
SC Okay, we're about ready to pull the LM out Joe.
CAPCOM Okay, 13.
SC Here she comes. Okay, looks like we're clear Joe.
CAPCOM Okay, looks good, it's weird because we get the TV about 10 seconds after you call it.
PAO We've been advised that within a few minutes we'll have to recycle the converter which converts the TV picture we're receiving from sequential black and white to color. This will require the converter to be down for a couple of minutes, while it's reloaded with tape and in that interim period of time we would expect the picture to be down.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Okay, we'll be waiting for you to tell us that you feel you're safely clear of the booster and give us the go to command the booster in its yaw maneuver.
CAPCOM 13, Houston. Did you copy my last about giving us a go for the yaw.
SC We're in maneuvers Joe and we hadn't picked her back up again yet.
CAPCOM Okay. Do you want to wait till you acquire it, before we yaw it.
SC How much time do you have, Houston? Can you wait, or do you want to do it right now?
CAPCOM We can wait if you want us to.
SC Why don't you wait just a little bit.
CAPCOM Okay.

SC Joe did they ever get an idea of what that, the TD & E fuel was?
CAPCOM Jack, they're not willing to pin it down to a specific number right now, because they say the tanks will warm up later on and the amount of consumption will go down. But it was nominal.
SC Okay.
SC Okay, Houston. We have the S-IVB in sight. You can go ahead and maneuver the S-IVB.
CAPCOM Houston, roger that.
SC We'll try to give you a, we were going to try to give you a shot of the S-IVB with the TV out window number 3.
CAPCOM Okay. Real good Jack. Our S-band signals strength has been fluctuating, does it seem to be going alright up there in the auto track mode?
SC Right now it has dropped off to about the ...

END OF TAPE

SC -in the AUTO track mode.
SC Yeah. Right now, yeah, it's dropped off to about the 70 percent point, Joe.
SC And Houston, do you have a TV picture?
CAPCOM Not at the moment, Jim. We had a garbled one there for a few seconds and we don't have one at this moment.
SC Okay. I can see the S-IVB now out the hatch window and it's -
CAPCOM We had a garbled one there for a few seconds and we don't have one at this moment.
SC Okay. I can see the S-IVB now out the hatch window and it's -
CAPCOM Suddenly we have a very good picture.
SC Okay.
SC And Houston, I can see the gold shroud around the IU and it looks that its all intact.
CAPCOM Roger, Jim. We copy that. Incidentally, the APS evasive maneuver will be about 4 minutes late. It'll be at about 04 plus 18.
SC Roger.
CAPCOM 13, Houston. Wonder if you could zoom in on that S-IVB for us a little bit?
SC Okay.
CAPCOM Yeah. Yeah. More like that.
CAPCOM That's nice.
CAPCOM It's off our screen to the right now.
CAPCOM Oh, that's very nice, very nice.
SC Okay, Joe. Is E COMM monitoring the 02 full highlight again?
SC We haven't yet started the venting yet.
CAPCOM Okay. Standby. I'll check.
CAPCOM 13, Houston.
SC Go ahead.
CAPCOM Jack, your cabin regulators are still making up but you're GO to open the waste management vent again at this time and we'll DELTA the time to close it by the appropriate amount for you.
SC Okay. Real fine.
SC Well, we'll wait till the S-IVB does its maneuver here.
CAPCOM Okay.
PAO We've just had a dropout in signal as the spacecraft maneuvered out of the field of view of the high gain antenna. At this point, the crew should be switching shortly to the OMNI antennas and we expect to reacquire

PAO -signal lockon.
SC Okay, Joe. We just had a momentary drop off in signal strength again there.
CAPCOM Roger, Fred. We had an LOS for a minute and we lost our TV picture. It looked -
SC Okay, Joe. We just had a momentary drop off in signal strength again there.
CAPCOM Roger, Fred. We had an LOS for a minute and we lost our TV picture. It looks like - Yeah. We just got it back.
CAPCOM It looks great again.
CAPCOM 13, Houston. You might stop the F stop down one more notch, if you've got any left
CAPCOM And 13, Houston. We'll be commanding the evasive maneuver in about 17 seconds.
SC Okay Joe. We can see it start to move. However, it doesn't seem to be a lot of debris or vapor coming out of it.
CAPCOM Roger that, Jack. Booster says that's great. He says the booster's doing its thing normally. Concur. We don't see much on the television at all.
CAPCOM And Apollo 13, Houston. We'd like to change the S-band antenna configuration. Like you to go OMNI DELTA. Like you to go MANUAL mode on the high gain with pitch of minus 60 and yaw of 90. Over.
SC Okay. You want us to OMNI DELTA and MANUAL on the high gain. The minus is 60 and the plus 90. Is that correct?
CAPCOM That's affirmative.
SC Okay, Houston. How much longer would you like the television?
CAPCOM Standby on that. We'll get a word.
CAPCOM Okay 13, this is Houston. You can turn the TV off anytime you're ready. We enjoyed the show.
CAPCOM 13, Houston. Before you secure the TV, we'd like to know whether that was in maximum zoom just for information?
SC That's affirmed, Jim had it in maximum.
CAPCOM Okay. Good deal. That was a real good picture.

END OF TAPE

CAPCOM - information.
SC That's affirm. Jim (garble).
SC Okay. Good deal. That's a real good picture. And 13, Houston, the APS evasive maneuver appeared to be nominal. The lox dump time is now 4 plus 39 plus 20 but 3 minutes late.
CAPCOM Roger.
PAO The booster engineer reports the preliminary indications are that our Saturn S-IVB evasive maneuver was successful. The flight dynamics officer will be evaluating the trajectory to assure that we've got the kind of separation from the spacecraft that we were looking for and also to determine to what extent we are heading toward the trajectory which would impact the S-IVB on the moon. At 6 PM central standard time there will be a press conference in the news center auditorium. This is the small auditorium in Building 1, with Ken Mattingly. Astronaut Mattingly until a few days ago was the command module pilot for the mission and due to exposure to measles was replaced by Jack Swigert. Mattingly has been in the control center and is currently in the control center observing the progress of the mission. I have to repeat that the press conference with Astronaut Mattingly is scheduled for 6 PM central standard time in the news center auditorium.
SC Okay, Joe, we are not opening the waste stowage vent.
CAPCOM Okay, check, we copy.
SC Okay, Houston, we are charging Battery B.
CAPCOM Roger, 13, we see it and it looks good.
CAPCOM Apollo 13, Houston. Request OMNI ALPHA now. Over.
PAO This is Apollo Control at 4 hours, 37 minutes. We are now about 3 minutes away from the scheduled lox dump. the propulsive vent of liquid oxygen through the engine nozzle of the S-IVB. The Saturn instrument unit will command this maneuver or command the lox dump and the lox will blow out the engine bell for 48 seconds or until the tank is empty whichever comes first. The preliminary plan would be for the lox dump to produce a change in velocity of about 28 feet per second which would contribute to the trajectory change placing the S-IVB on an impacting trajectory with the moon and subsequent midcourse corrections using the two 70-pound thrust auxiliary propulsion system units on the S-IVB would be intended to correct this trajectory and bring it into the precisely preplanned limits.
CAPCOM Apollo 13, Houston.
SC Go ahead, Joe.

CAPCOM Roger. They are having trouble verifying that the high gain is doing its thing. Want to verify that the pitch is minus 10, y is plus 350, during wide beam width and auto.

SC Okay. Minus 10, pitch plus 350 yaw and wide beam width and going into auto. You want high gain, John?

CAPCOM That's affirm.

SC Okay. We're coming at you.

PAO Astronaut John Young who was backup commander for Apollo 13 is now serving as capsule communicator in place of Astronaut Joe Kerwin.

PAO This is Apollo Control. The Ken Mattingly press conference is scheduled to begin shortly in the MSC news center auditorium. During the press conference, we will tape any conversation with the spacecraft and play that back immediately following the press conference. At 4 hours, 45 minutes, this is Mission Control, Houston.

END OF TAPE

PAO This is Apollo Control, Houston, at 4 hours 58 minutes. During the press conference the liquid oxygen propulsive vent from the S-IVB was completed successfully. We also had an exchange with the crew during which Jack Swigart and Fred Haise reported noticing what appeared to be contrails coming from the S-IVB and we advised them that this was a normal occurance and during the propulsive vent from the S-IVB. The plan was to dump the liquid oxygen for a total of 48 seconds or until the tank went dry. As it turned out, the tank did not go dry at the end of 48 seconds and the instrument unit, as planned, shut the vent off. Now this meant, then, that we continued to get non propulsive venting which produced the apparent con-trails viewed by the crew. We have a scheduled mid-course correction opportunity for the S-IVB at six hours. It is expected that this mid-course correction will be required and we also have an opportunity at 9 hours for additional mid-course correction on the S-IVB to assure that it is on a trajectory that will impact the moon, at the desired point. We'll play back for you now, the taped conversations with the crew, and I'll continue to stand-by for any live communications with the spacecraft.

SC Alright, Houston, 13.

CAPCOM 13, Houston, go ahead.

SC Is the S-IVB doing something different?

CAPCOM Well, I don't know. It should be, it should have started the LOX dump quite a while ago. I guess that's complete. Why do you ask that?

SC I'm looking out window 5 at what I think is the S-IVB and I'm seeing what looks to be double plumes, drawing in two very narrow bands maybe about three degrees streaming out from it. And then there is a less dense band that covers, maybe a forty degree swath through the sky that continues out also, in two directions.

SC Joe, what it looks like, kind of, if you pull up behind a guy that's pulling a contrail, if you get in his contrail, like if he's going away from you, if it is a long contrail.

CAPCOM Okay, stand by. Let me see what Hank's got to say about that.

SC Except we're between it, looks like we're between two contrails. One guy above and one below.

CAPCOM Roger.

SC It's a very pretty sight.

CAPCOM Okay 13, Houston. The booster says that the propulsive dump is concluded and he now has the non propulsive vents open and what you see is a normal phenomenom and should go on for another five minutes or so.

SC Okay.

CAPCOM And, while I've got you 13, at your convenience, we would like to have the results of the EMS bias test that you did pre TLI and pre SEP.

SC Standby.

CAPCOM Okay.

SC Okay, Joe. The TLI Delta-V, Del bias test fired at TLI and we had a .P10 and post TLI it was 1.0.

CAPCOM Okay, Jack. Copy that, thank you very much. Incidentally, as your tracking gets better, and better the size and MCC2 is getting lower and lower and figures to be somewhere between ten and 30 feet per second, now.

SC Sounds good.

CAPCOM Yes, sure does.

CAPCOM Apollo 13, Houston.

SC Go ahead Joe.

CAPCOM Okay. We have a PTC REFSMMAT ready if you're ready to go P00 and accept, we'll stick it in there.

SC Okay. Standby.

CAPCOM Okay.

SC Go ahead Joe.

CAPCOM Okay.

CAPCOM Apollo 13, Houston. We'll have a hand over in half a minute or so. You may get a momentary loss of contact.

SC Okay Joe.

END OF TAPE

CAPCOM Apollo 13, Houston. The computer is yours. Over.

PAO This is Apollo Control at 5 hours, 16 minutes. This is a relatively quiet period in the flight plan. We'd like to take this opportunity to replay a tape recording of remarks made today by Vice-President Spiro Agnew and West German Chancellor Willy Brandt at the Kennedy Launch Control Center following today's liftoff. A communications failure at the Cape prevented release of a large part of these remarks during the time they were delivered. We understand the total tape is about 10 minutes of duration. We'll play that for you now.

PAINE It is a great pleasure to introduce the Vice-President of the United States.

AGNEW Thank you. (Applause). Thank you very much. Thank you very much, Dr. Paine, Mr. Chancellor, Ladies and Gentlemen of NASA. I feel like a real veteran today. This is my first - my fifty, excuse me, Apollo launch. No matter how many I see, they all impress me. It's an overpowering step. You can't really get used to the - seeing that rocket when you sit there and you've had a few minutes to reflect on what's gone into it and how many people are giving so much of their attention and energy to the preparation of the shot. You can't help but be tremendously impressed successively with each shot. Today, we are honored to have with us Chanecllor Willy Brandt of the Federal Republic of Germany. I can only say to the Chancellor that men of his country have given much to the science of rocketry. Certainly our own people here, people like Werhner Von Braun and Kurt Debus bearing those names are testimony enough to the scientific accomplishment of the German people. But the thing that makes these shots very impressive is that they are not restricted to what people want, as far as the sense of accomplishment is concerned. I have had nearly every-one I talked to connected with the NASA program point out repetively that it is more important to them that the people who are doing these things, that the men who are executing the design that has been conceived and nutured by so many people. So many people here in the NASA program that have never set foot inside a capsule. These people have really brought the program into being and everyone who I have ever talked to is of the opinion that the important thing about the program is that these are human beings, fellow travelers on the planet Earth who are accomplishing these wonderful things that would have been considered comic strip material just a few years ago. Obviously what is taking place in the world of accomplish-ment depends upon the caliber and devotion of the people in the NASA program, thousands of people such as yourselves who

AGNEW had such serious responsibilities in technological and scientific sense who must put out the product that makes these flights possible and to you, on behalf of the President and, of course, myself and all of our people in Washington, I extend my very sincere congratulations to another successful mission. I am delighted that I have been privileged as Chairman of the Space Council to participate vicariously in your accomplishments. I want to say that I am very fortunate to have in Bill Anders, a former astronaut, as the Executive Director of the Space Council, a person who keeps me very well abreast on what's going on. As we move to the future, we must consider the all inspiring task of sorting out our national priorities. One thing is certain. A program which has been as successful, as efficient, as economical as this program has been must be carried forward and the spillover in useable data that can be applied to the betterment and the comfort and the culmination of man to improve his destiny is probably greater in this program than anything that we have ever turned our national attention to, and I can assure you that we appreciate that very much. Again, it is a pleasure to be with you and congratulations again on an outstanding accomplishment. (Applause).

PAINE (garble) of West Germany.

BRANDT Thank you, very much. Mr. President, I just wanted to say that I feel honored and deeply grateful to have been invited to the launching of Apollo 13 and to have this opportunity, not only to extend my personal good wishes for a successful journey to the astronauts, but also to congratulate all those of you, those who are here and many others in this great country who have prepared and are actually involved in this project. This is already the fifth time that men are about to leave, have left, as a matter of fact, for the moon but it is for that no less fearing an undertaking and no less exciting for anyone who had the privilage of watching it. In Germany and I am sure in all of Europe, people will follow this trip with the same keen interest, the same emotions as everybody in the United States. You here, together with all your colleagues can feel a (garble) for all mankind. On behalf of all my countrymen I wish that this not only will be a successful trip and a safe return but further progress for all mankind. Thank you very much. (Applause).

END OF TAPE

SC - 252
CAPCOM 13, Houston. I'll read them up in just a second.
CAPCOM 13, Houston. Okay. We've got them.
SC Okay. The time of torquing was 5 hours and 30 minutes and 40 seconds.
CAPCOM Roger. We copy.
SC Hello Houston. Apollo 13.
CAPCOM 13, Houston. Go ahead.
SC Okay. I just got all hooked up to get my COMM system here and I just wanted to check out. I've got my suit stowed, a few little odds and ends done and I'm back in business again.
CAPCOM Okay. Good deal. We're kind of hanging loose down here. I've got a lift off plus 15 pad. There's no hurry to read it up so let us know when you're ready.
PAO This is Apollo Control at 5 hours 41 minutes. At the present time, we show Apollo 13 to be 24 916 nautical miles from earth. The spacecraft velocity is 12 172 feet per second. The booster engineer here in Mission Control is currently -
SC Need a pad.
PAO And we'll stand by for that pad to the crew.
CAPCOM Jim, lift off plus 15 pad. GET-I 01500, DELTA VT 5622, longitude minus 165 and GET 400 K 04704. Over.
SC Okay, Houston. Liftoff plus 15. GET-I 01500, 5622, minus 165 04704. Is that correct?
CAPCOM Aw, that's right Jim.
PAO This is Apollo Control at 5 hours, 45 minutes. Our booster systems engineers just reported that the first midcourse correction opportunity with the S-IVB, the midcourse correction designed to put the S-IVB on the proper impacting trajectory with the moon will be required and it is expected that this maneuver will be a 217 second burn of the two auxiliary proportion system modules on the S-IVB. These modules each produce 70 pounds of thrust for a total thrust of 140 pounds. The booster engineer also reported that it would probably be required to utilize the second S-IVB midcourse correction opportunity at 9 hours to assure the proper trajectory. Midcourse correction 1 for the spacecraft, the command and service modules is not expected to be needed. The first midcourse correction opportunity which we would anticipate the possibility of having to make a small midcourse correction would be for midcourse correction number 2 at the scheduled time in the flight plan. At 5 hours, 47 minutes, this is Mission Control Houston.
SC Rog. We'd like to have the attitude sets which

END OF TAPE

PAO This is Apollo Control at 5 hours 59 minutes. We're about one minute away now from the scheduled mid-course correction with the Saturn S-IVB, the third stage of the Saturn. This mid-course correction will utilize the auxiliary propulsion units on the Saturn third stage. Each producing 70 pounds of thrust for a total thrust of 140 pounds. The maneuver will be commanded by the Saturn instrument unit. And is scheduled to have a total Delta velocity, change in velocity, of about 29.7 feet per second. The burn duration planned for 217 seconds. This maneuver will, is targeted to impact the S-IVB on the lunar surface at longitude and latitude of about 3 degrees south, 30 degrees west. Our booster engineer reports the mid course burn has been initiated at this time.

PAO This is Mission Control at six hours three minutes. The booster engineer has just reported that the mid course correction with the S-IVB is complete. We'll be standing by for analysis of the results of that mid course correction. Mid course correction opportunity is scheduled at six hours and nine hours for the S-IVB are intended to impact the Saturn third stage within about 200 kilometers of the Apollo 12 landing site. That would be 200 kilometers west of the Apollo 12 landing site. At the present time in Mission Control, we're in the process of changing shifts, Flight Director Jay Griffin is coming on to replace Flight Director Milton Windler. We expect that the change of shift briefing will occur at about eight P.M. Central Standard Time, in the News Center Auditorium. At six hours five minutes, this is Mission Control Houston.

CAPCOM Apollo 13, Houston.

SC Go ahead, Houston.

CAPCOM Would you please verify, tell us what S-band antenna configuration you're in, please.

SC Okay. Stand by. We're in high-gain.

CAPCOM Roger. Stand by a minute Jim. Our signal strength is getting a little low we may have a recommendation. 13, Houston. Are you in manual or auto in high-gain?

SC We're in auto-track, Joe. and in high gain.

CAPCOM Roger.

PAO This is Apollo Control at six hours seventeen minutes into the mission. The change of shift news briefing time has been advanced. We're anticipating the change of shift news briefing to begin in approximately ten minutes. Approximately ten minutes, in the news center briefing room.

PAO This is Apollo Control at six hours

PAO 38 minutes. The Flight Director Jerry Griffin has been taking status reports from each of his flight controlers. Every one reports, all spacecraft systems looking good. The Flight Surgeon reports the bio-medical instrumentation looks excellent, very clean data. He thinks that, when this crew completes this long day, they will be tired and will get a good night's sleep. They have about another six and a half hours before bed-time, today. Booster systems engineer reports the S-IVB has been saved, retaining attitude control and mid-course capability, but that all pressure spheres have been dumped. He also reports to the Flight Director, that the second mid course correction of the S-IVB may be later than ground elapsed time of nine hours. He wants to get a good tracking vector to use for this final maneuver and he's not quite sure whether he'll do the maneuver at nine hours or a little bit later after he refines his tracking data. He reports the S-IVB still has 372 seconds of burn time remaining, plus enough fuel in the APS after that to maintain attitude until 12 hours elapsed time. The guidance officer is watching Command Module Pilot Jack Swigart perform such lunar navigation tasks. Through telemetry, he's monitoring Swigart's markings stars with the sextant, he's very complimentary of Swigart's ability in this task. On his P23, says this procedure going very smoothly. At six hours 41 minutes, this is Mission Control, Houston.

SC Houston, you copy 13. Hello, Houston, Apollo 13, over.

CAPCOM 13, Houston, go ahead.

SC Hey, were you copying my P23 results?

CAPCOM That's affirmative Jack. We followed you through the whole thing. Your ahead of schedule.

SC Okay.. and Joe, we confirmed there is no mid course one, over.

CAPCOM That is affirmative as far as I know. Let's get a final check on it Jim.

SC Okay, 'cause we're standing by. We want to do a fuel cell purge and waste water dump.

CAPCOM Okay, Jim. We confirm there will be no mid course one.

SC Okay, sounds good.

CAPCOM 13, Houston. You can go ahead with your purge and dump at your discretion.

SC Roger, Houston. What we're going to do is, we're going to get rid of Fred's suit. Fred's suit has been right in the Commanders slot here for the last half hour so we're going to try and get it stowed.

CAPCOM Okay.

SC He did a pretty good job.

APOLLO 13 MISSION COMMENTARY 4-11-70 CST 7:09 p.m. GET 556 43/3

PAO This is Apollo Control at six hours 46 minutes. We'll take the release line down now while the change of shift news briefing is under way. We will tape any air-ground and play it back after the news briefing. This is Mission Control, Houston.

END OF TAPE

PAO This is Apollo Control at 6 hours 59 minutes. During the news conference the air to ground conversation totaled 35 seconds. We have a tape of that now. We'll play that for you and then we will stay up live.

CAPCOM Apollo 13, Houston. We'll have a handover in about 1 minute.

SC Hello Houston, Apollo 13.

CAPCOM Roger, Jim. We'll have a handover from Hawaii to Goldstone in about 30 seconds.

SC Very good, Houston.

CAPCOM We'll be handing over from Hawaii to Goldstone within a few seconds. You may get a temporary loss of COMM.

SC Okay, Houston. We've got a whole bunch of noise too.

SC Do you know we're also purging fuel cells 02 now.

CAPCOM Okay, Jack.

PAO This is Apollo Control at 7 hours, 9 minutes. Astronaut Vance Brand has just relieved astronaut Joe Kirwin at the CAPCOM console.

SC Okay Houston. The fuel cell purge in waste water dump is complete.

CAPCOM Roger, Apollo 13.

CAPCOM And this is your relief CAPCOM shift on now.

SC Well, good evening Vince.

SC Boy, you sure made it back fast.

CAPCOM Yeah. You guys had a beautiful launch there. Really nice.

SC Could you follow it all the way up, Vince?

CAPCOM No. I didn't see staging. It was too hazy for that but we could see it for a few miles anyway.

SC I'll tell you, it's sure an interesting ride.

CAPCOM Right.

SC Houston, Apollo 13.

CAPCOM Rog. Go ahead, Jim.

SC Roger. We're in that stage now where we're going to take some more photography. If you're standing by I have the camera aimed at the earth right now. I'll give you a MARK when I take this first picture.

CAPCOM Roger. We copy, Jim. We'll be standing by for the MARK.

SC Okay, Houston. 321 MARK.

CAPCOM Roger, copy.

CAPCOM And Apollo 13, Houston. Over.

SC Go ahead.

CAPCOM For the PTC, recommend that you disable quads

CAPCOM - A and B. Over.
SC Okay. Disable quads A B will do and soon as Jack gets finished thrashing around we'll be going to that PTC mode.
CAPCOM Okay.
SC Okay, Houston. We're starting our PTC. We're disabling quads A and B now.
CAPCOM Roger, Apollo 13, Houston copies.
CAPCOM Apollo 13, Houston. Over
SC Go ahead.
CAPCOM Jim we'd like to verify that the high gain is secured, that the S-band antenna is on OMNI and OMNI B should be the right antenna. Over.
SC Okay. You want the high gain secured, and you want the OMNI on the Charlie or bigger?
CAPCOM That's affirmed.
CAPCOM And this will be maintained in the PTC.
SC Okay.
CAPCOM And the high gain angles for stowage or for stowing are pitch minus 52, yaw 270.

END OF TAPE

SC Houston, Apollo 13.
CAPCOM Roger. Go ahead.
SC Stand by for another earth-weather picture. I'll give you a mark.
CAPCOM Okay. Standing by, Jim.
SC 3, 2, 1, MARK.
CAPCOM Houston, copies.
CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Houston, here. Your rates look very stable. It looks like your rates are damped out completely here. As far as we can see it would be all right to start the PTC.
SC Okay. We'll give it a try.
PAO This is Apollo Control. It's 7 hours, 46 minutes. Apollo 13 now 37,630 nautical miles from earth. Velocity 9,878 feet per second. Apollo 13 taking earth weather photography, photographing the earth one frame every twenty minutes for three hours. Jim Lovell has taken two photographs so far. We have a reminder for the news men from the print media. There will be a meeting at 9:30 AM tomorrow (Sunday) in the news center briefing room. The writing press will select representatives to fill the Mission Control Center pool positions at that time. 9:30 am central standard time tomorrow. At 7 hours, 47 minutes, this is Mission Control, Houston.
SC Hello, Houston. This is 13. How do you read?
CAPCOM 13, Houston. Loud and clear. L3, Houston is reading loud and clear. How do you read?
SC Okay. And do you have any estimates, Vance, on how long we will be charging Battery B.
CAPCOM Stand by one, Fred. Apollo 13, Houston.
SC Go ahead.
CAPCOM We'll be charging for 4 and one-half to 5 hours yet.
SC Roger.

END OF TAPE

SC Roger
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Fred, recommend that when your window comes around facing the earth again, that you catch another one of those pictures and at the same time you could probably start PTC again. We might have sent a confusing bit of info up to you. The disable two quads only, applies to an early step in the procedure. We didn't mean that, for the later part of the procedure where we have the statement enable all jets. Over.
SC Okay.
CAPCOM Apollo 13, Houston, Go ahead.
SC Vance, Fred said that you had some more information about PTC and a different way of establishing it.
CAPCOM Rog. Refering to the procedure on G8-2, if you have that open, I'll tell you what we had to give you.
SC Okay, stand by and I'll do that.
CAPCOM Okay.
SC Okay go ahead, Ben.
CAPCOM Okay. On checklish G8-2 under step 5 there is a statement "disable all jets on two adjacent quads" and that's what we were refering to when we called up saying "disable quads A and B" so that's all fine. However, going down now to step 7 where it says "enable all jets" we hoped you didn't think we meant leave A and B disabled there. In that case, it's as written. All jets should be enable. Over.
SC Okay. Our checkbook has all jets scratched out and says enable couples on all axis. So what we'll do is we'll re-establish this thing and come down to that step 7 then we'll enable all jets. That means enable quads A and B. Is that right?
CAPCOM That's affirm. You'll have A, B, C and D enabled for step 7.
SC Okay, real fine.
CAPCOM Okay. I understand you're going to re-establish.
SC And Vance on that picture. I was all set to shoot it a little before you called and the earth hasn't showed up in the window yet I don't know if we got too far off the belly or what.
CAPCOM Roger. Copy that.
CAPCOM Apollo 13, Houston.
SC Go ahead Ben.
CAPCOM Roger on the photo. You'll probably have to re-establish the attitude for PTC and whenever it comes...

END OF TAPE

SC Go ahead, Vance.
CAPCOM Roger. On the photo, you probably have to reestablish the attitude for PTC and then whenever it comes into the window again, why we'll just be standing by for the photo.
SC Okay.
CAPCOM Apollo 13, Houston.
CAPCOM Roger. You're coming in a little weak.
CAPCOM Have a recommended roll rate for this PTC if you could copy.
SC All right. Go ahead.
CAPCOM Okay. Recommend that you put in R1 the following. 03750 and that should give you exactly a rate of .3 degrees per second. Over.
SC Okay. 03750. Is plus or minus our choice?
CAPCOM Roger. The same direction you rolled the last time which I believe is plus.
SC Okay.
SC Vance would you monitor our rates and kind of give us an idea of when you think they're stable enough to start PTC.
CAPCOM Rog, Jack. We'll take a look and let you know as soon as they look stable enough.
SC Okay. I've got quad A and B disabled here.
CAPCOM Roger.
SC Did they come up with an idea of how much fuel I used on the docking and also the P-23 session at 5 hours or 6 hours.
CAPCOM I think we can give you something. Stand by a minute.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM It's looking good so far as RCS consumables are concerned, Jack. You're standing about 20 pounds above the curve right now. Looking at the TD & E, you expended 65 pounds or - stand by. 55 pounds correction on that,
SC How much?
CAPCOM And 14 pounds on P-23s, you've used a little more out of quad A than out of the others.
SC Okay. Thanks Vance.
CAPCOM Rog.
SC Could you say again about the TD & E fuels? We've got a difference - we all heard different things.
CAPCOM I said 65 and then corrected that to 55 pounds.
SC Okay.

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Okay Jim. Your rates look good. It's okay to start that roll again, if you'd like.
SC In work -

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-11-70 CST 950 GET 837 48/1

PAO This is Apollo Control at 8 hours, 40 minutes. Apollo 13's altitude now 42 464 nautical miles from Earth. Velocity 9210 feet per second.

SC Hello, Houston, Apollo 13.

SC Hello, Houston, Apollo 13.

CAPCOM Apollo 13, go ahead.

SC Okay, ready for a little count here, Vance, and I'll shoot another picture we found the earth again.

CAPCOM Okay, we'll be standing by, Fred.

SC A 3, 2, 1.

SC MARK.

CAPCOM Roger, copy.

PAO This is Apollo Control at 8 hours, 51 minutes. Tracking of the S-IVB since its first midcourse correction indicates that a second midcourse correction will not be necessary. I repeat; a second midcourse correction of the S-IVB trajectory will not be necessary, based on tracking to date since the first midcourse correction. The booster systems engineers plan to wait until about 10 hours elapsed time before making a final decision on whether to perform a midcourse. They want to get further tracking data from some other stations, and will have it by that time. The present indications are that the S-IVB is on the proper trajectory to impact the Moon at the planned impact point, and a booster has come up with a time based on present indications, a prediction that the impact will take place at 77 hours, 49 minutes, 23 seconds. He says he will update this time later, but that's the prediction at the present time. His studies all show that capability to command the midcourse will exist until an elapsed time of 13 hours, 48 minutes. Capability to command attitude control will exist to the same elapsed time 13 hours, 48 minutes. And, we at present have capability to track the S-IVB until an elapsed time of 84 hours, 42 minutes which is well past the predicted impact time. Apollo 13's altitude now 43 653 nautical miles from Earth. Velocity 9069 feet per second.

SC Okay, Houston, 13.

CAPCOM Roger, go ahead.

SC Okay, standby for a mark on another picture.

CAPCOM Okay, standing by, Fred.

SC 3, 2, 1.

SC MARK.

CAPCOM Okay, we got it.

SC Coming in. Okay.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Jim, Houston here. Two items, first of all your PTC is looking very good and should carry you through the night; second point, have a procedure to give you, if you are ready to copy, we'd like to set three bits in the computer and I will explain why.
SC Go ahead, Vance, we are ready to copy.
CAPCOM Okay. The procedure is as follows: VERB 25, NOUN 07 ENTER 1331 ENTER, 7 ENTER and ENTER. Explanation is as follows. During the P23's there was one time when VERB 37 was entered into the computer at about 16 seconds after the optics 0 zero switch was switched to zero. This is a very uncommon anomaly in that if you do this during a point of four-tenths of a second interval at around 16 seconds after you zero the optics so OPT bits are reset and this would mean that if you had a OCDU fail, it wouldn't be indicated so all this procedure is doing is setting these three bits back again where they should be.
SC Okay, Vance, and I guess I will try to be slower on that VERB 37.
CAPCOM Yes. Slower or faster, either one, I guess. Well, yes, slower. It is a very unusual thing to have that happen.
SC Okay, Houston, stand by for a mark on another picture.
CAPCOM Roger. Standing by.
SC 3, 2, 1. MARK it.
CAPCOM Roger, we copy, Fred.
SC Okay, Vance, we've completed that procedure and let me know if everything is okay.
CAPCOM Okay, thank you. We will let you know if anything isn't okay. I'm sure it is good now.
SC Tell G&C and GUIDO thanks a lot for keeping good track of me there.
CAPCOM Roger. They are right on the ball. And, 13, Houston, if you would like, we can let you know about every two minutes before the earth should be coming into your window. We think we've got it pegged down pretty well now. You won't have to look for it so much. You want that?
SC Yes. That would be fine, Vance.
CAPCOM Okay. And, 13, Houston, GUIDO says the bits are reset, rather are set.
SC Okay, thanks much.
PAO This is Apollo Control at 9 hours, 32 minutes. The booster systems engineer has just advised Flight Director Jerry Griffin that he and his group are going to pack it up and move out, meaning that no midcourse correction NO. 2 will be required for the S-IVB. The midcourse correction No. 1

PAO for the third stage of the booster has placed it on its trajectory which is calculated to impact at into the moon at the desired point. Several of the booster people will stand by and continue to monitor but at this point everything looks and the majority of the people at that position will be ending a very long day for them and leaving the control center. To repeat no midcourse correction No. 2 will be required for the S-IVB. This is Mission Control, Houston.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM It's time for Fred to start looking for the earth, should be coming by in a couple of minutes.
SC Okay. He's got his head out there right now.
SC Yeah. You've got that pretty well pegged, man. There it be.
CAPCOM Doesn't that give you confidence?
SC Yeah. I guess so.
SC In a minute though you're going to hear (garble)
CAPCOM Okay.
SC Okay. Stand (garble) for our countdown.
SC 3, 2, 1, MARK.
CAPCOM Roger, we copy.
CAPCOM Apollo 13, Houston. Over.
SC Go ahead there, Houston.
CAPCOM Rog. We're enjoying Fred's music there.
SC Yeah. (garble) tune up here.
SC Yeah. I kind of like it too, Vance.
CAPCOM Yeah. We didn't hear much of it though.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/11/70, 11:26 PM CST, 51/1

PAO This is Apollo Control. Fred's music was a few bars from the Marine Corps Hymn. Obviously recorded on the on - one of the on board tape recorders. Lunar Module Pilot Fred Haise is a former Marine aviator.

SC Houston, Apollo 13.

CAPCOM 13, Houston. Go ahead.

SC Okay, Vance, we did another EMS null bias test and the - it went from 100.0 to 101.8 in 100 seconds.

CAPCOM Roger. We copy.

CAPCOM 13, Houston.

SC Go ahead, Vance.

CAPCOM Jack, like to verify, was that 100 to 100.8 or 101.8?

SC 101.8.

CAPCOM Roger.

SC It was plus 100 to plus 101.8.

CAPCOM Roger.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Venus coming up in the window again in 1 to 2 minutes.

SC You got it. You're right again. Okay, stand by for a Mark here.

CAPCOM Rog.

SC 2 - 1 Mark.

CAPCOM Roger, copy your Mark. Apollo 13, Houston. We have a CSM state vector to send you. Request P00 and ACCEPT at your convienence.

SC Okay, Vance. There's P00 and ACCEPT.

CAPCOM Volterus coming up.

CAPCOM 13, the computer is yours again.

SC Okay, go back to block.

CAPCOM Yes.

END OF TAPE

SC Looks like picture taking time again.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Okay. You should be coming into view.
SC Okay.
SC Okay. Stand by, Vance. 3, 2, 1, MARK.
CAPCOM Roger. We got it.
CAPCOM Earth's starting to look pretty small now?
SC Looking at here now, Vance. It's hard to see the earth. All we see is water and clouds.
CAPCOM Well, I guess that's what we want. We want pictures of weather, right, clouds.
SC Yes, half of it's covered with clouds.
PAO This is Apollo Control at 10 hours, 37 minutes. Apollo 13 is 52 141 nautical miles from Earth. Velocity 8250 feet per second.

END OF TAPE

SC Houston, Apollo 13.
CAPCOM This is Houston. Go ahead.
SC Okay, Dan. Prepare to copy in the torquing angles on the P52 option 3.
CAPCOM That's affirm. That's affirm, but stand by.
SC Okay.
CAPCOM Okay. We've got them. Go ahead with the torquing, Jack.
SC Okay. That was stars 20 and 27 and star angle difference is 5 balls. Time at torquing will be 10 hours 40 minutes 15 seconds
CAPCOM 10 hours, 40 minutes and 15 seconds. 20 and 27 stars and 5 balls. Roger.
CAPCOM Apollo 13, Houston.
SC Go ahead, Vince.
CAPCOM Time to look out your window for us again.
SC Low and behold. Okay. It's 3, 2, 1, mark.
CAPCOM Roger. Copy.
CAPCOM Apollo 13, Houston.
SC Go ahead there, Houston.
CAPCOM Jim, we're coming up on a handover between sites. You might loose comm momentarily.
SC Okay. Unerstand handover, might loose comm.
CAPCOM That's -
PAO This is Apollo Control at 11 hours. That handover will be from Goldstone to Honeysuckle taking place now. Apollo 13 is 53 925 nautical miles from earth, velocity 8 093 feet per second.
SC Post-torquing checklist.
CAPCOM Okay, Jim. Real good.
SC Go ahead.
CAPCOM You should have the earth coming into view here shortly.
SC Okay. We got a new capcom now.
CAPCOM No, I changed my voice.
SC 3, 2, 1. MARK.
CAPCOM Roger. Copy.
SC That was a negative, Houston. Get that?
CAPCOM We got your mark, Jim.
SC Hey, you still there, man?
CAPCOM Roger. Go ahead.
SC I guess the world really does turn. I can see some of my land masses now. It must be Australia down there in the bottom and I guess we haven't really figured out what's over the - to the left. It must be some part of Asia. China probably.
CAPCOM Hey, maybe the fact that you verified that the earth really turns, we can call this Haise' theory, huh?

SC Looks very good, Dan. Very good.
SC It's looking good for you, Dan.
CAPCOM No. Seriously, very interesting. We can see on the map now that you're between Guam and Hawaii and a little bit north and you're almost out 60 000 miles.
SC Yes. I just did a P21 and we had 65 900.
CAPCOM Okay. That's pretty good.
SC I'll let you look at it again, Houston.
CAPCOM Incidentally, we're looking at a replay of your GD&E stuff here and the TV looks pretty good. First chance some of us had to see it.
SC Okay. Vance. And I wonder if our altitude in tens of miles is 65 290.
CAPCOM Okay. Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Okay. Looking at our computations back here we show you about 55 450 and going out rapidly now.
SC Well, HAL might be a little bit off.
CAPCOM Okay.
SC We have a 5 underneath our LEB disky that my name is Hal.
CAPCOM I can't imagine how that got there. Just remember you have to be nice to Hal.
SC We will.
SC I think this PTC's going to work out good. I been watching ther for the last hour.
CAPCOM Good. It's looking good here.
CAPCOM Good lord.
CAPCOM 13, Houston. You're very weak. Please repeat.
SC Vance, to my calculations we taken about 10 earth window photography pictures. I see nothing coming up here except constellation (garbled) here in a little while. I was thinking about getting that squared away to bed down for the evening pretty soon.
CAPCOM Okay. That sounds good, Jim. FAO here would like to request just one more picture before you bed down if you don't mind.
SC Okay. We'll go through with one more picture.
CAPCOM Okay.

END OF TAPE

SC I see nothing coming up here except to close the waste stowage vent here in a little while. I was thinking about getting squared away to bed down for the evening pretty soon.

CAPCOM Okay, that sounds good Jim. FAO here would like to request just one more picture before you bed down, if you don't mind.

SC Okay, we'll come through with one more picture.

CAPCOM Okay.

CAPCOM Apollo 13, Houston.

SC Go ahead Houston.

CAPCOM A couple of items Jim. The first is the time for closing the waste stowage vent is 12:24. If you turn in before that time, why it's okay as far as we're concerned down here to close it before that time just before you go to bed. The second point, we have some results on the P23's and if Jack's interested we could give him the corrected altitudes we're getting in so far.

SWIGERT Yes. I sure am man.

CAPCOM Okay. This is preliminary results, but it will give you some indication. Corrected altitude is turning out to be 17 plus or minus 4 kilometers, and the fact that it's plus or minus 4 kilometers indicates that you're being very consistent in judging the altitude. The effective altitude is turning out to be 10 plus or minus 12 kilometers. Comments are that, as I said before, you're being consistent on the horizon selection. The substellar point air is averaging 15 arc minutes and if you could hold the range to a minimum you might shoot for 5 arc minutes. That's the only comment there. Over.

SC Okay. I will try and do a little better next time.

CAPCOM But, they're real satisfactory.

SC Okay. Thank you Ben.

CAPCOM Roger.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Okay Jack, this is the last time for the earth coming into view in about 1 to 2 minutes.

SC Okay. I got my photographer looking up and (Garbled)

CAPCOM Okay.

CAPCOM 13, Houston. I just corrected. Actually, the earth will come into view more times. It's just that we're (Garbled) to the photography on it.

SC Okay. 3, 2, 1, mark.

CAPCOM Roger. We copy, and could you give us

CAPCOM the frame number on that last picture please.

SC Okay. We've been writing them all down Vance, as we went, but that one turned out to be 29.

CAPCOM Roger. 29 Fred.

SC Yes. Okay, Jack says I can't read the camera very well. It should be 28 based on our start frame.

CAPCOM Correction to 28.

CAPCOM 13, Houston. Understand the number showing that you read on the camera was 28. Was that affirm?

SC Yes. The readability of that thing is like half a the frame one way or the other so, 28 I think is a good number.

CAPCOM Okay.

MUSIC

CAPCOM Roger. Houston copies.

SC I'll have to not wear it out before Jack get's it.

CAPCOM Sounds like that music is a pretty nice thing to have on a long voyage.

SC You're right.

CAPCOM Apollo 13, Houston. Fred did you get any master alarms up there about 5 or 10 minutes ago? Folks thought they saw some here and they were curious about it.

SC Yes We got another 02 flow high load about 5 minutes ago.

CAPCOM Okay.

SC Vance, what the people down there might have been seeing is our testing.

CAPCOM Roger. Testing the caution warning?

SC Yes. We were ringing the siren device over the astro-alarm and were running a test on it.

CAPCOM Okay. Good enough, and anytime you're ready to copy, I've got a pad P37 block data.

SC Stand by. Okay. Go ahead Vance.

CAPCOM Okay. P37 block data starting with GETI. 025 00 5119 minus 165 07108 03500 7733 minus 165 07036 04500 6208 minus 165 09452 060 00 5993 minus 165 11853. Over.

SC Okay. 0500 5119 minus 165 07108 03500 7733 minus 165 07036 045 00 6208 minus 165 09452 060 00 5993 minus 165 11853.

CAPCOM Roger. That's all correct.

SC Oh.

PAO This is Apollo Control at 12 hours 5 minutes. Apollo 13's distance from earth now 58 828 nautical miles. Velocity 7690 feet per second.

END OF TAPE

CAPCOM Minus 165, 07108, 03500, 7733, minus 165, 07036, 04500, 6208, minus 165, 09452, 06000, 5993, minus 165, 11853. Over.

SC Okay, 02500, 5119, minus 165, 07108, 03500, 7733, minus 165, 07036, 04500, 6208, minus 165, 09452, 06000, 5993, minus 165, 11853.

CAPCOM Roger. That's all correct.

SC Okay. Houston, 13.

CAPCOM Roger. Go ahead.

SC We're starting presleep checklist. No medication.

CAPCOM Okay. The doc says very good.

SC Houston, (garbled).

CAPCOM Standby one. We need the LM CM Delta P for one thing, and I'll check back in a minute for the other.

SC Okay. We still have the vent valve open and we'll close it one of the last things and looking at LM CM Delta P right now and I see 5/10 in psi indicator.

CAPCOM Roger. 5/10. 13, Houston.

SC Go ahead.

CAPCOM The only other readouts we need are those on page 3 - dash 13 of the flight plan. Bat C, Pyro Bat A, Pyro Bat B, RCS A, B, C, and D readings, and DC indicator select there mean A or B.

SC Okay. Standby. Vance, we're still charging Bat D and do you want to dispense with that in a few minutes?

CAPCOM Standby on that, Fred.

SC Okay, Vance, I've got your readouts on page 3 dash 13 of the flight plan.

CAPCOM Okay. Ready. Copy.

SC Okay, Bat C is 37, 0 Bat A is 37, 0 Bat B is 37. RCS A 94 per cent, B 95 per cent, C 93 per cent, D 96 per cent.

CAPCOM Roger. Copy that. Apollo 13, Houston.

SC Go ahead.

CAPCOM Okay. In answer to the battery charging questions, I calculate that it should be fully charged at 12:35. Play that one, though, the same as the waste vent - if you want to do it earlier because you're turning in, why that's fine with us.

SC Okay, we'll continue on with a few other things that we got to get done, and just before turning in, we'll check with you, and you can remind us then.

CAPCOM Okay.

SC Houston, Apollo 13. Give me a call when you're ready for E memory dump.

CAPCOM This is Houston, 13. You are away, please repeat.

SC Okay, Vance give me a call when you're ready for our E memory dump.

CAPCOM Okay, 13. We're not quite ready yet. We'll give you a call when we're ready.
CAPCOM Roger. Go ahead.
SC Okay, Vance. I understand you're ready.
CAPCOM Negative, Guido isn't quite ready yet.
SC Okay. I thought I heard you call us.
CAPCOM But, we're ready now Jack, so Guido says he's ready to take it.
SC On the way down.

END OF TAPE

CAPCOM The LM CM DELTA P for one thing.
SC Houston, Apollo 13.
CAPCOM 13, Houston. Go.
SC Okay. Vance, OK to turn the vent valve back to close again, also battery charge OFF.
CAPCOM Roger. That's fine with us, Jim. Proceed.
SC Okay. We'll do that.
SC (Garbled).
CAPCOM Apollo 13, Houston.
SC Go ahead, Vance.
CAPCOM We think the spacecraft's looking in good shape. Nobody has any comment down here before you hit the hay.
SC Okay. How do they think we stand on the way of consummables so far?
CAPCOM You're looking in good shape in all respects. Consummables wise.
SC Okay. Real fine.
CAPCOM 13, Houston.
SC Okay, go ahead, Vance.
CAPCOM Just the last comment, Jack. Would you clear Hal, please, so he doesn't burn his lights out there tonight?
SC No, I'll just - I'll do that for you.
CAPCOM Okie doke. And we'll see you in the morning.
SC Okay. It'll be just a minute or two yet.
SC We have to finish up our Apollo chores.
CAPCOM What do you mean? It is morning.
SC (garbled)
CAPCOM Yes, that's right.
CAPCOM It's been a long day.
SC Yes, it sure was.
PAO This is Apollo Control at 13 hours, 8 minutes. We don't anticipate any further conversation with the crew tonight. At least we do not intend to put in any more calls to them. Apollo 13 crew settling down for a 10 hour rest period. Apollo 13 is 63 312 nautical miles from Earth. Velocity 7 358 feet per second. We'll take the release line down now. Come back up at approximately an hour with a status report. If there is further conversation, we'll come back up and bring that to you. This is Mission Control, Houston.

END OF TAPE

PAO This is Apollo Control at 13 hours 57 minutes. The White Team lead by Flight Director Gene Kranz is in the process of taking over here in the Control Center releaving the Gold Team, led by Jerry Griffin. Apollo 13 is 66 738 nautical miles from earth, velocity 7 123 feet per second. We had no conversation with the crew for the past hour. They have started a 10 hour rest period. It's a fairly quiet shift. At the beginning of the shift the crew was performing program point 3, sis lunar navigation, taking star markings with the sextant. That went very well. They established a passive thermal control mode and had to reestablish it a little bit later as the initial PTC was not well established. It has been performing very well since it was reestablished. For a period of several hours the Apollo 13 crew photographed the earth's weather. One photograph every 20 minutes. Mid-course correction number 1 was not performed by the space-craft. Midcourse correction number 1 for the S-IVB, the third stage of the booster, was performed just prior to the Gold Team coming on shift this evening at 6 hours elapsed time. Midcourse correction number 2 was scheduled for 9 hours. However, tracking determined that midcourse correction number 2 for the S-IVB was not required. And the S-IVB is expected to impact the lunar surface in the area that is desired at about 77 hours 49 minutes. The impact time will continue to be updated throughout the translunar coast period. Prior to saying good night to the crew we did have a report from spacecraft commander Jim Lovell that the crew had taken no medication thus far in the mission. And we reported to the crew that all spacecraft consumables are in good shape. 14 hours 1 minute, this is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70, 347 CST 1436 GET 58/1

PAO This is Apollo Control Houston, at 14 hours, 33 minutes, now into the flight of Apollo 13. Our digital displays presently show Apollo 13 traveling at a speed of 6923 feet per second, and at a distance away from earth of 68 941 nautical miles. The white team of flight controlers have settled into their respective console positions. The atmosphere in Mission Control, at the present time, could be described as quiet, businesslike, since the crew entered in their rest period some hour and a half to two hours ago. Flight director Gene Kranz, as is traditionally done, went around the room talking to each member of his flight control team, following their change over. Jack Lousma is presently filling the position of capsule communicator, however, we would not expect to hear from Mr. Lousma, assuming that the mission continues on its present flight plan. The report from flight surgeon during this around the room period indicated - the flight surgeon indicated that he felt all 3 crewmen were settled in and sleeping at the present time. He is recording data on the lunar module pilot, and his data indicated that Fred Haise went to sleep at 13 hours 30 minutes into the mission, some 1/2 hour ago. We're now at 14 hours, 35 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/12/70, 3:47 AM CST, 59/1

PAO This is Apollo Control, Houston at 15 hours, 33 minutes now into the flight of Apollo 13. Our digital display presently show the Apollo 13 spacecraft at 73 035 nautical miles away from Earth. Now travelling at a velocity of 6 731 feet per second. With the crew now well into its - into their rest period, here in Mission Control, we have not attempted to contact them. Continuing to monitor at 15 hours, 34 minutes into the flight, this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4-12-70, CST 4:47 GET 14:37 60/1

PAO This is Apollo Control, Houston, at 16 hours, 24 minutes now into the flight of Apollo 13. Our digital displays presently show Apollo 13 at 76 311 nautical miles away from Earth. Continuing to slow down, now showing a velocity of 6551 feet per second. Meanwhile during this quiet period in the Mission Control Center, the white team of flight controllers headed by Flight Director Gene Kranz are taking this opportunity to watch a television replay of the transposition and docking phase of the mission which took place yesterday afternoon. We're at 16 hours, 25 minutes into the flight. Continuing to monitor. This is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/12/70, 5:37 AM CST 61/1

PAO This is Apollo Control, Houston at 17 hours 23 minutes now into the flight of Apollo 13. Our digital displays presently show the Apollo 13 spacecraft at 79 919 nautical miles away from earth. And travelling at a velocity of 6350 feet per second. We've had no voice communications or contact with Apollo 13 crewmen Jim Lovell, Jack Swigert, or Fred Haise, since they started their rest period. Meanwhile, this has provided a period of quiet planning in the mission control center. One of the items being planned, midcourse correction number 2, will pass along preliminary planning numbers for you know. We're presently looking at a ground elapsed time of 30 hours 40 minutes 57 seconds for MCC 2, with a DELTA-V or a velocity of 23 feet per second. This, of course, will be performed with the service propulsion system of the command module and with a burn duration now planned of 3.25 seconds. Of course, these numbers will be reviewed and updated as the mission progresses. We're now at 17 hours 25 minutes into the flight of Apollo 13 and this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4-]2-70, CST 638, GET]7:27:30 62/]

PAO This is Apollo Control Houston at]8 hours 22 minutes since the start of the Apollo]3 mission. We now show Apollo]3 83 396 nautical miles out from earth, traveling now at a speed of 6157 feet per second. At this time the Apollo]3 crew continues in their rest period and meanwhile in Mission Control we will continue to monitor for any conversations or transmissions in the unlikely event they should occur. We're at 83 hours 20 minutes into the flight, this is Apollo Control Houston.

END OF TAPE

APOLLO]3 MISSION COMMENTARY, 4/12/70, CST 8:35 GET 18:27:30 63/1

PAO This is Apollo Control Houston at]9 hours, and 22 minutes now into the flight of Apollo 13. We've just concluded another silent hour in the Mission Control Center as the Apollo]3 crew is still sleeping. Meanwhile, backup pilot John Young has joined Jack Lousma at the Capsule Communicator's console. At this point, we will relay some flight dynamics data developed during this period of relative inactivity. Apollo]3 will reach its mid-point in its trip to the Moon, in terms of distance, at an altitude of]12 070 nautical miles. This will occur at a ground elapsed time of 27 hours, 20 minutes, 49 seconds. The spacecraft's velocity relative to the Moon will be 4207 feet per second, relative to the Earth, its velocity will be 4990 feet per second. Apollo]3 will be at its mid-way point in terms of time and our point of reference here is the lunar orbit insertion, now forcast to occur at 77 hours, 26 minutes,]2 seconds. Its mid-way point would be at a ground elapsed time of 38 hours, 43 minutes, 06 seconds. At that point, Apollo]3 will be at an altitude of 85 684 nautical miles away from the Moon and traveling away from the Earth at a distance of 14] 764 nautical miles. Its velocity relative to the Moon, 3776 feet per second; its velocity relative to the Earth 4098 feet per second. Apollo]3 should go into the lunar sphere of influence at ground elapsed time of 62 hours, 49 minutes. Zero seconds. Its distance at that time away from the Moon will be 33 82] nautical miles; distance away from the Earth]90 7]3 nautical miles, and traveling at a velocity of 364] feet per second, relative to the Moon, and 3025 feet per second, relative to the Earth. We are now at]9 hours, 25 minutes into the flight of Apollo]3, and this is Apollo Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 9:35 am CST 20:22 G.E.T. 64/1

This is Apollo Control, Houston at 20 hours 22 minutes now into the flight of Apollo 13. Our display now shows the Apollo 13 spacecraft at 90 380 nautical miles away from earth continuing to slow down, it's velocity presently reading 5843 feet per second. Meanwhile in the Mission Control one of our multi-purpose countdown clocks shows that the Apollo 13 crew has 2 hours 37 minutes remaining in their rest period. We're at 20 hours 23 minutes into the flight and this is Apollo Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/12/70 CST 9:37 GET 20:24:42 65/1

PAO This is Apollo Control Houston. We wish to make an announcement that the writer pool meeting - this is a writer pool for the Missions Operations Control Room - is getting under way at the present time in the small auditorium in building 1. This is Apollo Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4-12-70 CST 1034 GET 21:21 66/1

PAO This is Apollo Control Houston at 21 hours 21 minutes now into the flight of Apollo 13. Apollo 13 is now 93 640 nautical miles away from earth. Its velocity now reading 5699 feet per second. There's 1 hour 38 minutes remaining for the rest period for Jim Lovell, Jack Swigert, and Fred Haise. Based on Madrid tracking of the S-IVB, we're presently predicting a point of impact of 8 degrees, 35 minutes south, 33 degrees, 54 minutes west at a ground elapsed time of 77 hours 51 minutes 32 seconds. These are very early numbers and subject to considerable refinement through futher tracking. We're at 21 hours 22 minutes, continuing to monitor, and this is Apollo Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 11:08 am CST 21:55:20 G.E.T. 67/1

This is Apollo Control, Houston at 21 hours 55 minutes since liftoff. Apollo 13 is presently 95 511 nautical miles out from earth and now traveling at a speed of 5620 feet per second. In Mission Control center we're now experiencing a change over in flight control teams. The Lunney team has reported aboard, replacing Gene Krantz's team of flight controllers. At the capsule communicator position Joe Kerwin is now in place of Jack Lousma. For the entire shift we had no contact with the crew as they were in a rest period. Jack Lousma although he served as our capsule communicator, can be distinguished by the fact he had absolutely nothing to say over the loop this morning. We're at 21 hours 56 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

PAO This is Apollo Control at 23 hours, 12 minutes ground elapsed time. Apollo 13 now 99 589 nautical miles out from earth; velocity continuting to decelerate now showing 5453 feet per second, in velocity. Spacecraft Commander Jim Lovell just called Houston about - oh, some 12 minutes past the scheduled wake-up time. It had been decided here in Mission Control to let the crew sleep as long as they watned to this morning because its a rather relaxed day. We'll play back the tape now of this first few sentences in conversation and rejoin any subsequent conversation live.

SC Hello Houston, Houston, hello. 13. Over.

CAPCOM Good morning 13; this is Houston. How are you?

SC We feel right in there. We had a fairly good night's sleep.

CAPCOM Okay - real fine. At your leisure, you can give us radiation reports I guess, and we are getting a consumables update together for you, and a few other little details when you are ready to talk. About the only major thing on the spacecraft is that it is - farther away.

SC Okay, well, that's to be expected I guess.

CAPCOM Yeah.

SC And we're starting to charge battery A.

CAPCOM Rog on battery A Fred. Eecom said battery B looks real good.

SC Okay.

SC Houston.

CAPCOM Go ahead.

SC Okay, for information, Fred was on comm last night; and he was over in the left hand seat, and if you want radiation readings, we - I guess goofed - we left them all in the suits which are now nicely tucked away. We are going to get out jack' s suit in an hour or so anyway, and we'll get his dosimeter out if you wanted to get the reading on that one.

CAPCOM Okay, that will be satisfactory.

SC Okay.

CAPCOM And in exchange, the head surgeon would like to have a rough number of hours each one of your slept and a qualitative verb to describe it, whether it was good, fair, or poor

SC Okay, stand by.

SC Okay, Houston, we had an average of around 5 or 6 (static)

CAPCOM Jim, Houston, your comm got pretty garbled there just as you started to talk.

SC Okay, Houston, Apollo 13.

CAPCOM Okay, 13, you are loud and clear again.

SC We averaged about 5 and a half hours a piece, and we are estimating that the sleep was good.

CAPCOM Okay, copy that. Let's see what else we have for you Jim. Mid-course 2 looks like about 23 feet per second approximately retro grade and on time. And its holding real firm there. For your information, and you don't need to copy this down, cause its still pretty soft, but we have an SIVB impact of about 8 -

END OF TAPE

CAPCOM S4B impact of about 8.57 south and about 33.9 west, which is a little west and a little south of the flight plan value. We have it at a GET of about 77 plus 51 which is is just before AOS and the LOT pass are a little bit late, and as I say, its still pretty soft and we'll be updating you with firm numbers.

SC That's fine Joe. Just as long as it doesn't hit Cold Crater.

CAPCOM Okay.

CAPCOM And I'll have a consumables update for you in a little while. And I have a small flight plan update for you sometime a little later on. When you're ready to copy. There's no big deals in it.

SC Roger.

CAPCOM And 13, Houston. We'd like to verify that you cycled the 02 cryo fans. We saw the H2, but we didn't see the 02 get stirred up.

SC Yes Joe, we did, and it kind of looked like we might have had a little stratification occur right after we put them on we had a cryo press light.

CAPCOM Okay. ECOM told me that this might happen and he was right.

SC Okay, Joe. We're ready to copy a flight plan update and your consumables.

CAPCOM Okay, Jack. The Flight Plan update has a couple of items in it, and the first one we'd like to do is to update the TFM values in the GNC check list page G9-2. These are fairly small changes, but in case you need them we'd like you to have the exact numbers. Over.

SC Okay. Just a minute. I'll get it out of here. Joe was that the GNC checklist G9-2?

CAPCOM That's affirmative. GNC, page G9-2.

SC Okay. Go ahead.

CAPCOM Okay. On that page on line 04, column B. Change the number from 03366 to 05253. Over.

SC (garble) 53.

CAPCOM Okay, and line 05, column B, change from 11000 to 33661. Over.

SC 33661.

CAPCOM Okay. That's right. The only other thing I've got for you Jack is 3 additional questions for the booster systems debriefing, which is to take place at about 25 hours, and we thought we'd pass these questions up to you early so you can consider them. Over.

SC Okay. We're ready to copy.

CAPCOM Okay. The first question is - and let me get the original question because - This question says "More specifically on item 2 and Item 2 says, Were there any significant changes in the noise vibration level during the single stage of powered

CAPCOM flight. Specifically describe your observations during the early S2 center engine cutoff, and approximately 90 seconds prior to TLI cutoff you reported a high vibration in the S4B. We'd like you to describe the buildup of this vibration and its behavior through cutoff. Over.

SC Okay. Initially, what you would like us to talk about is vibration sequence during the early S2 cutoff of the center engine and also describe the vibration that we encountered during the S4B TLI burn? is that correct?

CAPCOM That's it. Okay. The second extra question is for you, Jim, and it says, Comparing this flight with your ride on Apollo 8, were there any significant differences in the powered flight environment?

SC Okay we'll describe a comparison with

END OF TAPE

SC okay it was a little (garbled) in comparison with 8 and 13 this time (garbled)

CAPCOM Roger, and the last additional question is what did the ordeal ball look like during TLI? You know, we passed you an update to that setting and we'd like to know whether it was right and right on zero or what during the burn. Over.

SC Okay, will do, we'll (garbled)

CAPCOM Okay, that's it and that's the whole flight plan update. I have a consumables update now if you want to listen to that.

SC Okay, Joe, we're ready to copy.

CAPCOM Okay, at 23 hours the total RCS is 1121, quad A is 274, quad Bravo is 286, quad Charlie is 274, quad Delta is 287 and the cryoes are as follows: H2 tank 1, 83 percent; H2 tank 2, 86 percent, 02 Tank 1, 87 percent; 02 tank 2, 87 percent. Over.

SC Okay, Joe, we got all those, and how do we compare them with where we should be in the time line?

CAPCOM As I understand it, Jack, you're running slightly ahead of nominal in both those areas.

SC Okay, okay, Joe, fine.

CAPCOM No problems.

CAPCOM And 13, Houston, that's all the business I have right now. I have a little news plan of the day for you if you feel like listening to that a little later on.

SC (garbled)

SC Houston, 13.

CAPCOM Okay, 13, Houston, loud and clear again. Go ahead.

SC Okay, Joe, on the news Jim would like to hold off a little bit on that and I want to make a request to FAO, if he would sometime during the day when we get a flight plan update with those activities we agreed to make optional during lunar orbit and the few activities we were going to delete. I think that I forgot and left that card back, during the (garbled) suiting I left it in the suit room.

CAPCOM Okay, wilco.

CAPCOM Okay, Jack, I understand FAO's working on that and we'll have something for you later on.

SC Okay, we're not in any hurry.

CAPCOM Roger.

END OF TAPE

SC Okay, Houston, 13.
CAPCOM Okay, Jack, we copy the angle. She's in, go ahead and torque them.
SC Okay, Joe. The time of torquing will be 23 hours 47 minutes 30 seconds.
CAPCOM Copy.
SC Houston, 13.
CAPCOM 13, Houston. Go ahead.
SC For your information, Joe, we're all configured back again now to our regular seating position so if you're monitoring us -
CAPCOM Okay, Jim.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 CST 1:17P GET 24:04:04 72/1

PAO This is Apollo Control continuing to monitor the air/ground from Apollo 13. Crew now in breakfast period. About an hour from now the launch vehicle's systems performance debriefing will be carried out between the crew of Apollo 13 and the flight controllers here in the Mission Control room. Additional questions over the ones that were preplanned and included in the flight plan will be passed to the crew from the booster systems engineer. The philosophy being that many of the debriefing items can be carried on in flight during rather quiet periods of the coast phases of the flight. And thereby reduce the amount of debriefing done after recovery. Spacecraft now 102 342 nautical miles out from earth; velocity now 5345 feet per second. Ground elapsed time now 24 hours 5 minutes. Apollo Control continuing to stay alive in anticipation of the morning news being read up by spacecraft communicator Joe Kerwin to the crew and a rather quiet day all in all. Coming up at 30 hours and 40 minutes with midcourse correction burn number 2 which is the hybrid transfer maneuver to take the spacecraft out of the free return trajectory and place it in a nonfree return. But still within the capability of the propulsion systems of the spacecraft to get back onto the prereturn. Pericynthion should this maneuver not be made would be 252 nautical miles above the moon. Post burn it's more in the neighborhood of 60.2 nautical miles if the maneuver is done on time and with the desired velocity change. 24 hours 6 minutes continuing to standby.

END OF TAPE

SC Hello there, Houston, 13.

CAPCOM 13, Houston, go ahead.

SC Gosh, we had forgotten we'd like to hear what the news is.

CAPCOM Okay, there's not a whole lot to it. Well, lets see, we'll start with - lets start with sports, what the heck. The Astros survived 8 to 7, the Braves got 5 or 6 runs in - 5 runs in the 9th inning, but they just made it, and the other important game of the day, the Cubs were rained out. I have all the rest of the scores, you can tell me if you want any of them. They had earthquakes in Manila and other areas of the Island of Luzon. There were 3 tremors and they kept the building shaking for about a half an hour or so and it was about a 5 on the Richter scale. Okay, lets see. The Beatles has announced they will no longer perform as a group. The quartet is reported to have made in excess of a half billion dollars during their short musical career. However, rumors that they will use this money to start their own space program are false.

SC Maybe we could borrow some.

CAPCOM Okay. Okay, West German Chancellor Willy Brandt, who witnessed your launch from the Cape yesterday, and President Nixon will complete their round of talks today. Brandt reportedly came to the U.S. to seek assurance from the president to go ahead with talks with the eastern European nations, especially East Germany, Poland and Russia. The air traffic controllers are still out, but reports indicate they are slowly returning to work and you'll be happy to know the controllers here in the MOCR are still on the job.

SC (garbled)

CAPCOM Go ahead.

SC I said thank goodness for that.

CAPCOM Okay, some truck lines are being struck in the midwest, and the school teachers have walked off the job in Minneapolis. Today's favorite pastime across the - uh oh, have you guys completed your income tax?

SC How do I apply for an extension?

END OF TAPE

SC How do I apply for an extension?
CAPCOM (laughter)
SC Joe, I gotta - it ain't too funny; things kinda happened real fast down there and I do need an extension.
CAPCOM (laughter)
SC I didn't get mine filed. I'm really serious; would you -
CAPCOM You're breaking up the room down here.
SC - time in it -
CAPCOM We'll see -
SC I may be spending time in it - I may be spending time in another quarantine besides the one that they are planning for me.
CAPCOM We'll see what we can do Jack; we'll get with recovery and see if we can get the agent out there in the Pacific when you come back. By golly, let's see. Professional basketball, the Nicks beat the Milwaulkee Bucks 110 to 102, and Billy Casper is leading the masters after 54 holes with a 208, and spring football practice is in full swing. And that's about all the news we got; the updated plan of the day for you guys is the uniform will be service struts inflight coverall garments with soards and metals, and tonight's movie shown in the lower equipment bay will be John Wayne, Lou Costello and Shirley Temple in The Flight Of Apollo 13. Over.
SC Outstanding. Houston, this is 13; is it true that Jack's income tax return was going to be used to buy the ascent fuel for the LM?
CAPCOM Well considering that he's a bachelor, and hasn't got any deduction to take, yeah.
SC Hey Joe, I'm glad you brought that up, because I was really serious about that.
CAPCOM Okay, Jack, we'll take care of it. Tom Stafford says he'll get an extension for you.
SC Okay.
CAPCOM Jim McDivitt says "yeah, now that you mention it, he forgot to fill the ascent stage."
SC (laughter) Suspicion confirmed.
CAPCOM Should give you very good performance on descent.
SC Should have a lot more hover time huh?
CAPCOM That's right.
CAPCOM Okay, crew, about the only other thing I've got for you right now is an update to your P37 pad for liftoff plus 35; this is a change in the pad we gave you yesterday. The reason for the update is for weather avoidance in the mid Pacific landing area at 70 hours, which is the return time for this pad, and in case the question arises in your mind, we don't expect any problem there for the end of the mission. The weather area is 20 degrees south of your

CAPCOM end of the mission landing point and it appears to be moving to the south.
SC Okay Joe, I'm ready to copy the pad.
CAPCOM Okay, GET of ignition is 0 3500 Delta VT 7883 longitude minus 155 and the GET 400 K 06954; over.
SC GETI is 03500, 7883 minus 155 06954.
CAPCOM Okay.
SC And Houston, Jack's gonna try to don his suit now for practice, and when he gets it out we'll give you a duplicate reading.
CAPCOM Okay, real good.

END OF TAPE

SC Houston, Apollo 13.
CAPCOM 13, Houston. Go.
SC Okay, we've retrieved Jack's dosimeter, and it reads 02022.
CAPCOM Okay. We copy. 02022 on the dosimeter, Jim.
SC That's correct.
CAPCOM 13, Houston. At your convenience, we'd like the LM CM DELTA-V reading.
SC That reading is .65.
CAPCOM Copy .65. Thank you.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4-12-70 CST 1:57P GET 24:34:30 76/1

DEAD AIR

CAPCOM Apollo 13, Houston.
SC Houston, Apollo 13.
CAPCOM Roger; we're thinking together. Waiting for your call.
CAPCOM Okay, you were a little broken up there Jim but I think its getting better - we are ready for the launch vehicle systems debriefing whenever you are.
SC Okay, Houston, Apollo 13. You were cut out again; repeat please.
CAPCOM Roger Jim. We are ready for the launch vehicle systems debriefing whenever you are.
SC Okay; just a moment.
SC Okay, Houston; 13. In answer to question 1, the changes in noise level occurred mainly between the first stage and the other stages - the other stages were about the same in noise level during climbing, the first stage of course made quite a bit of noise in the beginning which built up during the high Q, and went quiet just after high Q.
CAPCOM Okay, copied that Jim.
SC I might mention that the noise level during the first stage was not sufficient to be uncomfortable at all.
CAPCOM Roger. And I assume that comm was okay.
SC That's affirm. Comm was very good all during the entire flight, much better than expected.
CAPCOM Okay.
SC Now in answer to question 2, there was of course a vibration transient during the second stage that - due to the number 5 engine going up, which occured shortly before the engine went out and shortly after that the S2 stage was very smooth.
CAPCOM Okay, Jim. I guess the significant point there is that you did notice the vibration before you saw the engine light.
SC That's right. We noticed the vibration but it wasn't such that we thought that something catastrophic was going to happen, it just started vibration and then the EM light came on, and then the vibration went away and the stage itself was smooth.
CAPCOM Okay, copied that.
SC It was all pretty short span - just a second or so before and like a second afterwards, Joe. And on the S-IVB, the vibration of the vehicle itself was not the same as during it's powered flight - a very high frequency vibration.
CAPCOM That was - was that just during TLI, or did you notice that at insertion?
SC Well - there was a high freqencey vibration but more noticeable during the TLI burn than it was during the boost phase.

CAPCOM Okay, understand.
SC I guess the SIVB vibration during TLI was there all the time although it seemed to grow to us as the burn progressed, although that may have been just due to the weight decrease.
CAPCOM Okay, you called us about 3 and a half minutes, but I guess the thing was slowly building up throughout the whole burn.
SC That's right.
CAPCOM Okay, was it uncomfortable or did it cause your vision to degrade or anything like that?
SC No, not uncomfortable at all and in recalling the ride on 8, and the S-IVB was much more smooth than even it was in 13.
CAPCOM Copied that.
SC Okay, now, in answer to number 3, we did not experience any unexpected transients except all of us noticed the PU shift, we thought it was more pronounced than we had expected it to be.
CAPCOM Okay.

END OF TAPE

SC (Garble)
CAPCOM Okay. Understand.
SC Joe, on that. I guess most every time a new shift occurred we could feel definitely sorry for (garble)
CAPCOM Roger. Understand, Jack.
SC And during the last few hours of the flight the (garble)
CAPCOM Okay.
SC And answer to number 4. We got a pretty good look at the thermal shroud and the IU after taking the LM away and from our viewpoints the shroud was pretty intact. We saw no loose particles or (garble)
CAPCOM Okay, Jim. Understand.
SC And I guess the answer to 5. I don't think at any time do we have any degradation problem during power burn.
CAPCOM Roger.
SC And as for 6. The answer is essentially no. We don't know of any noticeable (garble).
CAPCOM Okay, Jim. I guess you described to us the non propulsive venting on the S-IVB after the APS maneuver and we copied that at the time.
SC Okay. That's all. Yeah, we had already talked about that Joe. It was also visible when it - course it did it, the course of the basic maneuver, we were looking at it. Okay, Joe. The last time we saw the S-IVB it was when (garble) and then later on we saw a particle or something out there and it might have been the booster or one of the SLA panels.
CAPCOM Yes. When was that Jim?
SC We're debating. It was somewhere between say something like 7:30 and 9 hours.
CAPCOM Okay.
SC But, Joe, assuming the S-IVB is still stable. The object I was looking at was definitely tumbling.
CAPCOM Okay, Fred. As I recall, it was stable then, although it's tumbling now.
SC It probably was the SLA panel we picked up.
CAPCOM Right.
CAPCOM Incidently, I guess the guys -
SC I think (garble)
CAPCOM Go ahead Jim.
SC I think we answered number 9. At around 5:32 I think was when we - I think number 5 light came on the S-2, and a definite vibration which was more than just a light vibration from the normal S-4 burn and as the light came on I followed the echo thinking at the time that it was 7:42

SC - and looked up at the time and realized it was early and when the light came on and the vibration stopped and the engine of the booster smoothed down and it was very smooth from there on.

CAPCOM Okay. This may be a stupid question, but do you have any idea what the frequency of it was?

SC Only to say that it was much higher. I couldn't say now. It was rather rapid longitudional vibration.

CAPCOM Okay, Jim. (Garble)

END OF TAPE

CAPCOM 13, Houston. I read you. We still have quite a bit of noise on the loop.

SC I'll standby. Roger.

CAPCOM Okay, Jim. It should be pretty good now. We copied you answering question number 9.

SC Do you want anymore comments on the SIV-B vibrations?

CAPCOM I don't think so. When you get all done, I'll make a quick check to see if the booster people have any additional questions. You skipped number 8, Jim, could you go back to that for a second?

SC Okay, standby.

SC Our only comment there, Joe, was that the burn on TLI to our knowledge was about 3 and three quarters seconds longer than had been predicted and that was the only thing that we really noticed; otherwise looked like TLI was nominal at cutoff.

CAPCOM Okay, understood.

SC Okay, on comparing the flight of 13 to Apollo 8, liftoff was about the same, the amount of vibration as I noted on 8 at the beginning of the flight there was less of the sideways motion than we experienced on Apollo 8. The SI-C separation felt more violent on 13 than it did on 8 maybe that's because I was in a different seat, I don't know. There was about 3 sharp transients of the cutoff and a couple of big bangs where we were thrown backwards longitudinally on our straps just before the S-2 went off. And the S-2 was of course just as smooth on 13 as 8 except when the number 5 engine and we do not experience the vibration that we experienced on 8 towards the end of the S-2 burn. And the SIV-B was ... had more vibration than on 8.

CAPCOM Okay, Jim, got all that.

SC The update on the ordeal ball was a good one. At the burn we were about - just about 8 degrees and we had to pitch down. The yaw was right on all the way through the entire burn and just towards the end of the burn the ball started going (garbled) and pitch a little bit.

CAPCOM Okay, sounds good, we'll give Mike Wash a gold star now. Okay, Jim, standby one while I see if we have any extra questions. Jim, while we're waiting to see if they have any more questions, I'd like to read you the booster peoples preliminary analysis on the S-2 cutoff. Over.

SC That'd be very interesting go ahead.

CAPCOM Okay, preliminary analysis of the data indicates that the center S-2 engine vibrated at a somewhat higher amplitude than we've seen on previous flights and it started at about a hundred and sixty seconds into the

CAPCOM S-2 burn. As a result of these vibrations, the engine chamber pressure decreased to the level where the two low level thrust sensors, thrust location sensors, initiated center engine cutoff. Early evaluation of data indicates that no damage occurred to the engine and the cause of the increased vibration amplitude is still under investigation. Over.

SC Okay, it was the center engine.

CAPCOM Yes, right.

SC Joe, do you have any word on what marks we had for TLI?

CAPCOM At the time of TLI, as I recall, you had 6 seconds longer than a nominal burn which was 3 seconds longer than the 3 signal low burn.

END OF TAPE

CAPCOM the nominal burn which was 3 seconds longer than the 3 sigma low burn and you were also GO for a second opportunity TLI if we required one.

SC Okay, we were just wondering because it appeared to us that we had a longer TLI burn than had been (garbled)

CAPCOM Yes, you did. We confirmed that cutoff time just about as you saw it and I don't have an explanation for it, but it was with the 3 sigma margin.

CAPCOM 13, Houston.

SC Go ahead.

CAPCOM Roger, we have no further questions. All the answers were clear and satisfactory and we thank you very much. You can press on with the rest of your busy day.

SC Righto.

PAO This is Apollo Control. The Launch Vehicle Systems Briefing is just concluded, no further questions from the booster controllers pass through Capsule Communicator Joe Kerwin. Apollo 13 now 106 747 nautical miles out from earth, velocity continuing to slow down now 5179 feet per second. The spacecraft will reach the midpoint in distance where it's equally far from the earth to the spacecraft or from the spacecraft to the moon at 27 hours 20 minutes 49 seconds. At that time it will be 112 070 nautical miles both ways to the earth and to the moon. Continuing to stand by on the air-to-ground circuit for further conversations.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 CST 2:47 PM GET 25:34:16 81/1

DEAD AIR

END OF TAPE

SC Houston, 13.
CAPCOM 13, Houston, Go ahead.
SC Okay, Joe. Out window five I just picked up the tumbling object again so for sure it must have been a SLA panel. I don't think we can still e in the proximity of the S-IV at this time.
CAPCOM I don't think so Fred. It's several hundred miles aft of you. Seven hundred miles is the number, I'm told, and since the SLA panel didn't make the mid course correction, that might be it.
SC Yes, it's, I can't really tell for sure even through the binocular what it is but it looks in the same relative position to the stars. The best I can tell about the same intensity and still about the same distance from us.
CAPCOM Can you see it tumbling. Does it have a shape or is it a point?
SC No. I can tell it's tumbling, I guess the flat side not only facing me, not only much brighter it's also it grows larger.
CAPCOM Okay. Very interesting. We'll see if we can figure out where that's at relative to you. They keep updating the S-IV impact on us a little bit. The last guess we had was that it will impact about the same longitude we gave you but close to zero lattitude and a little bit later. You still won't be able to see it. And they're saying it might make a -
SC Roger.
CAPCOM They're saying it might make a 100 to 120 foot crater too.
SC Well, we'll still be past the terminator (garbled)
CAPCOM Roger, right it will be at about the Rev 20 terminator so, it will be late, late in your lunar orbit activities before you will be able to photograph it and FAO is looking at whether we can work that in or not.
SC Okay.

END OF TAPE

SC Houston, 13
CAPCOM 13, Houston.
SC Hey, Joe, is FAO ready to - or are you ready to give me those items that we made optional and deleted in the solar book?
CAPCOM Check. We are not quite ready with that yet but we will be before too long. Can you wait awhile?
SC Sure can. Got lots of time.
CAPCOM Okay.

END OF TAPE

PAO Velocity now 4991 feet per second. Coming up in slightly over 20 seconds on the midpoint in distance. And at which time the spacecraft will be equally far from the Earth and from the Moon. The distance at this time will be 128 880.5 statute miles coming up, MARK. That computes out to 112 070 nautical miles. Continuing to leave the circuit alive, as we anticipate further discussions, and later on today the midcourse correction burn number 2 which will take Apollo 13 out of the free return trajectory into the so called hybrid trajectory. Which would not necessarily return to the vicinity of the Earth, the closest approach would be something in the nature of 40 000 miles coming back from the non-free return trajectory. At 27 hours, 21 minutes ground elapsed time, and standing by, this is Apollo Control.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 CST 5:04P GET 27:51 85/1

SC Hello Houston, Apollo 13.
CAPCOM 13, Houston. Go ahead.
SC Just a passing comment Joe, we're having lunch right now and I just made myself a hot dog sandwich with catsup. Very tasty and almost unheard of in the old days.
CAPCOM That's correct 13. As I recall the flight plan, you're suppose to put mustard on the hot dogs and not catsup but I guess we'll overlook that.
SC We blew it.
SC Right.
CAPCOM How's everything going?
SC About pretty good. We have about 4 different methods of spreading catsup, right now.
CAPCOM Okay, Jack. We'll have your update to you before too long.
SC Okay, fine Joe. We did a pit check on the Hycon camera and everything works okay.
CAPCOM Okay. Beautiful. We don't have anything else for you at the moment.

END OF TAPE

SC Houston, 13.
CAPCOM 13, Houston. Go ahead.
SC Okay. We'd like to get the FM up now to look at the (garbled).
CAPCOM Okay. Stand by and I'll get a go on this.

END OF TAPE.

CAPCOM 13, Houston.
SC Go ahead.
CAPCOM That's acceptable, Fred and meanwhile, when you guys are ready to copy, we've got an MCC-2 pad for you.
SC Okay. Stand by one.
CAPCOM Roger that and also if you can go to P00 and ACCEPT conveniently, we'd like to uplink.
SC Okay, you've got it.
CAPCOM Okay.
SC Okay, Joe, you can go ahead with the P30 pad.
CAPCOM Okay, here we go. MCC-2, SPS, G&N, 63634 plus 096 minus 023 030 40 4900 minus 00217 minus 00017 minus 00080 080 164 326 N/A N/A, 00232 003.5. We'll give you half a second on the burn time because it's so short. 00185 44 1359 281 and the rest is N/A. Comments, set stars 31 and 23 roll a line 288 PITCH 205 YAW 034 no ullage, LM weight 33499 and over.
SC Okay. MCC-2, SPS, G&N, 63634 plus 096 minus 023 030 40 4900 minus 00217 minus 00017 minus 00080 080 164 326 N/A N/A, 00232, burn time 003.5, 00185 44 1359 281 and the rest N/A. Set stars 31, 23, roll a line 288 PITCH 205, YAW 034, no ullage, LM weight 33499.
CAPCOM Roger. Readback correct. I have two more short comments on them but I want to wait just a second here to make sure I understand before I pass it to you.
SC Okay.
CAPCOM Okay, Fred, Houston.
SC Go ahead.
CAPCOM The two additional comments were just this. First of all, they biased DELTA VC by minus .34 feet per second based on your EMS null bias. Check, that's for information and the second one also for information is that you're targeted pericynthion is 60 miles after this correction.
SC Okay, I understand. For Jack's information the EMS DELTA V bias is 3.4 and targeted pericynthion after this maneuver is 60 miles.
CAPCOM That's correct on the pericynthion. The EMS bias is .34 - very small.
SC Okay. .34 on the EMS DELTA V bias.
CAPCOM Roger. And -
SC Hey Joe, we'll give - -
CAPCOM Go ahead.
SC We'll give you the results on another null bias test for comparative purposes.

END OF TAPE

SC - that's DELTA-V minus.
CAPCOM Roger. And -
SC Hey Joe, we'll give -
CAPCOM Go ahead, Jack.
SC We'll give - we'll give you the re - we'll give you the results of another null bias test for comparative purposes right before the - elapsed proper time.
CAPCOM Okay, real fine. And the computer is yours.
SC Okay, thank you, (garble).
SC Okay, Houston, 13, are you copying the torguing angles on the P52?
CAPCOM Okay, Jack. Give us a second.
CAPCOM And, 13, Houston, we have them, you can torque them.
SC Okay, Joe; time of torquing 29 hours, 0 minutes, 30 seconds.
CAPCOM Roger that.
PAO This is Apollo Control at 29 hours, 23 minutes ground elapsed time. Ignition countdown clock toward the midcourse correction number 2 which will take Apollo 13 out of its free return trajectory now shows 1 hour, 16 minutes, 55 seconds until ignition. This burn at a ground elapsed time at 30 hours, 40 minutes, 49 seconds will be service propulsion system burn, 23.2 feet per second retrograde. But will lower the spacecraft Pericynthion or closest approach to the Moon to around 60 nautical miles. At 29 hours, 24 minutes ground elapsed time, this is Apollo Control standing by for resumption of conversation between the spacecraft communicator Vance Bran who has relieved Joe Kerman here in Mission Control, and the crew of Apollo 13.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Joe.
CAPCOM Hey, you've got a new CAPCOM on now with the black crew and we have about 3 items to give you Jack.
SC Okay. Stand by 1. Are these updates or what?
CAPCOM I'm going to give you some high gain antenna angles for TV and the rest is just information - general words.
SC Go ahead (garble).
CAPCOM Okay. Burn attitude for TV, your pitch and yaw angles are as follows: Pitch minus 1 - minus 69, yaw 180 high gain.
SC Okay.
CAPCOM Okay. Second point is that you're GO for MCC-2 everythings looking good here.
SC Okay, real fine.
CAPCOM And the last items for Jack. Jack, the preliminary indications are that you can get a 60 day extension on filing your income tax if you're out of the country.
SC I guess that's good news.
SC I guess I qualify.
CAPCOM Yeah. We were just looking at the map and you're south of Florida so you're not in the country now. But we wondered how about your car tags. Have you taken care of those?
SC Yeah. I did. I managed that. I think I did.
SC Known as plan ahead.
CAPCOM Okay. Good.
CAPCOM And Apollo 13, Houston. Recommend OMNI ALPHA till you get to the burn attitude.
SC Okay.
SC OMNI ALPHA.
SC Okay, Houston. Apollo 13.
CAPCOM 13, go ahead.
SC Okay Vance, the EMS DELTA V pass passive, the results of the no bias pass in a hundred seconds they've gone from 100 to 101.5.
CAPCOM Roger. Copy plus 100 to plus 101.5 and that agrees fairly closer with the last one as I recall.
SC Okay. Fine.
SC Okay, Houston. We're at P-40 burn attitude. Give us any sextant star check and we should have a star in the sextant.
CAPCOM Roger, Jack, copy. Very good.
SC Well, we couldn't tell you whether it's 44 or not
CAPCOM Whoops

SC Okay, Houston. 13. We're a little bit ahead of ourselves. Do we have a GO to do the fuel cell purge on the waste water dump?

CAPCOM Jack, that's affirmed. You have a GO for those.

SC Okay. We're on our way.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Jim, battery A is charged now. Whenever you want to unhook it will be fine with us.
SC Okay.
PAO This is Apollo Control 30 hours 4 minutes now elapsed time. Some 36 minutes away from ignition and mid course correction burn number two. Apollo 13 presently 119 751 nautical miles out from earth. Velocity now 4734 feet per second. The scheduled television broadcast from Apollo 13 due in about 10 minutes. TV will last approximately 30 minutes and will include the activities prior to and during the mid course correction burn number 2. 30 hours 5 minutes in elapsed time, and standing by this is Apollo Control.
SC Houston 13. Are you still planning to have TV at the scheduled time?
CAPCOM Okay, 13, Houston. That's affirm. At the flight plan scheduled time.
SC Okay. Alright. We've got a beautiful sight we want to show you.
CAPCOM Right. 13, Houston. You can go ahead with the TV now, we're standing by.
SC Okay. Here it comes.
CAPCOM Okay.

END OF TAPE

CAPCOM Okay, Jack, it's coming in and it's right in the center of our screen.

SC Okay, Vince, think you could guess what that might be, Vince, better than Charlie?

CAPCOM I don't want to start flipping coins at this point.

SC Okay, Vince, we are pointed just a little ways off from looking directly at the moon and Jim is holding the camera through window 3. The sun is coming at about 40 degrees of our left side and what we are going to show you in just a minute is about a thirty-second waste water dump to show you just what it looks like. It's really fantastic.

CAPCOM Okay. We'd like to see that.

CAPCOM Okay. We saw some little droplets speeding out for a little while, Jack. Now we don't see anything.

SC Actually, Vance, what you are looking at is solid water droplets coming out at just about all the time. It lights up the whole sky around the moon. It's just hard to find them, now I think they are coming out a little thicker.

CAPCOM Okay. Yes, we see them.

SC Jack, it's about like seeing stars.

CAPCOM FIDO says he can understand why that would purturbate a trajectory now.

SC It's amazing watching these frozen deoplets maneuver. They seem to go in all directions, but finally after they get out a little ways, settle down and they all seem to be traveling in the same direction.

CAPCOM Right. That's coming in real well.

SC The objects in the foreground are parts of the LM that you are looking at.

SC The camera is now going (garble).

CAPCOM We can just barely see those parts of the LM. They must be in the shadow.

SC Okay. Now you are looking at a cluster of quads at the lower part of your screen.

SC I've got the F-stop all the way open now, Vance at the quad. It's Quad 1 you are looking at with the LM - the moon should be in view just over the top of the Quad.

CAPCOM Right. We see the nozzle of the quad, but it's dark and not easy to see.

CAPCOM 13, Houston, ENCO suggests you try average if you are in peak to see if that gives us a better picture.

SC Okay, we're in average now.

CAPCOM I think that helps out. We can see it better.

SC Okay. We shouldn't leave it there too long.

CAPCOM Okay. Now, 13, request you either move it away from the bright area or else move it back to peak. Over.

SC Okay, Vance, I cranked the focus down a little bit. Is quad coming in any better now?

CAPCOM It's coming in about the same, Fred, and you are a little weak now. We could see when you went back to peak.

SC And the (garble) is all the way out.

CAPCOM We can see you zoom in on the moon and it's near the center of our screen just a little to the left. Very clear.

SC Yes. I show it at just about 38.

CAPCOM We can't tell if it's gray or light brown though.

SC Do you have your grid down there, Vance?

CAPCOM That's negative, Fred.

SC I don't know if you can make out the features there, Vance, but it looks like the terminators are at central plains area somewhere around Descartes maybe.

CAPCOM Okay. We see it just as a bright portion of the lunar disc and it looks a lot like you see it from earth. Very bright. We are unable to see any features at all.

SC It's pretty much the same with the eyeballs from here, but -

end of tape

SC They're pretty much the same, but they aren't (garble) from here, and it looks a little bigger now. But the only way I couldn't see it very good at all, was with the monocular, a little while ago.

CAPCOM Okay, Fred, very good. We'd be interested to seeing the cabin when you get ready for that, too.

SC Okay, I'm fed up now.

SC And Vance we're counting now into midcourse 2, we're up to - our checklist - to minus 6 minutes to go.

CAPCOM Roger, 6 minutes. Understand you're about ready to turn on the gimbal motors, and all that sort of thing.

CAPCOM Okay, we see the computer now, in the upper middle part of the - the panel. I think we see somebody's checklist in the center couch. It must be Jim holding the checklist.

SC Right, and what Jim's holding now, he's got a pen in his hand we've rigged on a string, as sort of a simple-minded excelerometer. This burn's pretty short and I'm not sure even that's going to show very much. But we'll see if it'll stretch out at the end of its string.

CAPCOM Yes, we see the pencil at the top of the picture floating around. And Jack's coming into view now.

SC And have gone back - they have gone back to average now and outside the picture.

CAPCOM Roger.

SC And in a few minutes, Vance, I guess we'll see how about the only system we hit (garble) jet works. Everything else sure has worked mighty fine.

CAPCOM Right. The spacecraft's certainly working nicely.

CAPCOM Okay, we're picking up panel 2, now. There's still a little bit of the checklist.

CAPCOM Wondering if you can pick up the caution array, there?

CAPCOM Right, we just saw your - your testing of the caution and warning system at the left hand side of the panel on our TV.

CAPCOM See the lights all flash on, you're doing it again.

CAPCOM Your mission timer's showing up as a - a brilliant green in the upper left hand part of the picture.

SC Roger. I got the camera kind of canted on you here, Vance.

SC Vance, Jim's going to go to VOX now. (Garble).

CAPCOM Roger. Read you loud and clear, Jim.

SC Okay, we'll - what we'll do - we'll be at VOX for the remainder of the burn, that pre-burn countdown.

SC (Garble).

SC What we're waiting for is 54 minutes on our counter or 220 which would be minus (garble) -
CAPCOM Jim, we hear clipping on your VOX. Could you adjust it so that you're coming in continuously all the time?
SC Okay, standby one.
SC 1, 2, 3, 4, 5. (Garble).
CAPCOM Okay, that's better.
SC Vance. How do you read this T&P on VOX?
CAPCOM Jack, read you loud and clear.
SC Okay, (garble).
SC We show minus 8 1/2 minutes.
CAPCOM Roger, Houston copies.
SC Good.
SC Close -
SC Is that too close, Vance, or can you make out the SPS -

END OF TAPE

SC - and is that too close Vance or can you make out the SPS engine panel now?
CAPCOM We can see your fuel and oxidizer gages and hydrogen, oxygen gages at the top of the picture and the PUGS but it isn't coming in - in focus too well. It's a little dim.
SC Yeah. I think the problem is I'm about 2 feet and it doesn't go down but to 4.
CAPCOM Right. We understand that. There's a panel right in front of your face.
SC Okay. Just stand by for the main (garble).
SC Okay. We're minus 7 minutes.
CAPCOM Roger.
CAPCOM Fred, the focus is good enough that we can see the position of your 4 ball valves at the top of the picture for the big SPS engine.
SC Well, which went (garble)
SC Hopefully, you'll see - we'll see the two on left, here set A, go on here directly -
SC Minus 6 minutes.
SC Main buss ties 2 ON now, Fred.
SC Okay, SPS unit valve to AUTO and checked AUTO (garble)
SC ABC fuel power is 1 AC-1 Main A, 2 AC-2 Main B.
SC Okay. 1-MAIN A, 2-MAIN B.
SC Main buss ties OFF.
SC Okay. Reduce power Normal for 2-AC.
SC For 2-AC.
SC Click 2 OFF.
SC Click 2 OFF.
SC BMAGS, 3 at 1 rate 2.
SC At 1 rate 2.
SC Spacecraft control SCS.
SC SCS
SC (Garble)
SC Okay, lets do a primary TVC check.
SC Fred, you ready to start primaries?
SC Okay. Go ahead on primaries.
SC Okay. Pitch 1, START.
SC Good.
SC Yaw 1, START.
SC That one's good.
SC Now (garble) control.
SC .96 plus .96 minus .23.
SC That's affirm.
SC Check up TVC.

SC TVC checks.
SC Okay.
SC Okay.
SC Temps.
SC Degree.
SC Temperatures to NEUTRAL.
SC Clockwise on the transducer controller.
SC Mine?
SC No. MTVC -
SC No. MTVC.
SC Starting to (garble)
SC Okay.
SC Okay. Go ahead.
SC Pitch 2's START.
SC It's good.
SC Yaw 2, START.
SC Okay.
SC Looked good.
SC Good, good temp control. Minus .96. 6. Plus .96, minus .23.
SC Good.
SC Damp TVC. Mission Control NEUTRAL. That's trimmed up to zero.
SC No MTVC.
SC No MTVC.
SC Okay.
SC BMAGS mode rate 2.
SC Fuse line control power 2 normal AC-DC.
SC AC-DC.
SC Rate 2 Main A Main B.
SC B.
SC Okay. BMAGS you've got 3 rate 2. Okay, you'll proceed to final trim.
SC Right where we are.
SC Okay. BMAG modes 3 at 1 rate 2.
SC At 1 rate 2.
SC Able enter.
SC Okay. We'll do the gimbal test OFF.
SC Okay. Proceed.
SC Will do.
SC Plus 2?
SC Minus 2?
SC Zero, plus 2? 2 O.
SC Yeah, we can hear and feel the engine gimbal as we do the test.
CAPCOM Right. Good work.

SC Garble
SC Did he ask you for a (garble)
SC I've got it.
SC Rate High. Update DET
SC Time.
SC Lets's check it
SC Okay. We're coming up on 3 minutes. I'll give you MARK.
SC (Garble)
SC Mark 3 minutes DET is good.
SC Okay. We're set.
SC At 58, we want DELTA V thrust A to NORMAL.
CAPCOM Here in Houston, you're looking good down here. Go for the burn.
SC Burn (garble)
SC Okay 2 minutes -
SC DELTA V thrust.
SC (Garble) DELTA V thrust A to normal
SC Normal.
SC Translating and controller armed, Arm.
SC Irratational and controller, I've got mine armed. Okay, Fred. Tape recorder high bit rate. Record forward command reset.
SC Standing by (gargle)
SC T minus 1 minute.
SC Okay. Null in.
SC Bridge G.
SC MS mode to null 1.
SC Mode done.
SC Standby for (garble)
SC (Garble)
SC 2 ball.
SC Okay. Shut down.
SC Okay. Let's get through with the residuals.
SC Okay Houston, there are the residuals.
SC Okay (garble).
SC GARBLE
CAPCOM Okay, copy residuals.
SC Okay. Yaw 2.
SC Good.
SC Pitch 2.
SC That's good.
SC Primary.
SC Unload that rate.
SC Fine.
SC Go with the primary.
SC Okay. Yaw 1.
SC That's good.
SC Pitch 1

SC Okay.
SC TVC SERVO (garble) power is off.
SC Okay. Record the DELTA VC, you got that?
SC You got the DELTA VC minus 3.7.
SC Okay. Function off. Booth stand by.
SC Okay.
Sc Both stand by for -
SC Separation and control power OFF.
SC B power OFF.
SC Power direct 2 OFF.
SC 2 OFF.
SC Rate 2.
SC BMAGS rate 2.
SC How far on your low bit rate.
SC Okay.
SC (garble) so that we have less than 2/10ths.
CAPCOM Okay. Houston copied your residuals, Very low.
SC Okay. Fuel is 1.0; oxidizer .25; the OX unbalance is reading 200 decrease which doesn't mean very much.
SC I guess that wasn't too much for a push there, Vance. I didn't see the accelerometer do a whole lot. It's a little suprisingly how slowly the injector valves opened, at least on the indicators.
CAPCOM Roger. That was a very short burn. Request you give us a sweep across the panel when you get a chance, Fred -

END OF TAPE

CAPCOM Roger. That was a very short burn. Request you give us a sweep across the panel when you get a chance Fred. Let us see Jack and Jim again. Over.

SC Okay. Okay Vance, I was going to show, wondering if the folks down there might be interested in how we find out how far we're away from the moon. Going to do that right now in program 21 here.

CAPCOM Okay.

SC I'm asking the computer how far away we are. And the computer is telling me, we're 121 490 miles out.

CAPCOM Okay. That agrees rather closely with our map on the wall.

SC I'm glad. That means you're tracking us too. Vance, and if you didn't see our residuals it was 1/10th X, 2/10ths on Y and 1/10th Z and double DC was minus 3.8.

CAPCOM Jack, Houston. We show you down here 121 miles 520 up so I guess we all agree.

SC Okay. Real good, Vance. What I'm going to do is give you a shot of Fred. If we can get all the wiring out of the way. The big problem here is when you move the TV around this wire follows you like a snake here.

CAPCOM Yes, we have Fred now. Looks like he has a lariat there, getting ready to rope the checklist.

SC That's only half of it. We have most of it hidden away. It's been pretty interesting doing all the camera work here to get a little extra training running the TV here, hopefully for when we get on the ground at Fra Mauro. The monitor does make it pretty easy though.

CAPCOM Right. That's a real advantage in the cockpit. You're just a little bit dark. It looks like it might help to have the F-stops run down about one increment. See how it comes out.

SC I think we're wide open. Yes, we're wide open, Vance.

SC Okay, does that help any Vance?

CAPCOM Okay, it's reasonably good. We can make out Fred fairly well. Looks like he's in a shadow. Hey, that helps. You just turned up the lights, huh?

SC Yes, we went fixed on the -

CAPCOM Okay. You're on candid camera.

SC We did notice one thing, Vance. You know that new fad with long hair? It won't work too well up here in space.

CAPCOM What was that one again?

SC I said, you know the new, the new fad with long hair?

CAPCOM Right.

SC It doesn't work too well in space, you can't comb your hair up here.

CAPCOM Well, I guess you have to give up something.

CAPCOM Well, at least it helps to try. We can see you trying to comb your hair there Jim. It looks like your beards haven't come along to the point where you've had to use the razor though.

SC Well, we've been debating that. We thought we'd take care of our beards tomorrow and make that one of our daily routines. I take it that was a subtle hint Vance

CAPCOM No, we're not commenting on your appearance Fred. I mean nothing derrogatory, understand.

SC And Vance thought we get a picture of Jack so that all the girls will know that he's still here. (laughing) Say hello to them.

CAPCOM Yes, we, we'd appreciate that. There he is. Big Jack. Jack, you're in the shadow right now, we have a little bit of interference from your window which is bright, we can't, I think your smiling but it's a little hard to tell.

SC Think I'm smiling.

CAPCOM Hey, there we go. Incidentally, we've been getting all kinds of bits of information to pass up to you. We've had baseball scores coming in, basketball. Somebody said there's 220 days, shopping days left until Christmas.

SC Oh. Who won the Masters, Vance?

CAPCOM It was a tie for the Masters and stand by. It was a tie between Littler and Casper after 72 holes and there is going to be a play off Monday, we understand.

SC Oh. Sounds good.

CAPCOM One thing the world might be interested in knowing is what you do after the burn in the way of configuring switches back. We heard you go through the check list. But, I guess right now, basicly, you probably have all the switches back into position and your in the mode to continue on with what the flight plans say. You're going to be doing cis lunar navigation. So, Jack you're going to be down in the LEB is that correct?

SC That's right, Vance. I'll be going down there shortly.

CAPCOM Okay, the TV now is all but black. Looks like it might be pointing into a shadow.

SC What he's doing there, he's trying to give you one more shot of the moon and right now I'm setting to maneuver to the optics calibration attitude.

CAPCOM Roger.

SC What I wanted to point out and I don't know if it's apparent but we'll show the advantage of

SC doing all the dumps just before the burn we're looking again at the same scene over quad one at the moon and now you don't see all the sparkley growth and particles out there any more. We've sort of run off and left them.

CAPCOM Rog. We don't see anything out there anymore in the way of particles leaving the spacecraft. We suggest, maybe you zoom the moon in some a little bit, again so we can see the shape of it better. Okay, that brings the moon in. We can see the terminator at the top of the melon-shaped disk.

SC Okay. Now you can see a few of those sparkling particles going across the screen. Those are being emmitted by the thrusters. Jack's maneuvering the spacecraft now.

CAPCOM Okay. We can see those very poorly. Well, actually they're coming....

END OF TAPE

CAPCOM Okay. We can see those very poorly. Well actually, they are coming in better now. It looks like little specks going from the upper left part of the screen across to the right and understand those are from the thrusters.

Capcom Okay, 13, Houston. Just as an item of interest, advise your speed with respect to the earth is now 4667 feet per second.

SC Okay. Thanks, Vance.

CAPCOM Okay, Apollo 13, Houston. The moon has been in and out of our screen here. Right now it's off at the bottom side, but we can still see the particles coming off the spacecraft.

SC Okay, I am going to have to pull it off the window, Vance, the sun is coming up on the right side.

CAPCOM Roger, understand.

SC You want to see the sun on the ullage (garble)?

CAPCOM Say again.

SC Do you want to see any of the photographs or do you want the TV down in the LEB?

CAPCOM Right, Jim. It would be good to see what you are doing down in the LEB or the far corner of the space-craft where the optics are. It might be interesting to describe what you will do in the next few minutes in the way of sightings.

SC Okay, Vance, first we are going to give you a you a shot of the sleep station.

SC While Jack -is getting the sleep station rolled up. I thought I would show you one interesting corner. We have a temporary stowage back here and that's where all our waste paper and all that goes after every meal. It's in the right-hand corner down by our dump system.

CAPCOM Roger, understand. We are looking at the waste basket.

SC The age-old question that is always asked us is how do we get rid of liquid waste and that line that you see, I think you can see it now, it goes right outside where we open up the overboard drain dump and all our waste products, liquid waste products, go out through that line and get dumped overboard.

CAPCOM Roger, understand and we can see somebody's foot, as well.

SC Okay. Fred is now going down there and he is going to try to get underneath the sleep station on his side where we have a sleep restraint and the whole object of that is to merely position the body between the bottom on his side where we have a sleep restraint and the whole object of that is just to position the body between the

SC bottom of the spacecraft and and so it doesn't float up between that and the bottom of the couch.

CAPCOM Roger. The sleep restraint of the hammock is coming into view underneath the couch. It's a white object.

SC You perhaps can see the zipper of the hammock right now. The between the line and that white object.

CAPCOM Right. We can see it.

SC Vance, these hammocks, by the way, are very comfortable. When we first heard about them in the design of Apollo, we thought they weren't necessary, but they turned out to be a very nice device in the station.

SC I'm trying now to get down there with Fred to show you how it works. I keep floating up thought but maybe we can get a little shot here.

CAPCOM Okay. We have somebody upside down in the photograph now. Realizing of course, that in space there is no really right side up or upside down. It still looks that way to us.

SC Okay. That's Fred now. I'm trying to put him right side up. for you folks down there in the sleep station. Fred, would you move your hand there back off the view.

CAPCOM Okay. that is coming in real clear, Jim. We see Fred in the sleeper restraint.

SC As a matter of fact, Vance, Fred sits down there all the time.

CAPCOM Yes. I can see he appreciates that. Looks very comfortable. It looks like there is a lot of room down there considering all the boxes on the floor and underneath the couch.

SC It's surprising but there is quite a bit of room down there with the Hycon camera box down. On the way down we'll pick the camera back up.

SC Okay, Vance, if there is no more that you would like to see right now, we'll terminate our TV for you today.

CAPCOM Okay. Thanks very much, Jim. Appreciated seeing it.

SC Thank you. Good bye.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 CST 8:16P GET 30:03 96/1

PAO This is Apollo Control at 31 hours, 4 minutes. We've completed the change of shift here in Mission Control; Flight Director Milton Windler has replaced Flight Director Glynn Lunney. Our capsule communicator will continue to be Astronaut Vance Brand. The change of shift press conference is scheduled to begin shortly in the MSC News Center Auditorium, and participants will be Glynn Lunney; Flight Director, and Astronaut Tony England.

CAPCOM Apollo 13, Houston.

SC Go ahead, Houston.

CAPCOM Okay, at your convenience we have an item to give you which will have to be copied. It's information on how to photograph Comet Bennet at time 32 hours GET. Over.

SC Okay, standby one minute.

CAPCOM Okay.

SC Okay, Vance. Go ahead.

CAPCOM Okay. Time 32 hours, 00 minutes GET. Instructions at completion of P23 maneuver to following attitude: roll 101.0; pitch 0900; yaw 000.0. High gain antenna angles will be pitch minus 23; yaw 93. Use normal PTC procedures to dampen rates. After vehicle's stable, and before spin up, take photographs of Comet Bennet. Use the DAC on the sextant with Magazine G, that is, very high speeds black and white film, right? That's the dim light film. Take three photos, one each at 5, 20 and 60 seconds time exposure. Use auto optics. NOUN 88 values are: R1 plus 34717; R2 minus 08028; R3 plus 35075. Take three photos one each at 5, 20, and 60 second time exposure, using manual optics. Shaft will be 000.8 degrees; trunnion 12.5 degrees. Comment: Strip off about 50 frames, that is; 2 seconds of - at 24 feet per second before the first frame and after the last frame of the photos. That is, 2 second - 2 seconds at 24 frames per second - before the first frame and after the last frame of photos.

SC Is that it, Vance?

CAPCOM And that's all.

SC Okay, the time is - This event will be at 3200, and we're to maneuver to the following attitude, roll 101.0; pitch 090.0; yaw all zips. High gain angles will be pitch minus 23 -

END OF TAPE

SC - torguing angles will be pitch minus 23; yaw 93. And we're to use normal PTC procedures to damp the rates. And after damping the rates and before spin up, we're to put the DAC on the sextant with the Magazine G, the very high speed black and white film. Then, we're to take three photos, one each at 5, 20, and 60 seconds time exposure in audio - auto optics. Our NOUN 88 values R1 plus 34717; R2 minus 08028; R3 plus 35075. Thence three more photos, one each at 5, 20, 60 seconds time exposure, using manual optics. Shaft 0.8 degrees; trunnion at 12.5 degrees. And we're to take 2 more second bursts at 24 frames per second, before and after these pictures.

CAPCOM Your read back is correct, Fred.

PAO This is Apollo Control at 31 hours, 13 minutes. We understand the change of shift press conference is ready to begin in the MSC News Center Auditorium. During the press conference we'll be recording any conversations with the crew for play back immediately following the change of shift briefing. We might also add at this point that during the television transmission which lasted a total of 50 minutes, 41 seconds, among the viewers in the viewing room here in Mission Control were Astronaut Fred Haise wife, Mary, and his three children; Mary, Frederick, and Stephen. At 31 hours, 14 minutes, this is Apollo Control, Houston.

END OF TAPE

PAO This is Apollo Control at 31 hours, 34 minutes. During the change of shift briefing, Flight Director Milton Windler has been in the process of reviewing the mission status with each of his flight controllers. We've also had some conversations with the spacecraft. Vance Brant has given the crew the instructions for photographing the Comet Bennet at 32 hours. This will be done using the data acquisition camera, a 16-millimeter data camera on board the spacecraft. And, at this time, Jack Swigert is in the lower equipment bay doing a P23 exercise, the mid-course navigation, using the onboard optical equipment and the onboard computer and guidance system. Updating the guidance system with onboard sightings of five stars. We'll play back the tape recorded conversations that we have and then standby for live communications.

CAPCOM Apollo 13, Houston.

SC Go ahead then, Houston.

CAPCOM Jim, for a PTC tonight request that you disable Quads C and D. That's the opposite of last night's (garble).

SC Okay, for a PTC tonight disable Quads C and D.

CAPCOM Roger, and advise in approximately an hour we'll have some readups whenever you're ready to take them regarding solo book changes.

SC Okay, we'll (garble).

CAPCOM Roger.

SC Houston, 13.

CAPCOM Go ahead, 13.

SC Have you all got a chance to look at the update on the SPS, yet?

CAPCOM Standby one, Fred.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Fred, it looks good, but they haven't had a chance to evaluate every thing. They'll probably be finished with looking at strip charts in about 15 minutes, and after that we'll be back with you.

SC Okay, thank you.

CAPCOM Roger.

CAPCOM And that you change the NOUN 88 values for this last star, it - it looks like they haven't been changed. Over.

SC Okay, Vance.

SC That's better, let's read you what we - what we have. We have what they had in the flight plan, and if it's been changed from the flight plan, we don't have it.

CAPCOM Standby one.

SC We think you're right, Vance. It looks like they used the same set of NOUN 88 for both stars by mistake.

CAPCOM Okay, very good.
SC Okay, Vance, that ought to complete the P23's, right?
CAPCOM Okay, very good, Jack.
CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM We have some results on your - your first star, if you'd like to hear them. The rest of the stars we'll - we'll have to give you in a couple of hours. Over.
SC Go ahead.
CAPCOM Okay, the first star, the corrected altitude, 15 killometers plus or minus 4; effective altitude, 12 kil-lometers plus or minus 7; as far as substellar point the value is arc minutes - 2 arc minutes, and that's very good. And, like I said, we'll get back with you in a couple of hours for the rest.
SC Good.
CAPCOM Apollo 13, Houston.
SC Go ahead.
SC Go ahead.
CAPCOM Okay, we have several items, here. First, is a reminder on the PTC that R1 should be 375 - 0.375 degrees as last night to get 0.3 degree rotation rate. The second one -
SC Okay, copy that.
CAPCOM - Okay, second one -

END OF TAPE

CAPCOM 3-degree rotation rate. Second one -
SC Okay, copy that.
CAPCOM Second one at 32 hours looking at Bennet's Comet. We want the pictures taken when the spacecraft is as stable as it's going to be before starting PTC. The stability requirement is very high. We weren't sure if you understood that from what we passed up. In addition the photographs might now show as much as the eye can see of the Comet, so if you see anything interesting about the structure of the comet, why sketching it is in order and is encouraged.
SC Okay, Vance, what we'll do is when we get to attitude, we'll disable the quads and do like we did last night. We'll let GUIDO and you people down there tell us when you think we are stable enough, then we'll do all this work with the dack on the sextant first and then when we get that done, we'll go back and put the sextant eyepiece back on and see what we can observe visually.
CAPCOM Okay. That sounds good. Also, while you are waiting for the vehicle to stabilize, it might be interesting to have the eyepiece on and be looking at it visually. Okay. Next item. Your SPS burn had no anomalies whatsoever. It was a very good burn.
SC Okay. Very good.
CAPCOM Next item request hydrogen tank 1, heater off for balancing purposes and, Apollo 13, another item, something that we have observed and you might be seeing is a slight TCE fluctuation on fuel cell 3. This fluctuation has been going from about 152 to 160 over a 37 second period. It has been seen on other flights in the past. No one is worried about it but the usual fluctuation is about 1 and one-half degrees instead of 7 seconds so thought you should be aware of it.
SC Okay, Vance. There is one other slight distinction we noted is that the hydrogen versus the oxygen is not exactly matched on fuel cell 3.
CAPCOM Okay. We copy. The last item we'd like to send you an TRIG update so at your convenience request POO and ACCEPT.
SC Okay. We are in POO and ACCEPT, Vance.
CAPCOM Okay.
SC Quad C and D are disabled then.
CAPCOM Roger. Disabled. And down here we see that your hydrogen and oxygen on the fuel cell are exactly matched so we suspect it's purely a spacecraft readout problem.
SC Okay.

APOLLO 13 MISSION COMMENTARY 4-12-70, CST 9:11P GET 31:58:00 99/2

PAO At this time the crew is in the process of stabilizing the spacecraft attitude, eliminating all rotational rates in preparation for spinning up the spacecraft for the passive thermal control mode. Before beginning the slow rotation of passive thermal control, Jack Swigert will attach the data acquisition camera to the spacecraft's sextant, the 28-power sextant, and will attempt to get some photographs of Bennet's comet. He'll take a series of photographs at varying time exposure rates and he's also been advised if any particularly interesting features are noted visually of the Comet Bennet, that they should attempt to sketch them. At present time, Apollo 13 is 125 083 nautical miles from earth. The spacecraft velocity is 4571 feet per second. The fuel cell temperature fluctuations which were mentioned are occurring in fuel cell No. 3 -

END OF TAPE

PAO - the fuel cell temperature - fluctuations which were mentioned are occurring in fuel cell number 3, and this is a temperature that's measured at the condenser exhaust, at the point where the hydrogen reactant is flowing out of the fuel cell and the water's being separated from it. The other two fuel cells are remaining steady at about a 157 -

SC - when you're through with the DSKY's so we can load down 88?

CAPCOM Roger, we'll let you know, Jack.

PAO And as we were saying, the two other fuel cells, Fuel Cells 1 and 2, are remaining stable at a temperature of about 157 to 159 degrees. Fuel Cell 3 is fluctuating between about 152 and 160. Vance Brant advised the crew that this will cause no problem, with a possible exception that it could trigger a warning alarm to them. But we have seen this sort of thing on previous flights, and it should cause no problem.

CAPCOM Apollo 13, Houston. The computer's yours again.

PAO The Guidance Officer has just reported that the spacecraft appears to be approaching a stable attitude, and we expect that would be in a position shortly for the crew to begin - attempt to photograph the Bennet Comet.

CAPCOM Okay, you're go for the pictures.

SC Okay, Vance. We tried the auto optics and couldn't pick it up there. We're pointing pretty much right into the Sun and things are pretty well washed out. And I've gone to manual optics and I'm trying to get 0.8, 12.5 on the shaft and trunnion and I still can't pick it up. So, it's very light in the sextant, so I kind of think maybe we're to near the Sun to see it.

SC That's right, Vance. The sextant is all- it's - it's all milky and it - any Comet that could be seen today would just be in the background.

CAPCOM Okay, we copy that. We got some discussion. Standby.

SC It is the large reflection from the Sun behind us off the LM; and it is - it is coming on that Quad 1 there, and that Quad is reflecting back into the sextant.

CAPCOM Okay, Jack, understand. Just a question: If you look through the telescope, can you see the - the Comet at all? Over.

SC No, I can't, Vance. It's - it's still too light. A - ah -

SC Does that -

CAPCOM Standby.

PAO This is Apollo Control. You heard Jack Swigert advise and Jim Lovell confirm, that reflections of the Sun off the LM are apparently washing out the sextant

PAO - field of view and making it impossible to get a view of the Bennet - the Comet Bennet. This problem is being discussed in Mission Control right now. Ken Mattingly who is in the Control Center, and the Flight Activities Officier, and CAPCOM Vance Brant as well as astronaut Tony Angeland, are huddled around the Flight Director's console, discussing the possibility of perhaps seeking another spacecraft attitude that might avoid the reflection problem.

SC Say, Vance?

CAPCOM Roger, go ahead.

SC Are the flowers blooming yet?

CAPCOM Gee, I sure haven't seen any.

SC Okay.

CAPCOM Hey, we've - we've got quite a discussion down here on your trying to observe the Comet and this reflection is not unexpected. And give us another minute, and we'll be back with you on something on that.

SC Okay, I doubt very seriously, though, if we take any of these photographs with high speed black and white, with -

END OF TAPE

SC something on that.
SC Okay. I doubt it very seriously though. If you take any photographs with high speed Black and white with the light coming in to the face that you going to get anything out of it.
CAPCOM Okay. Unanimous opinion is that your right and we'll scratch all of this Bennett's Comet stuff on the way out, with the hope that conditions will be more favorable after TEI. Over.
SC Sounds good. Without the LM, we might have a better chance.
CAPCOM Rog. And Apollo 13, you're go for PTC, your rates are very low according to what we can read.
SC Rog. Okay , I'll give you a call on OMNI B, Vance. Do you read, Vance?
CAPCOM Roger. Go ahead, request OMNI B Fred, and secure the high-gain antenna.
SC Okay, you got it.
CAPCOM Okay.
CAPCOM Apollo 13, Houston.
SC Go ahead Houston.
CAPCOM Jim. Something to think about. In about 30 minutes we can generate the pads that we have yet to send up before the sleep period, so we could support earlier sleep period if you so desired. But, it will take us 30 minutes to get that stuff. The other thing is, any time your ready to copy, I can read up these solo book changes over. And also, two pages in the flight plan.
SC Okay, Vance. We're about ready to copy the solo book changes and the flight plan changes and whenever your pads are ready we'll take those and as far as moving up the sleep period, that's fine, but if we don't go to sleep right away, we'll use it to get out our lunar maps and study them.
CAPCOM Okay, and we'll get busy getting those pads for you as soon as possible then and I'll stand by on this copying bit.
PAO This is Apollo Control at 32 hours 46 minutes. The crew sleep period is scheduled to begin at 37 hours. You heard Vance Brand advise Jim Lovell that should the crew desire, we would be in a position to give them the pad information that they need to get before beginning the sleep period a bit early and if the astronauts themselves the option of beginning their rest period earlier if they desire. The primary activities remaining on the flight plan in addition to passing up those , the numerical data, is for the crew to change out one of the lithium hydroxide canisters and complete the pre-sleep checklist and their evening meal. And when those things have been completed they would be able to begin the rest period. We don't have any idea at this time precisely when the rest period would begin, that would be up to the crew.

END OF TAPE

PAO - when the rest period would begin. That would be up to the crew. At the present time Apollo 13 is 126 900 nautical miles from earth. The velocity is 4500 feet per second.

SC Okay, Vance, I'm ready to copy the solo book.

CAPCOM Okay. First, turn to page 12. On the right-hand side of the page starting from the middle of the page down, everything under Cycle 5 Frames, Replace Dark side or Dark Slide should be deleted until you get to the very bottom of the page where you have Acquisition MSFN ONMI D and that should remain in. Also, leave in Remove window shades which is about the third line down from where you started.

SC Okay. Okay. Under Cycle 5 Frames, Replace Dark Slide from there on down to the -

CAPCOM That's everything from there on down, with the exception of Remove Window Shades and at the bottom Acquisition MSFN OMNI D.

SC Okay. Copy.

CAPCOM And that includes in the margin to the left, the dap load that's at the very start there and the .0507 and plus 0500, further down.

SC Okay. Got it.

CAPCOM Okay. Going to page 13.

SC Okay.

CAPCOM In the left margin, just below 105 hours GET, cross out 0507 and the plus 0500 and below that add in dap load as follows. 10111 and 11111.

SC Okay. Got it.

CAPCOM Okay. Now next, at about 10505 there's a VERB 48. That should be moved up to 105 and below that the VERB 49 maneuver should be moved up, too.

SC Okay. VERB 48 moved up to 10505 and also to VERB 49.

CAPCOM That should be moved up to 10500. I'm sorry. Both.

SC Okay.

CAPCOM And what that does is give you more time to maneuver. Okay. Next.

SC All right.

CAPCOM Page 14, right-hand side, near the bottom under Oribital Science, scratch out verify DSC armed and also delete visual target 3 on track 180 plus 19 and cross out the penned in D5.

SC Okay. Got it.

CAPCOM Next, page 15, left-hand column, or left-hand side, rather, near the bottom, where it says Configure Cameras and Tape and goes down to Replace Dark

CAPCOM Side. Just make the comment there. Solar Corona is optional. Over.
SC Okay. Got it.
CAPCOM Next page, 16. This is a continuation of the same Solar Corona thing. On the right-hand side of the page, starting just above 10740 with

END OF TAPE

CAPCOM - duration of the same solar corona thing. On the right hand side of the page, starting just above 10740 with VERB 49 maneuver to solar corona attitude. From there on down to 10755, just beneath replace darkside, all of this is in an optional category. So you just might line off -

SC Okay. Got it.

CAPCOM That and put optional, solar corona. Okay, next page.

SC Okay.

CAPCOM Page 17. Starting at 10800 from the left hand side, line out stop orb rate at orb science attitude. At line out in the left hand column, the dap load of 10101 and 11111. Going down to 10810, add in the following: Stop orb rate at track attitude and in parenthesis 0,353,0. In the left hand -

SC Okay.

CAPCOM Okay, in the left hand column under 10810, put in a dap load in parenthesis of 10101 and under that 11111.

SC Okay.

CAPCOM Beneath that, scratch out spacecraft control dash CMC auto verify. Scratch out the VERB 79 and all in parenthesis after that like the minus 00507 et cetera. And beneath that, scratch out PRO to start pitch rate. In parenthesis 0230 slash 018,0.

SC Okay.

CAPCOM Okay. Looking to the right, the LM attitude or rather the CSM attitude will be incorrect so you can cross that off. And beneath the picture of the moon, cross out the in parenthesis 108.19 and the 0,230/018,0.

SC All right.

CAPCOM On the right hand half of the page, cross out the orbital science block and under that visual target 1 south of track TR. And under that, the penned in D/2/3/4.

SC All right. Got it.

CAPCOM And beneath that, cross out VERB 49 maneuver to track attitude by the C0,353,0 and the HU, SCL.

SC All right.

CAPCOM Okay. The information beneath that starting with configure camera earthshine photos down through replace darkslide is optional, so, just put in earthshine optional as a comment there, and in the camera settings, in the block that has F2.8 125 comma infinity, cross out the 125 and put in 18, 1/8 on other words.

SC Okay that last part was cross out the 124 and put in the 1/8. Is that right?

CAPCOM That's affirm.
CAPCOM Okay. Next page. No change. Go to page 19.
SC Okay.
CAPCOM Okay. On the right hand side, from the verb 49 maneuver to earthshine attitude, down through everything up to MSFN uplink, this is optional. This is earthshine optional.
SC All right. Got it.
CAPCOM And once again, a camera setting correction up near the top of that section that we called optional, where you have bracket MIR F0.9 comma 125, cross out the 125 and put in 1 slash 60. In other words, 1/60. Over.
SC Okay. Cross out the 125. Put in 1 slash 60.
CAPCOM That's correct, and further down at 10950, where you have visual target 17 et cetera, cross out that line and cross out the pinned -

END OF TAPE

CAPCOM Cross out that line and cross out the penned in D17.
SC Okay.
CAPCOM Now move to page 25.
SC Okay, go ahead Vance.
CAPCOM Okay. At about 1 14 10 everything under altitude set equals 60 miles should have the comment "solar corona optional" and on that first line of that optional where it says VERB 49 maneuver to solar corona and LM brightening attitude, cross out and LM brightening attitude.
SC Okay.
CAPCOM Going further down to 1 14 16 cross out the 14 DAC 18 VHVW LM brightening line and the line under that which is BRKT, MIR, etc.
SC Alright.
CAPCOM In the block where it says solar corona and LM brightening photos, cross out "and Lm brightening photos" and just put solar corona optional.
SC Okay. Got it.
CAPCOM Going a few lines below that where you see DAC on for 4 seconds at about 50 frame rate color lens, cross that out.
SC Hey, Vance, we lost you there.
CAPCOM Yes, I think we lost lock. Stand by a minute.
SC Okay, got you back.
CAPCOM Okay. Going on down, cross out 1142916 DAC on SR dash 40 seconds.
SC Okay.
CAPCOM And at the very bottom line on that half of the page should be crossed out which is 1142956 DAC off SR.
SC Okay.
CAPCOM On the right hand side of page 25 where you have the title solar corona and LM brightening photography cross out LM brightening photography.
SC Okay.
CAPCOM And in the figure where you have the DAC LOS line which is parallel to the X-axis on the horizon cross out DAC LOS parallel to X-axis on the horizon.
SC Alright.
CAPCOM And cross out the bottom block on that half of the page which is DAC magazine percent required 12 magizines, g et cetera.
SC All right.
CAPCOM Next page, 26.
SC Go ahead.
CAPCOM Okay. Cross out the top line on the right hand side of that page, which is DAC on for 4 seconds, 50 frame rate cover lens. And cross out the block to the right of that and down, which has magazine percent.

SC All right. Got it.
CAPCOM Okay. Next, page 28. Ready to go?
SC Go ahead.
CAPCOM Okay. On the left hand side of page 28, at the very bottom, cross out photo target 5 north, frame F5.6 215 infinity, et cetera. All of that line and over to the vertical strip. And cross out the pinned in E4 below that.
SC All right. Got it.
SC Okay. Go ahead.
CAPCOM Okay. And the next page, 29, right hand side, near the top, cross out photo target 13 north - -

END OF TAPE

SC Okay, go ahead.

CAPCOM Okay, and the next page; 29 right hand side near the top, cross out photo target 13, North at 5.6, 250, et cetera. All of that line. And cross out beneath that the pened in E5/6.

SC All right.

CAPCOM Going to page 30 next. Left hand side.

SC Go ahead.

CAPCOM At the top at 12701 cross out visual target 9 on tracked 180 degrees plus 0.47, and cross out the pened in E11 beneath that.

SC Okay.

CAPCOM Going down to 12711 cross out verify DSE on, beneath that aways cross out 1271420 start visual observations of Frau Mauro.

SC All right.

CAPCOM Beneath that, cross out continue visual observations, and cross out stop observations. And beneath that, cross out photo target 56 on track f:8 comma 250 infinity, 5, et cetera, to the end of that line. Cross out the 5.6 beneath that and the pened in E15.

SC Okay.

CAPCOM Over in the margin, to the left of all that, make a comment. Delete visual only.

SC Where was that, Vance. I didn't get that last one.

CAPCOM Okay. That's still on page 30 on the left hand side. In the time margin at the left where you have times just pen in beneath the 127 10 the following. Delete visual only. That's only a comment.

SC Okay. Alright.

CAPCOM Okay. Going to page 34.

SC Okay.

CAPCOM On the left hand side about almost half way down beneath the VERB 49 maneuver to topo target 54 A. Make the comment target 54 A is optional.

SC Alright. Got it.

CAPCOM And, next, page 35 on the right hand side. Everything from spacecraft control CMC AUTO verify on down should be given the comment zodiacal light photos optional.

SC Alright.

CAPCOM And, well, where you have the block in the middle of the page that says, the small block that says zodiacal light photos, just put optional in that title, too.

SC Okay.

CAPCOM And, next page 36 on the left hand side.

SC Okay, go ahead.

CAPCOM Okay. First a comment. In the middle of the page is where the zodiacal light stuff ends, just under VERB 48. And then if you'll go down to the bottom of the

CAPCOM page. Cross out the line photo target 12 on track, etc. And cross out the E5 that is below that line.
SC Okay, Vance. Can I break in a minute?
CAPCOM Sure.
SC We have the cryo pressure light on now. The H2 is hit at lower bounce. Do you want us to go back to AUTO on the H2 heater 1?
CAPCOM Stand by.
CAPCOM 13, Houston.
SC Okay, go ahead.
CAPCOM They request that you leave that switch in the AUTO position until you go to bed tonight. Stand by. I mean in the ON position. I'll repeat that again. In the OFF position until you -

END OF TAPE

CAPCOM All right. Standby. I mean in the on position. I'll repeat that again. In the OFF position until you go to bed tonight for reasons that you have a 3 percent imbalance, and they'd like to get that more even. So, just before turning in, we'll change the switch to AUTO.

SC Okay. Okay, Vance. Before we get away, would you ask FAO something I didn't get briefed on what the penned in E5 and those letters and numbers mean?

CAPCOM Okay. Just a minute. Okay, we'll have comments on that for you in just a second.

SC Okay.

CAPCOM Apollo 13, Houst -

SC Okay, Vance, I'm ready. To continue. I'm ready. Go ahead.

CAPCOM Okay, new subject like to break in to say that request you reinitialize PTT - PTC. For some reason, it's gone up to 18 degrees in Pitch and Yaw both. We don't quite understand this. All we can think of is - start it again. Over.

SC Okay. We'll go back.

CAPCOM Okay. We are at the - the end of the changes in the solo book, and I have two pages of changes in the flight plan. Those are pages 3 dash 122 and 3 dash 125. While you're looking that up, we'll put Ken on to answer your question.

SC Okay. I'll start back - let me start back at reinitializing PTC here.

CAPCOM Okay.

SC Okay, Vance, I'm on 3-122 of the flight plan.

CAPCOM Okay. Okay about at time 156:50 on the right - well, on the right hand half of the page, there's a line which states "Visual Target 16 south 180 plus 111 (garble) f/15. Request you cross out that line.

SC Okay, we'll cross them out.

CAPCOM That's all on 3 dash 122. Next change is 3 dash 125.

SC Okay, I'm looking at 125.

CAPCOM Okay, starting at the top of the page, Cross out the first 5 lines which are Setup Camera for Contamination and Photography, betelgeuse, CM 4/EL/80 et cetera, Mag T et cetera, Install window shades.

SC I've got them crossed.

CAPCOM Okay, then jump down to just about 159:28. Cross out Maneuver to Contamination Field Photography Attitude, and all other lines below that through Enable Thrusters A3, C4, B3 et cetera.

SC Okay, so we start with Manuever to Contamination Field Photography, and we cross out everything down to and including Enable Thrusters A3, C4, B3, and D4.

CAPCOM That's correct, and those are all of the flight changes - flight plan changes we have, and Ken is coming on now. Later sometime when we get PTC squared away, and it's convienent, I suppose you should read all these things back to make sure that we're squared away on them.

SC Okay.

END OF TAPE

CAPCOM - - are squared on them.
SC Okay. Go ahead PK.
CAPCOM Yes sir. Understand you have a question.
SC Yes. I guess I didn't understand what the letter and the number were for behind some of these photo targets.
CAPCOM
SC Okay.
Does that refer to the pages?
CAPCOM Yes sir. That's the map. Each fold is lettered in the lower - upper right hand corner as you work your way from east to west and the charts are labeled D, E, and F and the solar stuff will all be the D and E and they change with the plane change 1. That's the time they change the two maps.
SC Okay. I got it. Thank you.
CAPCOM Yes sir. You're doing good work.
SC Well, I had a good time coming and you taught me all I know.
CAPCOM Don't run out.
SC Hey, when FIDO gets a good hank on our projector, will you let us know?
CAPCOM How long you willing to wait?
CAPCOM He's looking at his calendar, if that means anything.
SC All right.
SC Okay. I'm back at the attitude here and I'll wait for rates to damp and you let me know when we're stable again.
CAPCOM Okay. Will do.
PAO That last exchange was between Jack Swigert in the spacecraft and Astronaut Ken Mattingly, whose been on the capcom console along with Vance Brand, since immediately following the television transmission this evening.
CAPCOM 13, Houston.
SC Go ahead, Vance.
CAPCOM Roger. Just a reminder you have to disable Charlie and Delta here as you've done in the past. Over.
SC Okay. I was kind of holding off on this. We're dumping a little waste water now.
CAPCOM Okay. Fido says he knew it all along. He's - he says he's been very concerned that you've been doing a lot of water dumping.
SC Okay, Vance. We've got quad C and B set.
CAPCOM Okay. Copy, Jack.
PAO This is Apollo Control at 33 hours 40 minutes. The brew at the present time is still involved

PAO in eliminating rotational rates and attitude rates from the spacecraft in preparation for reestablishing a passive thermal control mode. Once they get the spacecraft stable, they'll start it rotating at a rate of about 3-3/4 revolutions per hour.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM It may be awhile before your rates are settled down. We're still observing fairly high rates and dead banding. Over.

SC Okay. Thank you.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-12-70 CST 11:00P GET 33:47 MC108/1

CAPCOM Apollo 13, Houston.
SC Go ahead Vance.
CAPCOM Okay. We've got about 3 items. First one is all of your P23 batch 2 marks have been evaluated and a congratulations, looks real good, very happy with it. You're down to 4 arc minutes on the substellar point aspect of it, and that's the first thing to mention. The second is, unless you see a need, I don't see any need for you to read back the information we gave you on solo book and so forth. Do you concur?
SC Roger. I think I got it. I remembered a lot of it and so I think with what you gave me and what I remember, I'm pretty sure we got it right.
CAPCOM Okay, and the third item, I was just about to call out your rates for stabilize to start the PTC, but it looks like they're jiggling around again from a dump so we'll stand by some more.
SC Okay.
SC No secrets around there.
CAPCOM Say again.
SC Hey, that's right.
SC I said there's no secrets around here.
CAPCOM Yes. Big brother is watching.
CAPCOM 13 -
SC I can just see (Garbled)
CAPCOM Yes. You really have to watch that pair all right.
CAPCOM By the way, we have a maneuver pad for you, a fly-by pad, whenever you're ready to copy
SC Okay. Stand by.
SC Go ahead, Vance.
CAPCOM Okay, maneuver pad purpose fly-by SPS G&N 63 385 plus 097 minus 023 072 24 3308 plus 02127 minus 01417 minus 02548 148 316 050 NA plus 00225 03609 053 03563 33 3527 150 NA NA NA. Starting with latitude minus 2326 minus 16500 11477 36172 166 54 02 comments GDC align stars are 31 Arcturus and 23 Denebola. R align 288, pitch align 205, yaw align 034, ullage none -

END OF TAPE

CAPCOM 205, YAW align to 034. Ullage none. Other burn is SPS dot. LM weight 33 499. Over.

SC I've got as follows. Flyby, SPS G&N 63385 plus 097, minus 023 072 24 3308, plus 02167, minus 01417, minus 02548 148 316 050, NA plus 00225 03609 053 03563 33 3527 150, NA NA NA -2326 minus 16500 11477 36172 1665402 653123, ROLL is 288 PITCH 205, YAW 034, no ullage, SPS docked, and my LEM weight 33499.

CAPCOM Roger. That's correct. Want to verify under NOUN 81 that delta-Vx is plus 02127. You cut out right there.

SC Roger. Delta-Vx is 02127.

CAPCOM Roger. And your rates are low. Looks like you can start the PTC.

SC Okay.

CAPCOM Okay. And when the computer is available request (garble) ACCEPT and we'll ship you your state vector.

SC Well, I get PTC going very (garbled).

CAPCOM Okay.

SC Okay, Vance. We're (garble) ACCEPT. The computer is yours.

CAPCOM Roger. Here it comes.

SC You know somehow every time I do test P23 you guys uplift me a state vector. I don't think I do too well. It gives me a complex.

CAPCOM Now, you know how the FIDO's are. They like to load in their own data no matter what.

SC But our state vectors take into account they (garbled)

CAPCOM Yes, that's -

CAPCOM Apollo 13, Houston. It's your computer again.

SC Okay. Going to BLOCK.

CAPCOM And as a matter of interest understand, that a downrange comparison between the MCC and the computer is within 35 000 feet, and that's on the last siting which people think is pretty good.

SC Okay. Maybe that gives us a little more confidence that if we have a P23 on the way home, we'd make it.

CAPCOM No doubt about it.

END OF TAPE

PAO This is Apollo Control at 34 hours 13 minutes. At this time, the crew has very little to complete before beginning their sleep period. They still had a Lithium Hydroxide canister to change out. Following that, we expect they'll begin their eat period, and it's possible that they will begin the sleep period somewhat earlier than the scheduled 37 hours in the flight plan. Our latest estimate on the impact of the S-IVB, the Saturn third stage on the lunar surface is that this event will occur 77 hours 57 minutes 37 seconds, and our current tracking data indicates that the impact point will be 0 degress 56 minutes North, 29 degress 33 minutes West. Apollo 13 at this time is 130 736 nautical miles from the Earth travelling at a speed of 4 402 feet per second.

END OF TAPE

PAO This is Apollo Control at 34 hours 42 minutes. Our guidance and control officer reports that the spacecraft appears to be remaining quite stable in the passive thermal control mode. The spacecraft rotating slowly to maintain the proper thermal balance as the normal mode for the spacecraft to be in during sleep periods and periods of low crew activity. Jim Lovell advised some time ago - a couple of hours ago, that the crew might begin the sleep period early. He said if they had any problem getting to sleep or if they weren't particularly sleepy at the time they finished their other scheduled activities, that they might review some of their lunar charts before turning in for the 10 hours rest period. At this time Apollo 13 is 131 948 nautical miles from earth, travelling at a speed of 4 368 feet per second. At 34 hours 43 minutes this is Mission Control, Houston.

CAPCOM Apollo 13, Houston.

SC Go ahead, Houston.

CAPCOM Just info on your PTC, Jim. It's looking very good. Just excursions and pitch and yaw are very low.

SC Okay. Thank you and we're going to change another lithium hydroxide canister now.

CAPCOM Okay.

SC And, Vance. Has FIDO come up with any observations on the trajectory?

CAPCOM Well, a minutes ago he said that to tell you that he was passified now after your past comments on his trajectory and so forth and he hasn't seen any waste water dumps or anything and he's pretty happy.

SC Okay. I just wondered if we're going to need any more midcourse.

CAPCOM He says, seriously, it's looking probably like you won't have any more.

SC Hey, that's real fine.

CAPCOM FIDO's never guarantee anything, however.

SC Yes. That's right.

END OF TAPE

SC Houston, 13. I have the onboard readout, if you're ready to copy.
CAPCOM Roger. Go ahead.
SC Okay. Bat C 37, pyro bat A 37, pyro bat B 37, RCSA 97 percent, B 97 percent, C 96 percent, D97 percent.
CAPCOM Roger we copy that. Thank you.
CAPCOM Apollo 13, Houston.
SC Go ahead now Vance.
CAPCOM Jim, just an item for you and Fred to be thinking about in case you haven't been briefed on this, something that's now being talked about a little bit. To be conservative, people would like to have you read the SHE tank pressure when you go into the LM for the LM familiarization at 58 hours. If there's no midcourse 3, and it looks like there's a good chance that there will not be, why they might want to move the LM familiarization up from 58 to 55 hours. Over.
SC Okay. If we don't have a midcourse 3 then we'll probably move LM fam up to 55 hours in which case we'll go in there and read SHE tank pressure.
CAPCOM Roger. Along with the other fam stuff and it's not certain that we want to do this, it's just being talked about so this is just information for you.
SC Okay. This is beginning to sound like the sim that we ran not too long ago.
CAPCOM I don't think it will be a very big deal.
SC Okay. Houston, 13.
CAPCOM This is Houston. Go ahead.
SC Hey Vance, LM CM DELTA P is 0.9.
CAPCOM Roger, 0.9.
SC Roger.
PAO This is Apollo Control at 35 hours, 46 minutes. The flight dynamics officer has just recomputed a new impact point for the S4B, based on later tracking data. The current figures predict that the S4B will impact the moon at a Ground Elapse Time of 77 hours, 56 minutes, 54 seconds, and the coordinates of the impact are now predicted to be 2 degrees 35 minutes south, and 28 degrees 31 minutes west. These continue to be preliminary figures and we expect that there is a good chance they will be updated as we get further tracking data on the S4B. At the present time Apollo 13 is 134 624 nautical miles from earth, traveling at a speed of 4292 feet per second.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Vance.
CAPCOM Hacking into your presleep checklist yet?
SC We just finished eating and cleaning up a bit afterwards. Jim's going around collecting debris off of all the inlet hoses. And I guess you might say we're kind of thinking about getting ready to go to sleep.
CAPCOM Well, I hope you had a good meal.
SC It wasn't too bad.
(MUSIC)
CAPCOM Sounds like you guys are really living it up up there. All that music, food. I didn't say drink.
SC Yes, it is pretty nice. Not bad at all. You're right you didn't say it. This PTC we're in it's a pretty nice merry-go-round, Vance. Every 10 minutes alternately I get to look at the Earth and the Moon.
CAPCOM You couldn't ask for any more than that. Just so it isn't so bad.
SC No. Lot better remember from 8 when they didn't hardly ever get to look at either one.
CAPCOM That's right. They were tumbling about another axis weren't they.
SC Yep. It's pretty cloudy down there to-night, but the only land I can see is a portion of Australia and Korea and it looks like a part of China. Looks like clouds covering everything else.
CAPCOM Can you still see that clearly with the naked eye, or do you have to look through a glass.
SC I can see Australia with the naked eye and the China land mass, but it took the monocular to pull out the Korean peninsula.
CAPCOM How about the Moon? Is it looking very big, yet? SC No, not really. Bigger but we've got a ways to go.
CAPCOM I understand that they're estimating lunar pericynthian as now 62 miles.
SC Well, that's not bad.
CAPCOM That's supposed to be just right.
SC Yes.
SC Okay Houston, 13.
CAPCOM Go ahead, Jack.
SC Okay. We're into the presleep checklist now. As far as the crew status report, as far as medication goes, we've had no medication. And we're all feeling really good. Giving you the onboard readout. J im is quartering the potable water now. I'm ready for an E MEMORY dump whenever you're ready.
CAPCOM Stand by 1 on the E MEMORY dump, Jack. I think we'll be ready in about a minute.

SC Okay.
CAPCOM And ECOM says that as soon as you stir your cryos request you go back to AUTO on that one tank.
SC Okay. Will do that.
CAPCOM 13, Houston. We're ready to take your E MEMORY dump.
SC Okay. Coming down.

END OF TAPE

PAO This is Apollo Control at 36 hours 50 minutes. During that last series of conversations Jack Swigert passed along the crew physical status, reporting that they've taken no medication and they're all feeling fine. Prior to that, Fred Haise gave us an out-the-window description of the earth and moon. Fred also played back a short sample of the music that they have on board the spacecraft and reported that the food was fine. Apollo 13 at this time is 137 250 nautical miles from earth, travelling at a speed of 4 219 feet per second. The crew should be beginning their scheduled 10 hour rest period, shortly. That rest period is scheduled to begin at a ground elapsed time of 37 hours. They've completed all items in the flight plan necessary to beginning the sleep period. At 36 hours 52 minutes, this is Apollo Control, Houston.

CAPCOM Apollo 13, Houston. Were you trying to call?

SC Go ahead, Houston.

SC Houston. 13.

CAPCOM Apollo 13, Houston. We thought you were trying to call. Were you?

SC I don't believe so unless we inadvertently hit the microphone button.

SC Must have been some other guy trying to call, Jack.

SC You trying to get the word to me, Jack.

CAPCOM Roger. We saw the down voice subperiod come on. We thought maybe you were trying to call. Sorry. I hope we haven't disturbed you and from where I sit, it looks like you're running a rest home up there. Good night.

SC We're all going to bed now just after we play the last audition of "With Your Eyes on the Stars".

CAPCOM Okay, Jim. And we'd like you to check your S-band nominal voice switch OFF.

SC S-band normal OFF.

PAO This is Apollo Control at 37 hours 11 minutes. That was Jim Lovell reporting just a few minutes ago that the crew was ready to begin their 10 hour sleep period. That sleep period is scheduled to end at 47 hours ground elapsed time. Here in Mission Control, Astronaut Jack Lousma has replaced Astronaut Vance Brandt as Capsule Communicator.

SC 13. We'll be off comm, so if you need us send a crew alert please.

CAPCOM Okay, Jim. If we need you, we'll send a crew alert and we'd like to know whose got the duty

CAPCOM and the biomed. Is that you?
SC Yes. I'll be at the biomed.
CAPCOM Okay. We copy and you're spoiling my good record of two watches without saying anything.
SC Just want to keep you busy, Jack.
CAPCOM You're waking me up.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 2:28A GET 37:15:00 115/1

PAO This is Apollo Control at 38 hours 8 minutes. The crew is now about 1 hour into their scheduled rest period and here at Mission Control the activity has settled down primarily to watching the spacecraft systems. At the present time Apollo 13 is 140 357 nautical miles from the earth travelling at a speed of 4 135 feet per second. At 38 hours 8 minutes, this is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/13/70, CST 3:21, GET 38:08:00,116/1

PAO This is Apollo Control of 39 hours, 20 minutes. We're now some 2 and a half hours into the scheduled 10 hour rest period. The flight surgeon reports that Jim Lovell appears to be sleeping soundly at this time. Lovell is the only crewman who is wearing a biomedical harness, according to the plan. We have almost a little more than 7 1/2 hours remaining in the sleep period. All spacecraft systems continue to function normally at this time. Apollo 13 now 143 222 nautical miles from Earth and the spacecraft velosity is 4 059 feet per second. At 39 hours 21 minutes, this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 4:33A GET 39:20 MC117/1

PAO This is Apollo Control at 40 hours. Seven hours remain in the crew's sleep period. Apollo 13 is 144 784 nautical miles from earth, velocity 4019 feet per second. The latest S4B impact time update places impact of the third stage of the booster on the lunar surface at 77 hours, 57 minutes, 4 seconds. Predicted coordinates of impact 2 degrees, 10 minutes south, 28 degrees, 50 minutes west. This is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 5:14A GET 40:01 118/1

PAO This is Apollo Control at 41 hours. Everything continues to go well aboard Apollo 13 as the three crewmen begin the 5th hour of their scheduled 10 hour rest period. Apollo 13 is 147 103 nautical miles from Earth. Traveling at a velocity of 3960 feet per second. This is Mission Control, Houston.

END OF TAPE

PAO This is Apollo Control at 42 hours. Apollo 13 is now 149 375 nautical miles from earth, velocity 3903 feet per second. The crewmen are at the midpoint now of their 10 hour rest period. That rest period due to end about 47 hours elapse time. This is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/13/70 CST 8:12A GET 43:00:00 120/1

PAO This is Apollo Control at 43 hours. Four hours remains in the Apollo 13 crew's rest period. Spacecraft is 151 625 nautical miles from Earth, traveling at a velocity of 3847 feet per second. The Flight Dynamics Officer has again updated the expected SIVB impact time and coordinates. We are predicting SIVB impact at 77 hours, 57 minutes, 9 seconds. Coordinates of the impact location on the Moon, 2 degrees, 11 minutes south, 28 degrees, 58 minutes west. News men in the news center can see the impact point in relationship to landing zones on the monitors in the news center at this time. This is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 8:30A GET 43:17:00 121/1

PAO This is Apollo Control at 43 hours 17 minutes. Three briefings on future programs are scheduled for this morning in the briefing room at the MSC News Center. Topics and times are Space Station at 9:00 AM, the Space Shuttle at 10:00 AM, and the Reusable Space Tug at 11:00 AM. All three of these briefings will be conducted in the briefing room in the MSC News Center.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 8:55A GET 43:42:00 122/1

PAO This is Apollo Control at 43 hours 42 minutes. Apollo 13 is 153 172 nautical miles from earth travelling at a velocity of 3809 feet per second. 3 hours 17 minutes remains in the crews rest period. Astronaut Joe Kerwin is the Capcom now. This mornings briefings on future programs in the MSC News Center will be carried on this release line. The first one begins in about 5 minutes at 9:00 AM, CST. The topic of that briefing is Space Stations. This is Mission Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4-13-70 CST 9:55A GET 44:42:50 123/1

PAO This is Apollo Control at 44 hours 42 minutes. Apollo 13's distance now is 155 379 nautical miles, velocity is 3756 feet per second, and 2 hours 17 minutes remains in the rest period. Mid-course correction number 3 will not be required. Because of this, the plan now is to move the LM activation time and the TV transmission time from the 58 hours under the plan with the mid-course back to 55 hours. LM activation and the TV transmission time will now be at 55 hours elapsed time. That's about 8:13 PM CST this evening. The next briefing in the MSC News Room will begin in approximately 5 minutes, the topic will be space shuttles, and that briefing will be carried on this line. This is Mission Control Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 11:00A GET 45:47:10 124/1

PAO This is Apollo Control at 45 hours 47 minutes. Crew wakeup time is 1 hour 12 minutes away. Apollo 12 is 157 720 nautical miles from earth. It's velocity is 3701 feet per second. The 11 A.M. briefing on resuable space tug will be carried on this line. This is Mission Control Houston.
(Speaker meant Apollo 13)

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/13/70 CST 11:55A GET 46:42:50 125/A/1

PAO This is Apollo Control at 46 hours, 43 minutes. Spacecraft Commander Jim Lovell has just put in a call to us 16 minutes prior to wake up time. Here's that conversation.

SC Houston, Houston, Apollo 13; over.

CAPCOM Good morning 13, you're early.

SC Ah so - just thought we'd wake you up, and we are awake and getting the spacecraft ship shape.

CAPCOM Roger. Spacecraft is in real good shape. As far as we're concerned Jim. We're bored to tears down here. We do have a few little items for you, like P37 update and a couple -

(End of Recorded Playback)

SC Okay, gig us again in a few minutes; we're braking out some food, and we'll copy them then.

CAPCOM Okay, and surgeon will be ready for your sleep report whenever you get that together.

SC Right. LMP solid 9 hours of sleep; I couldn't wake him up this morning, the CMP had 6 hours, and the Commander about 5 intermittent. Jack's dosimeter - Jack's dosimeter is reading 02026.

CAPCOM Okay, we got it.

SC It might be interesting that just after we went to sleep last night we had a master alarm and it really scared us. And we were all over the cockpit like a wet noodle

CAPCOM (laughter) Sorry it wasn't something more significant. I've also got a procedure for you on that H2 tank - simple thing after you get done stiring up the cryos.

SC Okay.

END OF TAPE

SC Music
CAPCOM That was beautiful, what was it?
SC a little of lift their eyes to the stars wake up, wake up..
CAPCOM Sounds like all the comforts of home. Have you guys got a flower on your breakfast table?
SC Yes, Jack.
PAO The CAPCOM is astronaut Joe Kerwin. With him at his console is the backup crew commander John Young. Apollo 13 is 159 967 nautical miles from earth, velocity 3649 feet per second.
PAO The flight dynamics officer has again updated the S-IVB impact time and location. Impact time 77 hours 57 minutes 5 seconds, coordinates 1 degree 54 minutes south, 28 degrees 47 minutes west.

END OF TAPE

SC Houston, Apollo 13. Over.
CAPCOM 13, Houston. Go ahead.
CAPCOM 13. This is Houston. Go.
SC Roger, Joe. We're standing by for that P37 flight data if you have it aboard.
CAPCOM Okay. Got it right here, Jim, and it follows. This is the P37 PAD for liftoff plus 60. The reason for the update is for weather avoits in the MTL at 119 hours. It's the same one we passed you yesterday and it's the same weather, but we still don't expect a problem at the end of the mission. GETI is 06000 DELTA-VT 6079 longitude minus 153 GET 400K 11804. Over.
SC GETI of 06000 6079 minus 153 11804.
CAPCOM Roger. That's correct. I've got a consumables update for you Jim, if you're ready for that.
SC Ready to copy.
CAPCOM Okay, as of 47 hours, RCS total 1096 QUAD ALPHA 270, BRAVO 278, CHARLIE 270, DELTA 278, and the H2 they gave me the H2's in percent, 76 percent and on the 02 we have 81 percent, however, we show the 02 tank 2 reading off scale high now. We're quite sure it's a sensor failure. We'd like you to verify it with your onboard reading.
SC Okay. Stand by.
SC Joe, we confirm. Our gauge reading is on the numbre 2, 02 tank is high now but they tell me it was okay when we first looked at it this morning.
CAPCOM We verify that, 40 of that at 4645 we had 82 percent and

END OF TAPE

CAPCOM At 46:45 we had 82 percent and apparently when he stirred he cryos the sensor broke.

SC Okay.

CAPCOM So it's no problem. You're above nominal on all your consumables. On the H2 tank problem, we have a procedure that we'd like you to carry out which is simply turning the H2 tank 2 heaters to OFF at this time and we want to see whether that won't solve the problem of the tank pressure setting off CAUTION in 01 and we want to look at it that way for a few hours.

SC Okay, you want to both H2 and tank 2 off, is that correct?

CAPCOM That's negative, just tank 2. We want tank 01 to stay in AUTO.

SC Okay, tank 2 heaters OFF at this time.

CAPCOM Okay, good deal. That's been the high tank and apparently while waiting for that pressure switch to close to start the heater cycle, the tank 1 pressure has been dropping. It's been a little lower and just setting off CAUTION in 1, so we feel if we turn off the tank 2 heater and let tank 1 activate the heater cycle we won't get into the CAUTION and WARNING range.

SC Roger.

CAPCOM Okay, Jim, at your convenience we'd like P00 and accept. We're ready to uplink your state vector now since we will not do mid-course 3. Over.

SC Roger, you're in P00 and accept, no mid-course 3, and we're all set for receiving the uplink and I'm giving you the (garbled) early.

SC Okay, good deal. And I have flight plan updates for you later at your convenience.

SC Houston, Apollo 13. The LM/CM DELTA-P is 1.0 psi.

CAPCOM Copy 1.0, Jim.

SC Houston, Apollo 13. I'm about ready for the flight plan updates that you have.

CAPCOM Okay, 13. Starting off with got a minor procedural change for Jack on his next P52 if he's ready to listen to that.

SC Okay, Jack's still off COMM. We'll hold off on that a little bit and then we'll pick it up so he can talk now.

CAPCOM Okay, fine. I've got 2 updates for you, Jim. One is a procedure for looking for comet Bennett at about 49:45 and I'll wait till Jack gets up before passing you the details on that. The other update is concerned with going into the LM 3 hours early and I think Vance mentioned to you last night that this was a possibility, that we'd like to look at the she-tank pressure early and since we're not going

CAPCOM to do mid-course 3 we'd like LM entry at 55 hours. Is that okay with you?

SC Okay, right, that's fine with us. We'll move up LM entry to 55 hours.

CAPCOM Okay. I've got some details on the flight plan for you as follows: Of course, since there's no MCC-3 you'll be deleting all the mid-course 3 stuff including the

END OF TAPE

SC All the midcourse stuff including the P52 which is called out at about 54 and a half and we'll be slipping that til later, which I'll, which I'll tell, which I'll tell you in a minute. Okay, then you, we want to move the battery charge up 3 hours to about 52:30 and we want to move the - moving the LM tunnel vent valve to LM CM delta P up 3 hours to 52:45, and at that point you can simply go to the 57 hour point in the flight plan and change your number from 57 hours to 54 hours and start through that. In the remarks section at about 57:50 it says 02 fuel cell purge and waste water dump here if not performed earlier we want you to do that at 54 hours and 50 minutes. The TV cast then, will be at 55 hours or 55:30. We'll go right through the (background noise)

CAPCOM 13, Houston.

SC Hi, Houston.

CAPCOM 13, Houston, You back with us?

CAPCOM Apollo 13, Houston, are you back with us?

SC We're back with you.

CAPCOM Okay. I've gone through the battery charge, the LM vent valve, the fuel cell purge and then stop PTC at 55 hours and your roll attitude there will be 285 degrees, which is per the flight plan. The high-gain antenna angles are slightly different. Pitch 23 and Yaw 267 degrees. The TV pass till 55:30, the standard LM activation, except for some special steps we'll give you to take a look at C tank pressure which I don't have yet. Restart PTC at about 56:30 or whenever you're through with the LM activities and after that, at your convenience, we'd like you to - we are to do the P52 option 3 that we cancelled at 54 and a half hours. Over.

SC Okay, that last comment was tha and we'll do the P52 after we start PTC at about 56:30.

CAPCOM That's right. Any time after that. It's not time critical.

SC Okay, let's see if I have some of this, Joe. Around 52:30 we're to do the battery charge on Battery B.

CAPCOM That's correct.

SC And at about 52:40 we're going to do the LM tunnel vent valve and the LM CM delta P which has been written up at 55:40.

CAPCOM That's correct.

SC We're deleting midcourse 3 and we've moved up LM entry to 55 hours. So we'll merely follow all the - we'll follow all the procedure that leads up to that entry that was rescheduled for 58.

CAPCOM That's correct. You can start at 57 in the flight plan; call it 54 hours and press right on.

SC Okay, then when ever we finish the LM which we anticipate around 56:30. We'll commence -

END OF TAPE

SC around 5630. We'll finish PEC and sometime after that we'll do AEP, what did you do?
CAPCOM That's affirmative. You copy the new high gain angles for 55 hours?
SC Okay, we're going to start the PTC for EM entry and ROLL 285 and high gain angles, are PITCH 23 and YAW 267.
CAPCOM That's correct, Jim. And 13, Houston, the computer is yours.
SC The computer is ours. We're in

block and exactly when do you want the TV to be cranked up?
CAPCOM You can crank it up sometime prior to 55 hours at your convenience just to set it up. We'll be expecting transmission at 55 hours.
SC Okay.
SC And Houston, Apollo 13. One thing I missed about the 02 fuel cell purge and waste and water dump.
CAPCOM Roger. We'd like the the 02 fuel cell purge and waste water dump at 54:50.
SC Roger. We'll pick up those angles at 54:50.
CAPCOM Apollo 13, Houston.
SC Go ahead, Joe.
CAPCOM All right Jack. One thing we'd like to have done sometime soon is to have you cycle the cryo fans in 02 tank 2 one more time. We'd like to see if we can get that sensor back again.
SC Okay. 02 tank 2 fan on now.
CAPCOM Roger.
SC Hello, Houston. 13.
CAPCOM Go, 13.
SC We have just 1 question. The LM panel vent valve. We're a questioning why we're venting it til Delta P is greater than 1.7 and we're going to open up the panel, then pressurize the LM usual.
CAPCOM Right. Standby on that.
CAPCOM 13, Houston.
SC Go ahead.
CAPCOM Roger. The word on that, Jim is that they want to insure the proper 02 concentration in the LM when you get to the surface, and this is a method of doing that by bleeding out additional nitrogen.

END OF TAPE

CAPCOM fit of doing that by bleeding it out additional nitrogen.

SC Okay, thank you.

CAPCOM And 13, Houston. If Jack is up I'd like to talk to him about the P52 briefly.

SC Okay, he's here.

SC Go ahead, Joe.

CAPCOM Okay, Jack. What they'd like you to do on this P52 at 49 hours, they've been observing a slight jitter in the optics shaft angle of about 2/10th of a degree plus or minus. Before you come out of the optic zero position, at the start of this P52 they'd like you to just observe the shaft readout and see if the jitter occurs on your direct readout there and also they'd like you to briefly call up a VERB 16 NOUN 91 so we can look at the shaft and trunnion angles.

SC Okay, let me see if I got it right. On the P52 at 49 hours, before coming out of zero on the optics observe the shaft and also call up 16 91 and let you look at the shaft and trunnion angles to observe a possible jitter to see whether it occurs in the zero position as well as out of zero.

CAPCOM Roger, Jack, that's correct, and if you have time now I've got a flight plan update for you on looking for the comet Bennett.

SC Okay. Stand by one, Joe, and the commander's going off the air briefly.

CAPCOM Roger that.

SC Okay, Joe. I'm ready to copy now.

CAPCOM Okay, Jack. I'm going to read it to you and then add some comments and we'll talk about it a little. This should occur sometime after 49:30. After the P52 realine at 49 hours, if time permits we would like the crew to investigate while in PTC if there is a roll angle at which the comet can be observed for photos. If there is, record the optimum roll angle for possible photography and prior to reinitiating PTC at 56:30 or so, whenever the guys are done in the LM, use P52 planet option and the following half unit vectors for tracking comet Bennett at about 49:46. Are you ready to copy half unit vectors? Over.

SC Okay, go ahead, Joe.

CAPCOM Okay, R1 plus .34202; R2 minus .07374; R3 plus .35719 Read back.

SC Okay, copy R1 plus 34202; R2 minus 07374; R3 plus 35719.

CAPCOM Okay, that's correct and the last sentence on the update is that you can expect AOS of the comet at a roll of 45 degrees and LOS at a roll of 155 degrees. Now, the deal here, Jack, according to the plots they've shown me is the comet appears to be about 10 degrees away from the sun

CAPCOM and due to the geometry of the LM there shadowing the sun, it would appear that you will be able to see the comet through the sextant without getting sun shafting between roll angles of about 45 degrees and 75 degrees. It appears that as your roll gets higher than 75 degrees, although the comet is still in the field of view, the sun is also in the field of view and you probably will not have any success between 75 and 155 if you haven't got it from 45 to 75. If you do find that you can see the comet somewhere between 45 and 75 or 80 degrees, just note that roll angle and then if it's feasible we'd like you to photograph it after the LM entry part of the checklist. Over.

SC Okay, Joe, let me give it back to you and see if I've got it here.

END OF TAPE

SC Okay Joe. Let me give it back to you and see if I've got it here. After the P52, during our PTC you want us to use P52 and observe Bennetts Comet through the sextant note the roll angle if we can find it visible, be visible ideall6 between 45 and 75 degrees and we should lose at it about once every 55 rolls and if we do see it make an observation of whether it is photographical, note the ROLL angle for photographs after or prior to initiation of PTC at 5630.

CAPCOM That's exactly right Jack.

SC Okay. Real fine.

CAPCOM Apollo 13, Houston.

SC Go ahead, Joe.

CAPCOM We're ready to have to 02 tank 2 fan OFF, and thank you.

SC Okay. Doesn't look like you have it back, huh?

CAPCOM No it doesn't, Jack.

END OF TAPE

PAO At 48 hours 32 minutes, Apollo 13's distance is 163 thousand 513 nautical miles, velocity 3568 feet per second.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 1:46P GET 48:34:43 134/1

PAO This is Apollo Control at 48 hours 48 minutes. At the Control Center, the gold team, led by Jerry Griffin, is in the process of turning over to Gene Kranz and his white team. We're estimating a change of shift News Conference with Jerry Griffin for 2:30 PM CST in the briefing room at the MSC News Center.

END OF TAPE

SC Houston, Apollo 13.
PAO This is Apollo Control Houston at 49 hours 1 minute now into the flight of Apollo 13. The Apollo 13 spacecraft -
CAPCOM Hey, 13, Houston. Go ahead.
SC Okay, Joe. I've started into P52 here. I've proceeded on option 3 and on the 1525 - 1520 display I've called up 1691. I'm going to let you observe and see while the shaft angle while the optics are still in zero.
CAPCOM Okay, roger that Jack. We're looking at it and I'll give you a mark as soon as GNC is happy.
SC Okay, real fine.
PAO That was Jack Swigert, command module pilot, he's alining his spacecraft platform at this time.
CAPCOM 13, Houston. Jack, could you give us a readout on your counter now?
SC Okay. I'm showing a shaft of .2 and a trunnion of 359.92.
CAPCOM Roger, copy that. Is there any jumping around of the shaft?
SC You mean the on the T pack readout Joe?
CAPCOM Yes.
SC As a matter of fact, it went from .2 to .21.
CAPCOM Okay, copy that. Stand by one.
SC Okay, now it went down - it went down as low as .15.
CAPCOM Okay.
PAO Apollo Control Houston. Apollo 13 now 164 602 nautical miles away from earth, traveling at a speed of 3544 feet per second.
CAPCOM Jack, Houston. Let us watch that for another minute or so.
SC Okay, I'm in no hurry. It looked like it burned between .14 and .8 of an occasional spike up to .2.
CAPCOM Roger.
CAPCOM Apollo 13, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/13/70 CST 2:19P GET 49:06 136/1

PAO This is Apollo Control Houston. In the Mission Control Center, Gene Krantz is taking the reins of the flight control team, he's sporting a flashy white vest in the best traditions of his team color. Joe Kerwin remains on as the Capsule Communicator with the spacecraft. We are at 49 hours, 06 minutes into the flight and Apollo 13 is presently 164 698 nautical miles out from earth, traveling at a speed of 35 041 feet per second. This is Apollo Control Houston.

SC Hey Houston, are we free to torque; are you reading the torquing angles?

CAPCOM 13; Houston; go ahead and torque.

SC Okay, time of torquing will be 49 hours, 8 minutes, 35 seconds.

CAPCOM Roger that.

SC (garble)

PAO This is Apollo Control Houston at 49 hours, and 9 minutes into the flight, the change of shift news conference is still estimated as an estimated start of 2:30. Meanwhile in Mission Control, flight dynamics has updated our SIVB impact coordinates in time. We are presently looking at coordinates of 2 degree 18 minutes south, 28 degrees, 55 zero minutes west at a ground elapsed time of 77 hours, 57 minutes, 5 seconds. Apollo 13 is now 164 814 nautical miles away from Earth, traveling at a speed of 3539 feet per second.

CAPCOM Apollo 13, Houston.

SC Go ahead Houston.

CAPCOM Roger - for Jack, we missed the star angle difference on the P52.

SC Roger - It was all balls.

CAPCOM Okay.

PAO That was Jim Lovell, Spacecraft Commander, responding to Joe Kerwin. We are at 49 hours, 11 minutes now into the flight, and this is Apollo Control, Houston.

END OF TAPE

PAO This is Apollo Control Houston 49 hours 15 minutes now into the flight. We'll take down our air-to-ground line at this time since the change of shift briefing is now scheduled to begin. This is Apollo Control Houston.

END OF TAPE

PAO This is Apollo Control Houston, 49 hours, 32 minutes now since liftoff. Apollo 13 presently 165 573 nautical miles out from Earth, traveling at a velocity of 3522 feet per. second. Since we took the line down for the change of shift briefing, we've had no voice communications with the crew, however, we will leave the line open at this time and stand by and continue to monitor. At 49 hours, 33 minutes into the flight, this is Apollo Control Houston.

PAO This is Apollo Control Houston at 49 hours, 35 minutes since liftoff. We are presently looking at the start of LM activation at 55 hours, ground elapsed time, and Goldstone will be feeding the TV transmition at that time. Apollo 13 165 675 nautical miles away from Earth, and traveling at a speed of 3520 feet per second. We are 49 hours, 36 minutes and this is Apollo Control Houston.

END OF TAPE

SC Hey Houston, 13.
CAPCOM 13, Houston; go ahead.
SC Okay, Joe, I got into P52 about 49:34. We loaded the planet, or Bennett Comet vectors into the planet option and P52 tracked it all the way across except that it was always occulted by the LM, and we are in a roll angle of 155 now.
CAPCOM Roger - we are copying your roll angles. At what roll angle were you able to start tracking it Jim?
SC Okay - at the time we entered it there, we were about 66 degrees roll, so either we started too late, Or maybe somehow we got a wrong calculation on the roll angle.
SC Okay, let me have G&C comment on that, I suspect that the roll angles we gave you were calculated for exactly 90 degrees pitch and your probably wobbling enough that they are not exactly correct.
SC Yeah, I think you probably got the right idea.

END OF TAPE

CAPCOM 13, Houston. Over.
SC Go ahead.
CAPCOM Okay, Jack. Notice you've secured from that, and that was going to be our recommendation, anyway. We're going to have the guys in the back room look at it, and see if they can come up with some - with some better numbers based on the cone angle that - that you're traveling through. Whether there are any roll angles that - that are available to you, and if there are, and we have time, we might give it a - another try, if not we'll just will forget it.
SC Okay.
CAPCOM Apollo 13, Houston. Over.
SC Go ahead, Joe.
CAPCOM Okay, Jack, I'd like to pass you a switch configuration on the cyro 02 tanks, and give you the reason. Right now we'd like you to go to heaters tank 1, off; tank 2, auto, which is the opposite of the way you've got them now. Over.
SC Okay, Houston, go forward.
CAPCOM This is 02 and standby for a minute and we'll have it.
SC Excuse me, this is H2.
SC That's right it's H2.
SC (Garble) auto (garble).
SC Okay, Joe, do we have you back again?
CAPCOM Okay, Jack, we're getting you back, and I hope you copied my - my correction of my mistake I'm talking about the H2 cryo tanks. We'd like the tank 1 heater to off; tank 2 to auto. Over.
SC Okay, we lost you again. Here's our heater configuration now. H2 heaters 1, off; 2, auto. Both 02 heaters are in auto.
CAPCOM Okay, that's the configuration we want you in and here's what we're thinking about. When we went to tank 1, auto, tank 2, off; we found that the heater cycle that a tank 1 pressure of about 233 psi which is well above the caution and warning limit, and if we go to that configuration for sleep, we'll keep from getting caution and warning lights during the sleep cycle. Okay, in order to do that, comfortably, we want to spend the rest of the day using more H2 out of tank number 2, so as to get an unbalance in favor of tank 1, so at the end of the sleep cycle it'll all come out even. And that's why we have you in tank 1, off; tank 2, auto; now. We expect to get about a 3 percent unbalance over the next 10 hours; and prior to sleep we'll call you to reverse the configuration again.

END OF TAPE

CAPCOM - once over the next ten hours and prior to sleep we'll call you to reverse the configuration again. Now the only disadvantage here is that during the day you will probably get a few caution and warnings and we just figured it would be better to get them now than while you were sacked out. Over.

SC I'll buy that 100 percent.

CAPCOM Okay. Good deal. One other detail for your check, G&C tells us that the optics jitter is very similar to what we had on Apollo 12. It's no problem but when you are not using the optics we recommend that you turn the optics power switch to OFF to guard against a possible degradation as the flight progresses.

SC Okay. Will do.

CAPCOM Okay. Apollo 13, Houston. I have one more update for you and it's another update to the erasable memory onboard crew charts on page G9-7. Over.

SC Houston, 13. We copy.

CAPCOM Okay, Jim. These are gyro compensation terms. They have already been uplinked and we are just updating your onboard charts now. In Column A, No. 11, change from 77546 to 00114; No. 12 change from 77332 to 77546; No. 13 change from 76617 to 77201. Over.

SC The changes are as follows. Column A, No. 12, the new change is 77546; No. 11 the new change is 00114; and 13 the new change is 77201. Over.

CAPCOM Roger. Readback is correct.

SC And, Joe, you know - are you going to try and let us spot the Bennet Comet on this next revolution there or do you want me to turn the optics power off now?

CAPCOM Stand by one, Jack. Okay, Jack, we don't have confidence in those roll angles yet so why don't you turn the optics off and we'll update you later.

SC Okay. Going off now.

CAPCOM Roger.

PAO This is Apollo Control, Houston, at 49 hours, 55 minutes now into the flight. Apollo 13 now 166 341 nautical miles away from earth, traveling at a velocity of 3505 feet per second. What you heard, was a relatively long exchange between capsule communicator Joe Kerwin and both command module pilot Jack Swigert and spacecraft commander Jim Lovell. The AUTO and OFF heater positions referred to are the switch positions for the H2 heater used to control redundant heaters in the two cryogenic hydrogen tanks. We are at 49 hours, 56 minutes into the flight and continuing to monitor, this is Apollo Control, Houston.

END OF TAPE

PAO This is Apollo Control Houston at 50 hours 09 minutes into the flight. We presently show Apollo 13 at an altitude of 166 801 nautical miles, now traveling at a speed of 3495 feet per second.

END OF TAPE

PAO This is Apollo Control, Houston at 50 hours, 25 minutes now into the flight. One display presently shows Apollo 13 at 167 355 nautical miles away from Earth. And traveling at a speed of 3483 feet per second. We've had no voice communication with the crew for the past 15 or so minutes, however, we will standby and continue to keep the line open and alive. We're at 55 hours, 25 minutes, and this is Apollo Control, Houston.

CAPCOM Apollo 13, Houston.

SC Go ahead.

SC Go ahead, Houston.

CAPCOM Roger, Jim. If you've got a couple of minutes now, I'd like to read up to you the change to the LM entry procedure, that we'd like you to observe at 55 hours, and the rationale for it. Over.

SC Okay, standby.

CAPCOM Roger.

SC (Garble).

SC Go ahead, Joe.

CAPCOM Okay. Before you start copying, this procedure is - is basically simply to activate the supercritical helium pressure gaging so that you can read it. And -

SC No.

CAPCOM - the concern here - is lest this supercritical helium pressure reach 1800 psi by 103 hours, at which point we'd be within a possibility of rupturing a burst disk, when you activate the DPS. Now, based on the pressure at launch, and based on a nominal rise time of about 6-1/2 psi per hour, between then and now, the pressure should read about 710 psi. Standby.

SC Houston, you were cut out. Would you say again about the helium pressure.

CAPCOM Roger. Based on the prelaunch pressure in the SCH tank and the nominal rise time of about 6-1/2 psi per hour the pressure should be about 710 at 55 hours. Are you reading, over?

CAPCOM Jim, Houston. Did you read that last?

SC Okay, Joe. I'm on OMNI C, now. How do you read?

CAPCOM 13, Houston. You're loud and clear now. EECO tells me he's having a little problem at Goldstone, and wants me to standby for a minute.

SC Okay, how do you read now, Joe? I'm going from OMNI C to D, now?

CAPCOM You're still loud and clear on - on D, Fred. Standby one.

SC Okay, I'll put her back to OMNI B if you all want to take command again?

SC And the last thing we heard Joe, was that the supercrit should be reading about 710 psi.

CAPCOM Okay, that's the last thing I passed up, and while we're waiting for EECO to decide here, let me continue. The DEADBAND that is considered acceptable is between 660 and 770 psi. In other words, any rise time that'll give you one, a pressure between those two, will keep you below the critical pressure at 103 hours or so. So, we expect it to read in that - in that band and if it does, there will be no problem. If it reads between 770 and 800 psi we will want you to check the pressure again at about 59 hours. And I'll get the detailed procedures in a minute. If the pressure is equal to or greater than 800 psi, we're going to have to go into some more detailed procedures, we're going to try to - to get PCM data on it, for one thing. We may have to have -

END OF TAPE

CAPCOM - to get PCM data on it for one thing. We may have to have you sit there and stare at the gauge for awhile to find out when it clicks up and get an accurate rise time on it and then in extreme case, we are even thinking about a ditch burn, but we don't really think that will happen. Now, if you are ready to copy, what I have for you is a change or an addition to the LM activation checklist between pages TLC-1 and TLC-2 which consists of 7 steps and if you can find a blank side to write it down on, I would like to pass it up. All right?

SC We're reading you on OMNI C now.

CAPCOM Okay. You're loud and clear on ONMI C now. Stand by one while we get ENCO sinked up.

SC Okay, The rest of your update was that it's okay if it is anywhere between 660 and 770 psi. If it's above 770, you are going to ask us to consider going back in at 59 hours. And, either get PCM going or sit there and give you gauge reading changes on the basis of that. You said something about an extreme measure, you may have to consider some sort of dips maneuver.

CAPCOM That's correct, Fred. We don't have procedures for that yet and we don't have any real expectation of getting into it. The procedure I'd like to read up to you now is simply the steps required to get the supercritical helium pressure reading at 55 hours. Over.

SC Okay.

CAPCOM Okay. We're calling this page TLC-1-A, Step 6, Transfer to LM Power.

SC Stand by one, Joe.

SC Okay, Joe, he's ready to copy.

CAPCOM Okay. Step 6, Transfer to LM power (flood lights blank) , caution warning power, caution light con. Report GET to MCC, panel 11 circuit breaker EPS trans-lunar bus tie, close. Circuit breaker panel 16, EPS trans-lunar bus tie, close. Circuit breaker panel 11, lighting utility, close. And activate utility lights. Over. And, 13, Houston, select OMNI BRAVO, please.

SC Okay, Joe, I've created a new page here called TLC-1-A, Item 6, Transfer to LM power and the usual check that the flood lights blank, caution light, power light ON, I get a GET from Jack and I will pass that on down to you. Item 7, Circuit breaker EPS translunar bus tie panel 11 and 16 closed. Step 8 circuit breaker lighting and uitlity on panel 1, close and turn on the utility lights However, the lighting is such that I don't really need those. They are in stowage right now, I guess, and I probably could leave them there.

CAPCOM Okay. That's optional and the way we had page TLC-1-A written, that was all part of Step 6. You haven't even gotten to Step 7 yet. Step 7 is as follows.

CAPCOM Fred, Houston, are you with me?

CAPCOM Apollo 13, HOuston, do you read me now?

END OF TAPE

CAPCOM Apollo 13, Houston, you read me now?
PAO This is Apollo Control, Houston.
CAPCOM 13, Houston, loud and clear, what OMNI you on now?
SC I'm going to stay on OMNI B, if you all want to take command back and you can let it go I'll jockey them around between B and D and how many steps we got, so I know the right (garbled) Joe?
CAPCOM Okay, we got step 6 through 12 but step 7 is the same size as six and eight through 12 are short. They're only one line each.
SC Okay.
CAPCOM Okay, step 7 follows. Circuit breaker panel 11 AC bus B, helium PQGS propellant display close, circuit breaker 11 AC bus B numeric lighting, close. Circuit breaker 11 AC bus B bus tie inverter one close. Circuit breaker panel 11 EPS inverter one close. Circuit breaker panel 16 instrumentation sic sensor close. Inverter one...
SC Hold on Joe.
Capcom Okay.
SC My shorthand is rather poor today. Okay I'm now up to circuit breaker panel 11 inverter one close.
CAPCOM Okay. Next was circuit breaker panel 16 instrumentation six sensor close. Then inverter one, select. Then helium monitor to super crit press. Report super crit press ...
SC Houston, 13.
CAPCOM 13, Houston, you're coming through. We still have some background noise. Do you want to read back step 7?
SC Houston, 13.
CAPCOM 13, Houston, go ahead.
SC Okay, Joe. The last thing I got was helium monitor to super-crit pressure.
CAPCOM Okay. The last part of step 7 is report super-crit pressure to MCC, and read back step 7.
SC Okay. Step 7. Circuit breaker panel 11 AC bus B, helium PQGS display close. Main circuit breaker..

END OF TAPE

SC - Circuit breaker panel 11, AC buss B; helium PQGS display CLOSED. Main circuit breaker panel 11 AC buss B numeric lighting CLOSED. CD panel 11 AC buss — Is that AC buss B? Buss time 01 CLOSED.

CAPCOM That's affirmative.

SC And CBE?

SC CB EPS at inverter 1 panel 11 CLOSED. CB panel 16, instrument signal sensor CLOSED, inverter 1 SELECT, Helium burner to super crit pressure report pressure MCC.

CAPCOM Okay. That's correct. Now step 8, is on MCC request perform step 9. In other words, you want for us to decide what to do and that's according to the guide we've already given you. And step 9, I'll give you now is helium monitor to OFF, inverter to OFF. Over.

SC Okay. Step 8 is set in a MCC HOLD. Step 9 says on MCC's words that helium monitor OFF, converter, OFF.

CAPCOM Roger. That's correct. Step 10. is configure circuit breaker panels per activation 3 and 4.

SC Okay. Configure - Step 10, configure circuit breaker per activation page 3 and 4..

CAPCOM Roger. That's correct. Step 11 is deactivate the utility lights if you activated them and step 12 which is the last one is transfer to CSM power, usual observations, and report time to MCC.

SC Okay. Step 11, deactivate utility lights. 12, transfer to CSM power and note the usual observations and report the GET.

CAPCOM Okay. That's set. And of course Houston will be requesting you to go to step 9 if the pressure is less than 770. If the pressure is between 770 and 800, we will be asking you to do the following if you're ready to copy.

SC Stand by. Got a pen and some more paper.

CAPCOM Yeah. This is going to be page TLC-3 but it's very short.

SC Okay. Go ahead with TLC-3.

CAPCOM Okay. Stand by 10 seconds,s, Fred.

CAPCOM Fred, Houston.

SC All right. Go ahead.

CAPCOM Roger. We'll hold off on that. It was a short 3-step procedure which said repeat activation pages 1 1A and 2 but there was another step in it that nobody understands. So, essentially what we'd recommend in that case would be that you repeat the procedure we just passed up for reading the super crit pressure. If we need

CAPCOM - to, we'll clarify it later on. And that's all we've got.

SC Up. Okay.

PAO This is Apollo Control Houston at 50 hours, 51 minutes now into the flight. We experienced some communications difficulties during that extended conversation. However, that was Joe Kerwin adding to the LM activation procedures for the 55 hour time in the flight plan giving steps required to get readings of the super critical helium pressure in the LM after Jim Lovell and Fred Haise go inside Aquarius. Fred Haise copied that report for Apollo 13. We now show on our displays, Apollo 13 at 168 262 nautical miles out from earth and slowing down, traveling at a velocity now of 3463 feet per second. Continuing to monitor at 50 hours, 52 minutes, this is Apollo Control Houston.

END OF TAPE

SC Houston, 13.
CAPCOM 13 Houston, go ahead.
SC Okay. One thing Joe, I just want to double check again. All the stuff that normally was going to start at 57 hours, which the first item was pressurize CSM 5.7 psia. We're going to do that at 54 now so we our LM entry which was nominally at 58 at 55 is that correct?
CAPCOM That's correct Jim.
SC Okay.
PAO This is Apollo Control, Houston, at 51 hours 03 minutes now into the flight. Apollo 13 presently shows an altitude of 168 651 nautical miles relative to earth. And traveling at a velocity of 3455 feet per second. Among those presently at the capsule communicators console here in Mission Control is Command Module Pilot, Ken Mattingly. We're at 51 hours 04 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Roger, 13. Because of the 02 tank 2' quantity sensor drop out, EECOM wants to keep a little closer track of the cryo quantities and he's going to be asking you to stir all the cryo tanks at slightly more frequent intervals than at the plan and the first time is now and we will be calling you probably every 5 or 6 hours except during sleep period and high activity periods. We'd like you to do it now. Over.
SC Okay. We'll stir the cyro tanks now.
CAPCOM Thank you. And 13, Houston, for your information, a normal one minute or so stir will -(static).
PAO This is Apollo Control, Houston, at 51 hours, 17 minutes into the flight. We presently show Apollo 13 at a distance of 169 111 nautical miles out and travelling at a speed of 3445 feet per second. In the Mission Control Center we are having a change in capsule communicators. Vance Brand has reported in taking the place of Joe Kerwin. We are at 51 hours, 18 minutes now, this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 4:32P GET 51:19:00 149/1

PAO This is Apollo Control, Houston, at 51 hours 29 minutes now in the flight. Apollo 13 now 169 526 nautical miles in altitude and traveling at a velocity of 3436 feet per second. We've had no communication with the crew of Apollo 13 for about the last 30 minutes. It's very possible that they have also stepped ahead the eat period in their flight plan. We'll stand by however and continue to monitor and at 51 hours 30 minutes into the flight, this is Apollo Control, Houston.

END OF TAPE

Dead air.

END OF TAPE

PAO This is Apollo Control, Houston, at 52 hours, 7 minutes now into the flight of Apollo 13. Our digital display presently shows the Apollo 13 spacecraft at an altitude of 170 752 nautical miles, continuing to slow down now at a speed of 3410 feet per second. A relatively quiet period here on the second shift that the White Flight Control Team has pulled at this point in time. Most of the flight controllers talking things over with their respective backrooms. We have not had contact with the crew for almost an hour. We'll stand by and continue to monitor at 52 hours, 7 minutes into the flight. This is Apollo Control, Houston.

CAPCOM Apollo 13, Houston.

SC Go ahead, Houston.

CAPCOM Jim, just an adivsory, expect a caution and warning on H2 tank 1 pretty quick. No problems, just warning.

SC Okay. Zero pressure light on H2 tank 1 coming on shortly.

CAPCOM Right.

SC Okay.

SC Well, you're pretty close. It just came on.

CAPCOM Any other predictions you'd like.

SC Well there's — I guess all sorts. Can't you go to the horse races with me?

CAPCOM I'm sorry you were garbled. Say again.

SC I said I would like to invite you to the horse races with me.

CAPCOM Right. We'll send EECOM.

PAO That was Vance Brand with a caution and warning light advisory timed almost to the second. Jim Lovell responded from the spacecraft. We're at 52 hours and 9 minutes into the flight and the show of Apollo 13. At 170 831 nautical miles above the earth, travelling at a speed of 3408 feet per second. Gene Krantz just spoke to the EECOM and said that's pretty lucky, then he said, "Oh, correction, that's pretty skillful." We are at 52 hours, 10 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

SC Well it's time for a little grits again here Vance.

CAPCOM Understand. Some grits, huh? Chow. Bon apatit.

PAO Apollo Control, Houston. That was Fred Haise, a native of Mississippi, saying it's time for some grits in here now. Obviously his conversion of, for describing it's mealtime. We're at 52 hours 18 minutes into the flight and this is Apollo Control, Houston.

PAO This is Apollo Control, Houston at 52 hours 23 minutes, now into the mission. Apollo 13 is presently 171 246 nautical miles away from earth. Its present velocity reads 3399 feet per second. Continuing to monitor, this is Apollo Control, Houston.

END OF TAPE

Dead air.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 5:47P GET 52:34:00 154/1

PAO This is Apollo Control, Houston.
At 52 hours, 36 minutes into the flight of Apollo 13. The Apollo 13 spacecraft now shows a distance of 171,726 nautical miles away from earth traveling at a speed of 3389 feet per second. We've just received a further update from the flight dynamic's officer with regard to predicted time and coordinates for the S-IVB impact. We now read a time of impact of 77 hours 56 minutes 45 seconds with coordinates now displayed here in Mission Control of 2 degrees 33 minutes south, 18 degrees 18 minutes west. We're at 52 hours 37 minutes into the flight and this is Apollo Control Houston.

END OF TAPE

CAPCOM Roger. Just expect that same caution and warning to come on again. And you want us to keep warning you of that thing?
SC Go ahead, Houston.
CAPCOM Roger, Jim. Just expect a caution and warning to come on the same as it did about an hour ago.
SC Go ahead, Houston. (Garble).
CAPCOM Roger. How are you reading me now, Jim?
SC Houston, Apollo 13.
CAPCOM Hi, 13. Houston. How do you read now?
SC Okay. Read you good now. Seems like we had a little trouble with the (garble).
CAPCOM Yes. I guess partly because you are further out. We just wanted to tell you that you are going to get that caution warning that you just got.
SC Right. We just got.
CAPCOM I won't bother you with those calls anymore, unless you especially want them.
SC That's okay, you don't have to call us about that, unless it's something serious.
CAPCOM Okay.
SC We just ate a can of ham salad and that was an experience.
CAPCOM Roger. Copy.
SC It's really kind of like eating on the sly. Chasing it around.
CAPCOM Right. Copy.
PAO This is Apollo Control, Houston, at 52 hours, 48 minutes into the flight. Spacecraft Apollo 13 is now at an altitude of 172 125 nautical miles and going at a speed of 3381 feet per second. That last conversation exchange we heard from both Jim Lovell and later describing ham salad sandwich was Fred Haise. We're at 52 hours, 49 minutes into the flight and continuing to monitor, this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 6:03P GET 52:50:00 156/1

PAO This is Apollo Control, Houston at 53 hours 08 minutes into the mission. We now show Apollo 13 at a distance of 172 771 nautical miles and traveling at a rate of speed of 3367 feet per second. This is Apollo Control, Houston.

END OF TAPE

SC (Garble).
SC Houston, Apollo 13.
CAPCOM 13, Houston. Go ahead
SC Right, we're not doing anything right now, Vance, we're just getting curious, we could start the LM entry procedures, and get everything squared away, and then when the TV comes up at 55 hours, we can just use it for the TV and we wouldn't be worrying about checking out the SHE tank pressures and everything like that.
CAPCOM Okay, let us mull that one a minute here, and I'll get right back with you.
SC Okay.
PAO This is Apollo Control, Houston at 53 hours, 21 minutes into the flight. Apollo 13 now at a distance of 173 207 nautical miles. And preceding at a speed of 3358 feet per second. That last report came to us from the spacecraft Commander Jim Lovell, there is a discussion here in the Control Center now as to what our response may be. We're at 53 hours, 22 minutes, and continuing to monitor. This is Apollo Control, Houston
SC Also, Houston, Apollo 13, we'd like to move up the waste water dump, and maybe the 02 fuel cell purge a little bit early if we could.
CAPCOM Okay, standby.
CAPCOM Apollo 13, Houston.
SC Go ahead, there, Houston.
CAPCOM Jim, you're clear to go on into the LM, and just advise though that the TV time is still fixed at 55 hours, and, so we'll be standing by to support your entry and we'll get back with you on a minute - in a minute on the 02 fuel cell purge and the waste water dump.

END OF TAPE

CAPCOM - so we'll be standing by to support your entry and we'll back with you on a minute - in a minute on 02 fuel cell purge and the waste water dump.

SC Okay. Sounds good.

CAPCOM And also request your LM/CM DELTA P which was on the flight plan for 53 hours. What did you vent it down to? Over.

SC We have 1.7 now. We're going to vent to that figure.

CAPCOM Okay, you've vented down to 1.7 and what did it start at?

SC It was about 1.1 Vance.

CAPCOM Roger, copy.

PAO This is Apollo Control Houston, 53 hours 28 minutes. There you've heard the response from CAPCOM Vance Brand clearing the Apollo 13 commander and lunar module pilot for going into the LM about an hour earlier than had previously been planned. However, the television transmission time will remain unchanged at 55 hours ground elapsed time. We presently show Apollo 13 at an altitude of 173,422 nautical miles and at a velocity of 3354 feet per second. This is Apollo Control Houston.

CAPCOM Go ahead, 13.

SC What do you read for suit pressure down there?

CAPCOM We're reading 4.3, Fred.

SC Okay.

PAO This is Apollo Control Houston, so we have Jim Lovell and Fred Haise cleared to go inside Aquarius a bit earlier and they're proceeding in that direction now. Although Jim Lovell is presently the only astronaut to have taken a second trip atop the Saturn V and is the first of his group to make a second journey to the moon. This evening will mark his first step inside the lunar module inflight. The Apollo 8 crew circled the moon with the command and service modules only. We'll standby and continue to monitor at 53 hours 36 minutes into the flight.

SC Houston, 13.

CAPCOM Go ahead, Apollo 13.

SC We'd like to know the combination when we close the tunnel vent valve back to map CM DELTA P, we are reading about 17 - 17.5 and it slowly went up now to about oh, I'd say a little less than 22. Seems to be holding there - is there a lag in the gaging system?

CAPCOM Okay. We'll ask that question. Stand by.

APOLLO 13 MISSION COMMENTARY 4-13-70 CST 6:40P GET 53:27:00 158/2

CAPCOM Apollo 13, Houston.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Okay, to answer your question, Jim, that increase is pressure is normal because it was just tracking an increase in cabin pressure.
SC Okay. Okay. Why didn't I think of that?
CAPCOM And, 13, from Houston, it's okay with us if you want to move the 02 fuel cell purge and the water dump up to this time. Over.
SC Okay. We'll work it in there shortly. Thank you.
CAPCOM Right.
PAO This is Apollo Control, Houston, at 53 hours, 44 minutes into the mission. Apollo 13 at the present time 173 934 nautical miles out from earth and now going at a speed of 3343 feet per second. We're at 53 hours, 44 minutes and this is Apollo Control, Houston.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Jim, recommend you stay in the PTC until we stop it for the TV at 55 hours in case you were thinking of -
SC Go ahead, Houston.
CAPCOM Roger. Recommend you continue PTC until 55 hours. Over.
PAO Apollo Control, Houston, ECOMM confirmed to Flight Director Gene Krantz the fuel cells are being purged and water dump being accomplished at this time.
CAPCOM That's affirmed, Jim. How do you read now?
SC Okay. We read you loud and clear.
CAPCOM Okay. The only comment that we just made was that in case you were thinking of stopping PTC, there's no need to stop it until 55 GET when TV starts.
SC Right. We'll stop it when we're setting up our TV.
CAPCOM Roger.
PAO Apollo Control, Houston, 53 hours, 48 minutes, EECOM confirms to Flight Director Gene Krantz that the cabin pressures are being equalized now. We presently show Apollo 13 at an altitude of 174 070 nautical miles and traveling at a speed of 3340 feet per second. We're at 53 hours, 48 minutes, this is Apollo Control, Houston.
PAO Apollo Control, Houston, 53 hours, 51 minutes, EECOM reports the cabin pressures have leveled off now reading 4.7 - 4.8. We now show Apollo 13 at 174 160 nautical miles away and going at a speed of 3338 feet per second. This is Apollo Control, Houston.

END OF TAPE

SC Okay, Houston, the waste water dump and fuel cell purge are complete.

CAPCOM Houston, roger.

PAO This is Apollo Control, Houston, at 53 hours 55 minutes. That was Back-up Commander for Apollo 13, John Young, returning that call from the spacecraft. Capsule communicator Vance Brand has left his console for a brief period of time to attend a meeting on the LM activation procedures and the monitoring of the super critical helium tank readings. We're at 53 hours 55 minutes and now show Apollo 13 at 174 309 nautical miles and traveling at a rate of speed of 3500 correction 3335 feet per second. This is Apollo Control, Houston.

SC Okay, Houston, the LM/CM delta p is constant. We're going to go ahead with hatch removal.

CAPCOM Houston, roger.

PAO Apollo Control, Houston. That was Fred Haise telling Houston that they're ready to procede with hatch opening.

CAPCOM No, this is Jack's replacement.

PAO Apollo 13 apparently mystified for the moment about John Young's voice. We show 13 at an altitude of 174 664 nautical miles with a velocity of 3328 feet per second. We're now at 54 hours 07 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

SC Okay, Houston, 13.
CAPCOM Houston, go ahead.
CAPCOM Go ahead, 13.
SC Houston, Apollo 13.
CAPCOM This is Houston, go ahead, 13.
SC Okay, Houston, Apollo 13.
CAPCOM Roger, go ahead, 13.
SC Okay, the LMP has entered the LM.
CAPCOM Roger.
PAO Apollo -
SC John?
CAPCOM It sure is. How're you doing?
SC Fine.
CAPCOM Yes, you're doing great, man.
SC Thank you. I had a good CDR.
CAPCOM You're doing it on your own now.
SC Yes, I'm feeling like I'm back at home, again, John, down in here.
SC I hope you did a good job, John.
CAPCOM Roger.
PAO Apollo Control, Houston, 54 hours, 26 minutes into the flight. That was Jack Swigert reporting that Fred Haise is now inside the lunar module. And carrying on a brief discussion with his former spacecraft Commander - his backup Commander - for this mission, John Young. We now show Apollo 13 at an altitude of 175 307 nautical miles.
SC Houston, we want to take the FM and bring up TV here, for our own use, then we'll go to transmit one - at 55 hours.
PAO Apollo 13 now traveling at a speed of 3314 feet per second. We're at 54 hours, 27 minutes now into the flight, and this is Apollo Control, Houston.

END OF TAPE

PAO This is Apollo Control, Houston, at 54 hours 42 minutes now into the flight of Apollo 13. Apollo 13 now shows an altitude of 175 826 nautical miles and its speed reads 3204 feet per second. Network has been advised by Goldstone that network does now have the capability of receiving television at any time. We will stand by in the event we should receive an early television transmission. At this point we do not expect to receive such, but we will stand by at 54 hours, 43 minutes into the flight. This is Apollo Control, Houston.

SC Okay, Houston, we've transferred to LM power, time was 54 hours, 46 minutes and 15 seconds.

CAPCOM Got you, Jack. Transferred to LM power. Thank you.

SC And the docking tunnel index was minus 2 degrees.

CAPCOM Say again, Fred, you are coming in with a lot of background noise.

SC Okay. The docking tunnel index mark was minus 2 degrees.

CAPCOM Roger. Minus 2 degrees.

SC Okay. Jack, how do you read?

CAPCOM Fred, Houston is reading you loud and clear.

SC Okay, I've got up to Step 7 now and not getting much of a light in the helium indicator here. Why don't I review for you how we proceeded and you look at the procedure you gave me and see if we've missed anything.

CAPCOM Roger. Go ahead.

SC Okay. We transferred to LM power and it looked okay. (Garble). Caution and warning lights, all the red flags, and we got both exlunar buss tie breakers in, the utility lighting breaker is in, then then AC buss B, helium PQS display, AC buss B numeric lighting and AC buss B inverter one, its buss tie is closed. Then I closed the inverter one breaker and I've selected on panel 16 in the signal consensor breaker and then I selected inverter one and put the helium on the switch to supercrit and have no lights.

CAPCOM Okay, Fred, let us take a look at it.

SC Do we need a --

END OF TAPE

CAPCOM Okay Fred, let us take a look at it.
SC I was wondering do we need a - Do we need possibly in the one in the A NOM NOM top component breaker set?
CAPCOM Stand by one.
SC Okay, Jack. Hold the phone. They forgot the reostat was cranked all the way down on the A NOM NOM it's showing 720. It looks like a pretty good pretty good number.
CAPCOM Roger, we copy 720.
SC Then flashed to 7.
SC Ken just flickered down to 710. It's kind of flickering between 710 and 720.
CAPCOM Roger, 710 to 720.
CAPCOM Okay, Fred those were good numbers and we're not going to have to crank up the TM. That's the number we were looking for.
SC Very good.
SC Back out of this in reverse at least as far as getting this part of it power down.
CAPCOM Stand by one.
PAO You've heard that report from Fred Raise.
CAPCOM Fred, this is Houston. Go ahead and back out of this little test and proceed.
SC Roger.
PAO Our super critical helium pressure rating was 720 pounds per square inch. A very desirable number. We're at 54 hours 53 minutes now into the flight. Apollo 13 at 176,171 nautical miles away from earth. We're standing by now for receipt of television.
PAO Apollo Control Houston, 54 hours, 55 minutes. We repeat that earlier report from LM pilot Fred Haise. He read his super critical helium pressure at 720 pounds per square inch. Well under the 770 pounds per square inch mark earlier identified as a point for further scrutinization.
PAO We now show 13 traveling at 3296 feet per second and at a altitude of 176,240 nautical miles.
PAO Apollo Control Houston at 54 hours, 57 minutes Jack Lousma is now filling the position of capsule communicator in the mission control center. That was Jack who received that last report from lunar module pilot Fred Haise. Standing by, this is Apollo Control Houston.
SC Okay. We're back on CSM power. The time was 54 hours, 58 minutes 50 seconds.

CAPCOM Roger Jack. 54, 58 and 50. Thank you.
SC Okay. Here's where we'll try to pick you up on the'high gain.
CAPCOM Roger.
PAO Apollo Control Houston. Standing by now for receipt of television transmission.
CAPCOM And 13, we're ready on the TV when you are.
SC This is 13. Say again Houston.
CAPCOM 13, we're ready on the TV when you are.

END OF TAPE

CAPCOM 13. We're ready on the TV when you are, anytime.

SC Okay, sounds good. We'll have it in a minute, we're just playing with the high-gain right now.

SC Okay, Houston. How do you read us with the high-gain.

CAPCOM We're hearing you five square, Jim, how me.

SC Okay. You're coming through okay.

CAPCOM As you were on that Jim. We don't have you on the high-gain yet. We're still looking at you.

CAPCOM 13, Houston. In this attitude we suggest pitch five, yaw 237 on the high gain, over.

SC Pitch 5, yaw 237, roger.

PAO Apollo Control, Houston, 55 hours 05 minutes, continuing to stand by for television transmission.

SC Can, can you read the high-gain now?

CAPCOM Affirmative Jack. We've got you on the high gain that appears to us that we're on the wide beam width.

SC Yes. We can't get it to come down to narrow. We tried to switch to auto track or REACQ, and yaw drives around from pitch 70 to 0. And pitch goes from about 6 degrees around to 90. I'm trying, we're putting it on manual now at the angles that you gave us and I'll try to get you in medium and narrow beam with picking it up manually here.

CAPCOM Roger, Jack. Meanwhile, we'll look at the situation you described there.

SC Okay. And it does it on both sets of servo electronic power.

PAO Apollo Control, Houston, 55 hours 07 minutes. We now show Apollo 13 at 176 598 nautical miles.

SC Jack, what it looks like is that when we hit 239 degrees at this attitude, it hit some sort of scan limit or something and drops off.

CAPCOM Roger, Jack, thank you.

SC Okay, I'm trying you in wide and medium beam width now. Can you pick up the TV in this condition here at all?

CAPCOM Negative, Jack. We'll have to have the narrow beam width.

SC Okay, can you give us, maybe, a slight maneuver?

CAPCOM Jack, we'd like you to check two high gain circuit breakers down in panel 25. Check your high gain group too in your high-gain and flight books. Over

SC Okay. Okay, Jack they're both in.

CAPCOM Roger. 13, we've got an attitude suggestion for you. We suggest that you go to roll 285 and try pitch 90 and yaw zero. Over.

SC Okay.

END OF TAPE

SC Okay, Houston, Apollo 13. I think we've got high gain locked up now. Do you confirm?
CAPCOM We confirm that, Jim, we've got you locked up on the high gain and narrow beam.
SC Okay, sounds good. We'll get the TV started right away.
CAPCOM Roger.
PAO That was spacecraft Commander Jim Lovell confirming that they had the high gain narrow beam locked up.
CAPCOM And we'd like to disable Quads C and D, use Alfa and Bravo. Over.
PAO We're now receiving a transmission, television transmission.
CAPCOM - C and D. Use Alfa and Bravo. Over.
SC Okay.
SC (Garble) Quads C and D. Roger.
CAPCOM Okay, 13 we've got Fred "0" on TV.
SC Roger, Houston. What we plan to do for you today is start out in the space shipper Odyssey, and take you on through from Odyssey in through the tunnel into Aquarius. And show you a little bit of the landing vehicle, and your TV operator is now resting on the center couch, looking at Fred Haise, whose head is now just about at the beginning of the tunnel, and his back is against the - our equipment bay optical area. And Fred will now transport himself into the tunnel, and into the spaceship Aquarius.
SC Yes, one thing I noted, Jack, when I first came across there, that starting upright in the command module - and heading down into Aquarius, there's a little bit of an orientation change that, even though I'd been through it once, in the water tank, is still pretty unusual. I find myself now, standing with my head on the floor, when I get down into the LM.
SC (Garble).
CAPCOM That's a great picture, Jim. You got the light just right.
SC And one of the nice things, Jack, particularly for a novice like myself is the - the ease of moving around in here. It's of course, as you know from working in the command module simulator, it's really quite a boon to have zero-gravity as an aid. Cause you get - pretty confining really, at one-g to move around very much in there, and it's quite easy in this environment.
SC The LM as you can see it looked pretty clean, I found a couple of loose washers about it and the - a little plastic cap off the sequence camera had come loose and it's on this - lodged over by the ED panels. (Garble).
SC Okay.
SC (Garble)

SC Right under Jim, now, he's actually standing on a - what looks to be a can here. And, for the sake of all the people back there, housed inside this can is the — the LM acsent engine, where hopefully, you can see my hand resting on top of right now. The engine that we use to get off of the Moon. (Garble). Immediately adjacent to the engine cover here, I have my hand on a - a white box now, which has been shown before. This happens to be Jim's PLSS, or the back pack which'll supply oxygen and water for cooling while on the lunar surface. This device we hope to make use of for - a planned 4 hours and possibly up to as much as 5 hours. Right - right behind the PLSS, a couple of little square packages I now have my hand on here; one here and one right below; are our OPS's, which are in essence the emergency oxygen supplies, which are good for some 40 to 45 minutes. These are - when we get ready to mount up and head outside, will be placed up on top of the PLSS.

SC (Garble).

SC The second back pack is mounted down on the - the LM floor. Positioned right between the two of us. I have my hand on it, at this time.

CAPCOM Roger, Fred, we see it. The picture's coming through real good, and your description is good. We see Jim's got the camera oriented the way we like to look at it. So, keep talking.

SC Okay. I guess everybody has pretty much envisioned the space program as being all a lot of exotic electronics, and certainly a lot of it is. But, I thought I'd bring out a couple of items here, in conjunction with the PLSS. After the first EVA, you get a very accurate measurement of the amount of water that's left in the PLSS'es we're going to make use of this bag I'm showing now, to collect the remaining water out of the PLSS and see just how much we really did have left. And, hopefully, on future missions to be able to extend safely the allowable time on these units, even a little further. And, my other hand, I have the mechanism by which we determine just how much water we really have in this bag.

SC And I guess this - an apt description for this device would be a fish scale. And you can see I'm weighing myself right now, and it says I weigh actually less than zero right now. Guess it's calibration isn't too good.

CAPCOM That'll be the day.

SC I think even you'd weight zero here, Jack.

CAPCOM Touche.

PAO Apollo Control, Houston. We now show 13 at 175 000 nautical miles in altitude.

SC Houston, this is Jim. Since Fred's been in the lunar module, since he's the Lunar Module Pilot, this

SC - is the first time that he's felt that he's right side up.

CAPCOM Roger, Jim.

SC I might tell you that we're looking at right now, that round bag that's just behind Fred holds our vacuum hose; and when we get back inside the LM we hook the vacuum off our suits, and it's resting or it's attached to the hatch which will - we will open to go onto to the lunar surface, and of course, to come back in. The hatch which we hook up to now is a round hatch which is our docking hatch between the - between Odyssey and Aquarius.

CAPCOM Roger, and we see Fred looking in the vacuum cleaner there, now.

SC Okay, what I have out now, Jack, is the — levva which has also been shown before, it's a head garment for wearing out on the surface, and I - I'm bringing Jim's out here to show a couple of mods. One problem before is that the cast of characters down on the surface haven't been able to be distinguished apart very well. So, not only Jim's suit has some red stripes on it, but as you can see his levva also has a - a redish -

END OF TAPE

SC - so not only Jim's suit has the red stripes on it but, as you can see, his levva also has a red stripe.

SC And now you can see one other mod here too, Jack, which I hadn't really seen myself before. I guess on 12 Pete and Al commented about having trouble with sunlight in the eyes so on our levvas they put on a new center section which you can pull down and use sort of like a baseball cap.

SC Okay, Jack, who fixed up our levva?

SC How's the detail on this one, Jack?

CAPCOM Say again, Fred.

SC Can you see any detail in this picture now or am I blocking out too much of the sunlight?

CAPCOM That affirmative. We get a good picture of the levva there and it's coming through loud and clear.

SC Okay.

SC Okay, Jack, while Fred is putting away my helmit, you are looking over into Fred's station now. How's this picture, is it okay or do I have to adjust it?

CAPCOM We have a hunch that the setting might be in peak but we recommend average on the AOC if you haven't got it there already.

SC We're in average, Jack.

CAPCOM Okay. And we're getting a good picture of the LMP side with the DEDA over there.

SC Hey, Jack, one question on the command module here. I have the dap right now on wide deadband, do you want me to begin setting up narrow deadband and nulling the rates and start PTC again?

CAPCOM Stand by, Jack.

SC What I'm fishing out now, Jack, is a new piece of hardware that we are taking along this time as a result of some comments made on Apollo 12 flight.

SC What Fred is opening up is a drink bag that we place inside of our neck ring that will allow us to drink while we are on the lunar surface. Pete and Al did not have that on Apollo 12 and they consequently got very thirsty. We hope to allevaite this situation by having our own little bag of water which with very little effort we can have a sip or two while we are looking around and doing our geology work.

So if you hear any funny noises, it is probably just the drink bag. Fred, you look happy. Fred is now looking through our optical device. It is an instrument in which to align our platform and Fred is now looking into just to see what kind of an outside picture he might be able to get and then he'll use the TV camera to look through our optical instrument to the outside of the command module. A few minutes ago while

SC we first came in we did manage to look to the outside of the side hatch of the command module through our optical instrument. Stand by, we'll try to see what we can do here.

CAPCOM Roger, Jim, break, Jack, we'd like you to stay in the deadband you are now in and we'll make a change when the TV is over. Another thing we would like for you to do is check your PITCH and YAW on your high gain meter so we can compare it with what we are seeing down here.

SC Okay, it's showing about 28 degrees and 267.

CAPCOM 20 and 267.

SC 28 and 267.

SC Okay, Jack, have you got that picture now.

CAPCOM Fred, about one-quarter of our screen is lighted and it's impossible to determine what you are looking at right now. Maybe you could give us a little verbal description.

SC Okay. It's looking through the AOT in position 4, right rear, and we're looking back toward, over the side hatch at the aft side of the service module. Okay. Is it too dark a picture, Jack? You think the F-stop open may help.

CAPCOM No, Fred, it's got to be centered up a little bit. That's primarily what you have to do.

SC Jack, we can't center it up anymore because the side hatch is only one part of the AOT. The rest of that blackness you see is really space.

SC Okay. We'll try another one and a little better centered. In fact, the only other one we have shows the whole picture. We're in the forward D-10 of the AOT now, position 2 and you should be seeing something from here, like the radar antenna.

CAPCOM Okay, we see you moving the camera up to the AOT lens and we got a real good picture now.

SC Okay, Jack, I'm looking out the right window now and not too far off in the distance now you can see the objective and I'll zoom in on it a little here and see if this brings it in better.

END OF TAPE

SC That's actually beginning to look a little bigger now. I can see quite distinctly some of the features with the naked eye. And so far I guess I have to even agree with Jim that it's still looking pretty gray - and white spots.

CAPCOM Okay Fred. We're getting a good picture of your destination there.

SC Jack, you've been looking at Fred's workshop now and you can see the abort guidance and computer. And over there tucked away in his armrest is our aclamation checklist which we'll be using very shortly. Up on the top of the window we have our camera already mounted ready for photographing the descent. And now Fred's engaged in his favorite pastime, I found out on this flight so far.

CAPCOM He's not in the food locker, is he?

SC That's his second favorite pasttime. He's rigging his hammock for sleep on the lunar surface now to find out to see what it's going to be like.

CAPCOM Roger. Sleeping and then eating.

SC It's kind of difficult here Jack, getting into our hammock in zero g. I'm not sure if I can keep floating away from it or it keeps moving away from me.

SC If you notice a few things floating around, we found just about 1 or 2 washers occasionally.

SC And for the benefit of those that may wonder where Jim sleeps, it'd be a little difficult to reach his hammock in here right now with the hatch open, but his runs laterally in this direction (garble). So he is the upper berth and I get the lower berth.

SC And now while Fred's taking his hammock down and restowed it, I might give you some idea of what sort of confusion of attitudes since there is no up or down and I'm situated on top of the ascent engine just at the entrance to the tunnel. I'll reverse the camera 180 degrees and go from Fred, look through the tunnel and get back at Odyssey and we might pick up part of Jack.

CAPCOM There he is. We see him.

PAO That's Jim Lovell now pointing the camera at Jack Swigert in Odyssey. We're at 55 hours 38 minutes into the flight of Apollo 13.

SC Okay, Houston. For the benefit of the television viewers, we've just about completed our little inspection of Aquarius and now we're proceeding through the hatch gap into the tunnel and going back up the Odyssey.

CAPCOM Okay Jim. It's been a great show so far.

PAO This is Apollo Control Houston

PAO - 55 hours 39 minutes now into the flight. We presently show Odyssey and Aquarius at an altitude of 175,552 nautical miles now traveling at a speed of 3171 feet per second. Although we copied no voice confirmation as to exactly when spacecraft commander Jim Lovell first went inside Aquarius. The flight plan called for a ingress time of 54 hours 30 minutes and we assumed that this occurred around that time.

SC And finally, Jack's let me back into the Odyssey as he - sled on through the tunnel here.

SC Houston, 13. Are you still on TV?

CAPCOM Yeah. We sure are. We've got a good picture of the skipper there.

SC Okay. What we can show you now — a little - and a bit of - we've got the drogues on Fred's couch in the command module right now. We stowed it temporarily while we're checking out the Aquarius and underneath is a couch, we've got the probes stowed. (Garble) and we'll do a shot of it for you.

SC You're looking now at our probes the place on the nose of Odyssey. It's a very heavy thing but I suppose in zero gravity it weighs nothing and it's much easier to move around. As a matter of fact, both Fred and Jack commented as many people in the past have — How much bigger the spacecraft appears in actual flight when you have such ease moving compared to our simulator switch (garble) difficult.

CAPCOM Okay. We're seeing a good picture of the probe there, Jim and looks like the characters there shaved before the show this time.

SC Well Fred said he had to keep up his TV image.

SC Yeah. That may be my first and last time though, Jack.

SC It took Fred one hour to shave.

END OF TAPE

SC We might give you a quick shot of our entertainment on board the spacecraft, which has been keeping us company for some time. (music) This little tape recorder has been a big benefit has been a big benefit to us in passing some of our time away on our transit to the moon, and it's rather odd to see it floating like this in Odyssey, while it's playing the theme from "2001". And of course the tapes wouldn't be complete with "Aquarius".

CAPCOM Okay, Jim. We're seeing the tape recorder now and by the way, how long do you expect to keep the TV on this evening?

SC Well, when, stand by one. Yes, I've got to put the cabin reprint valve in there Jack. Every time he does that our hearts jump in our mouths. And Jack anytime you want to terminate TV we're all set to go.

CAPCOM Okay, Jim. It's been a real good TV show. We think we ought to conclude it from here now, but what do you think?

SC Roger. Sounds good. This is the crew of Apollo 13 wishing everyone there a nice evening and we're just about ready to close out our inspection of Aquarius and get back for a pleasant evening in Odyssey. Good night.

CAPCOM Thank you 13.

PAO Apollo Control, Houston, 55 hours 47 minutes. Apollo 13 presently at 177 861 nautical miles away. Velocity now reading 3263 feet per second.

END OF TAPE

CAPCOM Apollo 13, Houston. The next thing we'd like you to do is to..

SC Go ahead.

CAPCOM We'd like you to roll right to 060 and null your rates for photography of the Comet Bennett. To do that we would like you to enable quads C and D for the maneuver use all your quads. And in precisely one minute, we'd like you to terminate the battery charge and battery B. One other request, we'd like to have ...

SC Okay, we'll do it.

CAPCOM One other request, we'd like you to verify your high-gain configuration. We'd like to know what track mode, what servo, and what beam width.

SC Okay, Jack, during the TV we were auto-track, narrow beam width and the primary electronics. And we had a good lock up just after we started the maneuver, I was able to lock you up and get real good signal strength and it just seemed that right there about 239 degrees in yaw that the signal strength would just drop off and yaw would go to zero and pitch would go to 90.

CAPCOM Roger, we copy and the TV show was great.

SC Okay, real fine. Okay, I'm going to maneuver to 060 090 and 0.

CAPCOM And 13, we'd like you to check C4 thrusters.

SC Okay, Jack, the battery charge has been terminated on the battery B.

CAPCOM Roger, we see it Jack. And we got a reading of minus 2 degrees on the docking index. We'd like to know if that's 2.0 precise or if it 2.1 or 1.9.

SC No it's minus 2.0 precisely.

CAPCOM Thank you.

CAPCOM 13, we've got one more item for you when you get a chance. We'd like you to stir up your cryo tanks. In addition have shaft and trunion

SC Okay.

CAPCOM for looking at the Comet Bennett if you need it.

SC Okay, stand by.

SC Okay, Houston. Hey, we've got a problem here.

CAPCOM This is Houston, say again please.

SC Houston, we've had a problem. We've had a main B bus interval.

CAPCOM Roger. Main B interval. Okay, stand by 13 we're looking at it.

SC Okay, right now, Houston, the voltage is looking good. And we had a pretty large bang associated with the caution and warning there. And if I recall, Main B was the one that had a amp spike on it once before.

CAPCOM Roger, Fred.

SC In the interim here, we're starting to go ahead and button up the tunnel again.
CAPCOM Roger.
SC Yes. That jolt must have rocked the sensor on C NON and 02 quantity 2 it was oscillating down around 20 to 60 percent, now it's full scale high again.
CAPCOM Roger.
SC And Houston. We had a restart on our computer, we have PGNCS light and the restart and reset.
CAPCOM Roger. Restart and PGNCS light.
SC Okay. And we're looking out our service module RCS helium one. We have B is manifold and P is manifold, helium two D is manifold and secondary propellants I have A and C manifold. T mag temperatures. Okay AC two is showing zip. I'll try and reconfigure on that.
CAPCOM Roger.

END OF TAPE

CAPCOM Roger.
SC Yeah, we got a main buss A under volt now to showing.
CAPCOM Main A under volt
SC It's reading about 25 1/2, Main B is reading zip right now.
SC (Garble)
CAPCOM Standby one, Jim
CAPCOM 13, Houston, we'd like you to attempt to reconnect fuel cell 1 to Main A and fuel cell 3 to Main B Verify that quad delta is open.
SC Okay, Houston, I'm showing, I tried to reset and fuel cell 1 and 3 are both showing gray flags.
SC But they are both showing zip on the flows.
CAPCOM We copy.
SC Okay, Houston, are you still reading thirteen?
CAPCOM That's affirmative. We're reading you. We're still trying to come up with some good ideas here for you.
SC Okay, let me give you some readings (garble) in the interim to help Main A voltage Jack, got bus tie easy on it.
CAPCOM Say again, Fred.
SC In the interim to help out main A voltage, I've got Main bus tie bataC on. Or would you rather accept the 25 volts we are seeing on Main A.
CAPCOM Okay, bus tie AC on. 13, Houston, we need OMNI CHARLIE, please.
SC You got it?
CAPCOM 13, Houston, we would like you to verify couple of readings for us. We would like the nitrogen pressure on fuel cell 1, we need the oxygen pressure on fuel cell 2.
SC Okay. Nitrogen on 1 and oxygen on 2. Is that correct.
CAPCOM Negative. Oxygen on 3.
SC Okay. Okay. The systems test 1A, said zip. And 2 BAKER which is 3 oxygen says .6.
CAPCOM 2 BAKER says .6 and say again the other one.
SC Fuel cell 1 nitrogen reads zero.
CAPCOM Roger. Zero.
CAPCOM 13, HOuston. We'd like you to open circuit fuel cell 1, leave 2 and 3 as is.
SC Okay. I'll get to work on that.
SC And, Jack, our 02 cyro number 2 tank is reading zero, did you get that?
CAPCOM 02 quantity number 2 is zero.
SC That's AC, okay. Yes, that's AC and it looks to me looking out the hatch that we are venting something. We are venting something out into the - space.
CAPCOM Roger, we copy your venting.

SC It's a gas of some sort.
SC Hey, fuel cell 1, you just wanted it off the line now, Jack, is that right?
CAPCOM We just wanted you to open up fuel cell 1.
SC Okay. She's off the line.
PAO This is Apollo Control, Houston. This rapid exchange of conversation you've heard, may the main B bus is off the line, fuel cells 1 and 3 also off the line, fuel cell 2 is presently on the line. We now show 13 in an altitude of 178 643 nautical miles. We're at 56 hours, 12 minutes into the flight.
CAPCOM 13, Houston, we see you getting close to gimbal lock there. We'd like you to bring up all quad C's on main A, quad C1, C2, C3, C4 on Main A and also bring B3 B4 up on Main A. 13, Houston, do you read?
SC Yes. We got it. Affirm.
CAPCOM Okay. Can you tell us anything about the venting. Where it is coming from, what window you see it at -
SC It's coming out of window 1. Right now Jack, and could you give me the thrusters again?

END OF TAPE

SC It's coming out of window one, right now Jack and could you give me the thrusters again?
CAPCOM Okay, the thrusters...
SC What bus?
CAPCOM We'd like on main A, we'd like Charley 1, 2, 3, and 4. Also Bravo 3 and 4 on main A.
SC Okay. Got it.
PAO The reference there is to the reaction control system thrusters. We're 56 hours 14 minutes now into the flight.
CAPCOM 13, we need OMNI BRAVO.
SC OMNI Bravo.
CAPCOM Okay, 13, this is Houston, We'd like you to go to your G & C checklist the pink pages 1-5. Do power down until we get a Delta of 10 amps. Over.
SC Alright. Roger.
PAO Apollo Control, Houston. That last report from Lousma asked the 13 crew to reduce the electrical load on the spacecraft.
SC Garbled. the pink pages 1-5.
CAPCOM Okay. We'd like you to go down that power down procedure until you get a Delta of 10 amps. Over.
SC Roger. I think.
PAO This is Apollo Control, Houston...
CAPCOM Did you copy our power down request?
SC Roger, Jack, we're doing it right now. Where did you say that was located, Jack?
CAPCOM That's in your Systems Checklist page 1-5.
PAO Apollo Control, Houston, we repeat again that ...
CAPCOM I'd also check for those pages in your Launch Checklist. They're emergency pages. Pink pages 1-5 and we'd like you to get your power down....
SC Okay, (garbled) in the launch checklist Jack.
CAPCOM Roger. Power down until you get an amperage of 10 amps less that what you've got now.
SC Okay.
PAO Apollo Control, Houston. We repeat again the main BUS B on the Command and Service Module is now off the line. They're functioning with main BUS A. Fuel Cells 1 and 3 connected with BUS B are now off the line.
SC Okay. Jack, are you happy with the amps we have now?
CAPCOM Stand by one, Fred.
SC Okay, Jack and on this page 1-5 we proceeded right down the list all the way down, we're right now at B MAG number 2 at a warmup.

CAPCOM Roger we copy at B MAG 2 and warm up. We'll follow you through.

SC Okay and something is giving us a reach, Jack, both in Pitch and Roll, so I'm suspecting that maybe it's whatever it is that's spinning back there. I had to use direct in order to stabilize it, and as soon as I do we're going to pick up rates again. Can you pick up any jets firing?

CAPCOM Stand by. What direction are your rates in Jack?

SC It's negative pitch and negative roll.

CAPCOM Roger. 13, Houston. We need to get somemore instrumentation up. We'd like you to put inverter one on both AC BUSSES over.

SC Okay. Okay, you got inverter one on both AC BUSSES, and Jack, one of the items we turned off was the, all the fuel cell pumps. Okay, and you might let us know when the fuel cell two needs its pump back we ought to take care of that, Jack.

CAPCOM Roger. Okay, Fred, we want fuel cell 2 pumps to AC one please.

SC Fuel cell 2 to AC one roger. Okay, it's on AC one.

END OF TAPE

CAPCOM OMNI Charlie, please, 13.
SC OMNI Charlie.
CAPCOM Okay, 13, we've got lots and lots of people working on this, we'll get you some dope as soon as we have it, and you'll be the first one to know.
SC Oh, thank you.
SC Okay, Jack, and the weird configuration we're sitting in now, is we have the hatch installed, we still have the probe and drogue inside the command module, and we're going to stay in this situation until you kind of give us an okay to reinstall the probe and drogue. Or if necessary to use the LM consumables.
CAPCOM Roger.
SC You need help?
CAPCOM 13, we'd like to have you put thruster Alpha 3 on MAIN A, please.
SC Alpha 3 on MAIN A.
SC Okay, Jack, are you monitoring the quad temps in the Quad A, package temps?
CAPCOM Affirmative.
CAPCOM 13, this is Houston. We'd like to power down just a little bit more so let's get BMAG 2 off; and make sure your lights are down. Over.
SC Okay, the lights are down, and BMAG 2 going from standby to off.
PAO The BMAG is part of the SCS system on the Apollo Command Module, of course, we're still attached to the lunar module, so this is less of a crucial item to power down at this time. We're at 56 hours, 34 minutes into the flight. Continuing to monitor, this is Apollo Control, Houston.
CAPCOM 13, Houston -
SC Okay, Jack, now I've got a rate -
CAPCOM - we'd like you to open circuit fuel cell 3.
SC Open circuit fuel cell 3.
CAPCOM Go ahead, Jack.
SC Okay, fuel cell 3 and it's off the line, now.
CAPCOM And 13, Houston. We'd like you to turn all your Bravo thrusters off; and put all your Delta thrusters on MAIN A, please.
SC All Delta thrusters on MAIN A and all Bravo thrusters off. Roger.
CAPCOM 13, Houston, turn battery A off (garble).
SC (Garble).
SC That's why we were pulling current all the time.
SC Battery A off, Roger.
SC (Garble).

SC I'm transmitting. I don't have any current now. Hey, it's off. It's off. They - they killed the BUS completely now.

SC It's dead.

CAPCOM 13, Houston. We'd like you to isolate your 02 surge tank. Over.

SC Is the surge tank off now, Jack? Okay, Jack, are you copying 02 tank 1 cryo pressure?

CAPCOM That's affirmative. And we're trying to get power to that tank. Standby we're working on it.

SC Okay.

SC Okay, we had a service module RCS B light, Jack. Ditto package temperature.

CAPCOM Service module RCS B. We copy, no problem.

SC Let's read you the lights we got on now; cryo press, fuel cell 1, fuel cell 3, MAIN BUS B interval; suit compressor.

CAPCOM Roger, we copy them and we'd like to build up the pressure in 02 tank 1, so turn the heaters on manually, we'll watch your pressure for you.

SC Okay, do you want to see -

CAPCOM Go ahead.

SC - we're going to get a main bus in interval, probably.

CAPCOM Roger, we realize that, we feel we can stand 5 more amps on it.

SC (Garble).

SC Okay.

SC Okay, heater on main bus on.

CAPCOM 13, Houston. We'd like you to additionally bring on the fans in 02 tank 1, and we can stand the additional ampage, on that.

SC Okay -

END OF TAPE

CAPCOM - and we'd like you to additionally bring on the fans in 02 tank 1 and we can stand the additional amperage on that.

SC Okay. Bring up the fans 02 tank 1.

CAPCOM 13, Houston. We'd like you to check some circuit breakers on panel 226. CYRO 02 heater number 1 Main A, and check the three CYRO fan motors tank 1, three phases.

SC Okay Jack. 226 is configured just like it should be. I got 3 react breakers and 3 rad breakers open. All the rest are closed.

CAPCOM Okay Fred. Thank you

SC Jack, looking outside the upper particles have diminished greatly almost ceased now which indicates maybe what was venting has almost stopped.

CAPCOM Roger Jack. Thank you. We copy.

SC I'm still getting some rates in negative pitch though.

CAPCOM Roger.

CAPCOM And 13, we'd like to verify that both BMAGS are OFF, please.

SC Negative. We just have 1 BMAG. BMAG number 1 is still ON.

CAPCOM Okay Jack. Let's take BMAG 1 OFF.

SC Okay BMAG number 1 off now.

CAPCOM 13, this is Houston. We'd like you to give us a survey of your displays on MDC's 1 and 2. Give us a gage readings and talkbacks. Over.

SC Okay. We'll start with display number 1.

SC Okay Jack. On MDC 1, there's nothing abnormal. All the rate indicators are in zero. Ball number 2 is frozen since first lost MIN B. That's got - ball number 1 appears to be working normally. Right now I'm sitting at roll zero, pitch 180 and yaw about 13 degrees.

SC I'm going to try and hold on 0, 180 and 0.

SC Okay, Houston. The center panel I'm looking at the RCS indicator A. We have a tankage temperature of about 180. Our helium pressure is 3900. I'm looking at fuel pressure of about 180 and percentage of about I'd say 85 percent. B is about the same except that tankage pressure is 190. Our quad C, we're looking about the same except that the tankage temperature is 100. On quad D, we're looking at tankage temperature of 160. All other indications are about the same. CM pressure - RCS pressure is looking nominal. Helium pressures up around 4 thousand now. And tankage temperature is about a little less than

SC - 80 on ring 1 and about the same on ring 2.
PAO This is Apollo Control Houston.
SC - appearance of the SMRCS has got helium 1 now are all gray. Helium 2, all gray. Primary propellant all gray. Secondary propellant has 2 barberpole and A is barberpole, B gray, C barberpole and B gray. Okay. On the ECS radiators; barberpole is gray. On the ECS primary indicator.
SC Okay Jack. Starting at the top. Okay, the CYRO tanks are Hz 1 is reading 230 and the same for 2 our 02 CYRO tank 1 is it looks like its barely holding its own at 300. And CYRO tank 2 is reading zip. Our quantities are H21 and reading 73 to 74. On the 02 side, we're reading 021 - quantity corners 76 02 2 pegged full scale high.

END OF TAPE

SC 76 022 pegged full scale high. Rad temps primary inlet were reading about 55 grad out is reading about 30 and secondary outlet is reading -

PAO This is Apollo Control -

SC 52 degrees and the evap out temps 45, deep pressure .17 and then glycol discharge 48. Supercrit is reading zip. The (garble) is reading 30, H2O waste is reading about 34, portable reading about 98, secondary rad inlet is reading about 71, and the rad out is about 30, glycol evap temp is reading 65, steam pressure pegged full scale high, discharge pressure 9 psi.

CAPCOM Excuse me, Fred, we'd like to butt in here a minute. We'd like to have thrusters C1 off.

SC C1 is off.

CAPCOM And proceed. My last copy is secondary rad in,

SC Okay, your secondary rad in. I gave it to you 72 degrees, the rad out is about 30, the glycol evap temp is reading about 65, steam pressure full scale high, glycol discharge pressure about 9 psi. The tube secondary accumulator is about 34 percent. Temperatures suits showing about 52 degrees, cabin about 58 degrees, pressures suit reading 4.1, cabin at 5. Partial pressure CO2 is up to little over 1, about 1.1. On the SPS side of the house, the temperature is 72 degrees, helium reads 3500, N2A is reading 2300, N2B about 2450. Ullage pressure fuel is reading about 165 oxidizer 170. Fuel cells. Fuel cell 1, both closed are zip, skin temp 405 degrees, vent exhaust is full scale. Fuel cell 2, right now we've got an 02 or an H2 flow reading of .13 to .14 and the 02 flow is right now pegged full scale high although it has been varying depending on thruster activity which has also given us main buss A under volts from a steady reading of about 1.1 up to full scale high. The T skin is about 445 and the condensor exhaust about 17, correction, 180. Let's see if you want it on the Dc indicator, fuel cell 1 is 0 amp, 2 is reading somewhere between 44 and about oscillating 44 to 48 again depending on the thruster activity.

CAPCOM Stand by.

SC 3 is zero amps. Say again, Jack?

PAO Apollo Control, Houston, continuing to trouble shoot with Apollo 13 crew, closely watching oxygen quantities and pressures in the command module. Isolating the search tank leaves oxygen for entry if this should become necessary. Also, if necessary, the 13 crew could open a tunnel and use oxygen from the lunar module.

CAPCOM Apollo 13, how do you read.

CAPCOM Okay, 13, this is HOuston. It appears that we are losing 02 flow -

END OF TAPE

CAPCOM Okay 13, this is Houston. It appears to us that you're loosing 02 flow through fuel cell three. So we want you to close the react valve on fuel cell three. It looks like fuel cell 1 and 2 are trying to hold up okay. You copy?

SC Are you saying fuel cell 1 and 2 are trying to hold up but we're leaking 02 out of fuel cell 3? And you want me to shut the react valve on fuel cell 3, did I hear you right?

CAPCOM That's affirmative. Close the react valve on fuel cell 3.

SC Okay. I'll go the SSRP do you want me to go through that whole smash for fuel cell shutdown. Is that correct?

CAPCOM Stand by.

PAO Apollo 13, now 180 098 nautical miles from earth. Velocity now reading 3219 feet per second. We're at 56 hours 58 minutes now in the flight.

CAPCOM Okay, 13, we want you to turn the inline heaters off, on fuel cell 1. Then we want you to go through the fuel cell shutdown procedure on fuel cell 3. Read back.

SC Okay. Shut down the inline heater on fuel cell one. We're proceding with the shut down special sev routine for fuel cell 3.

SCAPCOM That's affirmative.

SC Okay.

CAPCOM 13, OMNI Bravo, please. 13, Houston Over.

SC Go ahead.

CAPCOM Okay, you got OMNI Bravo and we'd like to have you verify that the tape recorder is off please.

SC That's affirmative.

SC Okay, Jack. I'm sitting here with an 0618 showing and I can't get rid of it. Oh, stand by, Houston. Okay, fuel cell three we answer off, Houston.

CAPCOM Roger, Jim. Thank you.

PAO This is Apollo Control, Houston. Speaking from the spacecraft for most of that conversation has been Lunar Module Pilot, Fred Haise. We're at 57 hours 01 minute now in the flight.

SC Okay, Jack. Step 2 special subroutine one of the fuel dump procedure has been completed.

CAPCOM Roger. Thank you.

SC Okay, Jack, I'd like to bring on Jet A4 I've got no on negative pitch control, negative pitch control and right now neither direct or auto coils.

CAPCOM Okay. You say no pitch in either direct or auto. You want to bring on A-4?

SC Yes. I've got a positive pitch rate and I can't stop it.

CAPCOM Okay. Okay, Jack, bring A-4 on, stop the pitch rate.

SC Okay. That got it.

CAPCOM And 13, we need OMNI Charley, please.

SC OMNI Charley.

CAPCOM And Fred, we would like to have you verify fuel cell reactants talk back is barber-poled.

SC That's firm. I watched it and it went barber-pole as I threw the switch.

KRANZ Roger. Okay, all Flight Controllers, I'm handing over to Glynn. I assume the majority of the team guys are pretty much briefed and up to speed as best we can. Now what I suggest is the White Team do two things. They go over the D-log..

SC Okay, Jack, let me give you a thruster configuration right now. Able one, Charley one, Able 2 are off. Charley two main A all that the thrusters that have been call that are on are on main A. Baker one off, dog one on, Baker two off, Dog two on. Able three, Charley three Able four, Charley four on. Baker three off, Dog 3 on, Baker four off, Dog four on.

END OF TAPE

SC - mod 4.
CAPCOM Okay, Jack, that thruster configuration now looks okay.
SC All right. Okay. Do you want some readings from the systems test meter regarding fuel cells?
CAPCOM Stand by one, Jack. let me ask this.
SC We've got some incompatibility.
CAPCOM Okay 13, we'd like to have you give us those systems test readings on fuel cell 1 and 3.
SC Okay. 1 and 3 coming up
SC Okay, Jack, 1A is reading lower scale zero, 1B is reading 3.45, Okay. You only want fuel cell 1 and 3. Ignore that 1B reading. 1C is reading 3.4. 1D is reading 2.4. 2D is reading .25.
CAPCOM Is that 2 BRAVO, Fred?
SC That's 2 BRAVO is reading .25 to .3.
CAPCOM Okay. Let me get back with you men. Stand by on these readouts.
PAO This is Apollo Control, Houston, 57 hours, 11 minutes -
SC 4.1.
PAO We now show an altitude of 180 521 nautical miles. Here in Mission Control we are now looking towards an alternate mission swinging around the moon and using the lunar module power systems because of the situation that has developed here this evening. We now show a velocity of 3210 feet per second. This is Apollo Control, Houston.
CAPCOM Roger. 4.0. Say again what it is, please.
SC 3 able, 3A. 3B is reading 1.8 and 3D is reading 1.95.
SC And Houston 13, 02 tank pressure on 1 is less than 300 now.
CAPCOM Roger, we see that and confirm it. 13, Houston, we are going to have to have you go through the shutdown procedure on fuel cell 1. Our 02 pressure is going down as you note and the temperature confirms it. Copy?
SC Okay. What bus configuration, what main bus do you want powered?
CAPCOM Okay, Jack, we want you to leave the bus configuration as it is. Fuel cell 2 on main A, and we need OMNI BRAVO.
SC Okay, Jack, we are proceeding on the shutdown procedure for fuel cell 1.
CAPCOM 13, Houston, we would like for you to isolate the repress package, please.
SC Isolate the repress package. Roger.
SC I can confirm repress package is OFF.

CAPCOM Roger. So now you've got the repress package and the search tank isolaters. Is that affirm?
sc That is CHARLIE.
SC Okay. Now, as soon as we are ready to close the reacts of fuel cell 1, is that right?
CAPCOM Jack, stand by on the reading.
SC One last confirmation. Okay.
CAPCOM Roger. We' -
SC One last confirmation -
CAPCOM Okay, Jack, we're getting that one last confirmation. Stand by, please.
SC Okay.
CAPCOM Okay, 13. We verify that we want you to close down, shut down fuel cell 1 and close reacts valve.
SC Roger. Fuel cell 1 and close reacts down.
SC Fuel cell 1 is closed.
SC Okay, Jack, I can confirm step 2, the fuel cell shutdown procedure is complete for fuel cell 1.

END OF TAPE

SC Okay, Jack, I can confirm step 2 of the fuel cell shutdown procedure is complete. For fuel cell 1.
CAPCOM Roger.
CAPCOM 13, we recommend that you enable BD rolling to DAP. Over.
SC Okay. Will do.
SC (Garble) BD rolling to DAP.
CAPCOM 13, Houston. We're working on the big dish now, so turn the high gain power switch off, please.
SC Okay.
SC Okay, Jack. When we got the loud bang, we got also a restart, did you copy that in the - Does GUIDO want anything, a VERB 74 or anything done with the CMC?
CAPCOM Standby.
SC Okay.
CAPCOM 13, Houston, we're ready with a VERB 74, now, please.
SC Coming down at you.
SC Okay, Jack, it looks like 02 tank 1 pressure is just a hair over 200.
CAPCOM We confirm that here and the temperature also confirms it.
SC Okay. Does it look like it's still going down?
CAPCOM It's slowly going to zero, and we're starting to think about the LM lifeboat.
SC Yes, that's something we're thinking about too. You want me to do a quick P52, it kind of looks like - we've been talking it over, and it kind of looks like we'd probably align our plats, our, LM platform with our platform and then power down the CM - and keep the LM powered up doing a DPS whatever DPS burns you give us?
CAPCOM 13, we're not going to concern ourselves at the moment with a DPS burn, it's going to be sometime before we'd get to that. But we're working on other procedures to give you, which will - allow us to use the LM systems. Over.
SC Okay, real fine.
CAPCOM Apollo 13, Houston. We'd like to charge battery A now.
SC Charge Battery A, Roger.
CAPCOM And Jack, in regards to your question about the P52 in LM platform, it's - there's no need to worry about that now. We wouldn't be using the LM platform for until about 79 hours, so, let's go as is on the platform for now. Over.
SC Okay, we understand.
SC Okay, Jack.
SC And, Jack, we've turned off the waste dump heater. If you're going to consider dumping any more waste water, we probably ought to do it while the conductor's warn, there.

CAPCOM Roger, standby, Jack.
SC Okay.
CAPCOM Okay, Jack, let's keep the water, no need for a dump right now.
SC All right.
CAPCOM 13, Houston. We see the PROP-ISO valve on RCS Quad Charlie, closed, so we'd like to also disable - auto RCS feature in Quad Charlie.
SC Do you want to isolate the auto RCS features in Quad Charlie?
CAPCOM Affirmative.
SC Okay, Jack, I didn't plan to reset that Quad Charlie - PROP-ISO, do you want me to do that?
SC Okay, we just tried it and Quad Alfa and Charlie barberpols are showing.
CAPCOM Standby, Jim.
SC Okay, Jack, that's a sec - secondary propellant - are barber poles on Alfa and Charlie.
CAPCOM 13, Houston. It won't do any good to try to power the propellant valves, on A&C, so we want you to - disable the auto on RCS Charlie. And we have a procedure for getting power from the LM, we'd like you to copy down.
SC Okay. Stand by, Jack. It sounds like good news.
SC Okay, Jack. About how long is it?
CAPCOM It's not a very long procedure, Fred. We figure we'll get about 15 minutes worth of power left in the command module. So we want you to start getting over in the LM and getting some power on that. And are you ready to copy your procedure?
SC Okay.
CAPCOM Okay. In the CSM.
SC Stand by.

END OF TAPE

CAPCOM are you ready to copy your procedure?
SC Okay.
CAPCOM Okay, in the CSM...
SC Stand by. Go ahead.
CAPCOM Okay, in the CSM on panel 5 circuit breakers LM power, 1 and 2 open. Then LM power switch reset and release. In the LM on panel 11 and panel 16, trans lunar BUS tie, both circuit breakers close. On panel 16 circuit breaker ascent ECA control close. On 16 descent ECA control close. On panel 14, put your bat 5 normal feed on. Bats 1, 2, 3, and 4 low voltage taps on. Bat 5 normal feed off. Ascent ECA control open. Copy.
SC Stand by one. Okay, it's CSM panel 5 we want the LM power 1 and 2 open. Then the LM power switch to reset release. In the LM panels 11 and 16, trans lunar BUS tie breakers close. On panel 16, the ascent ECA controls close. The descent ECA control closed. On panel 14, bat 5 normal feed on. Followed by bats 1,2,3,4 low voltage taps on. Then bat 5 normal feed off. Ascent ECA control breaker open.
CAPCOM That's a good read back Fred.
CAPCOM And 13, Houston. As a final effort here we would like you to turn on the fans in tank two. Over.
SC Roger. Understand. Turn on the fans in tank 2. Do you want the 02 fans in tank 2 Jack?
CAPCOM That's affirmative, Jim.
SC 02 fans in tank two are on.
CAPCOM Roger. 13, Houston. We'd like you to start making your way over to the LM now.
SC Fred and Jim are in the LM.
CAPCOM Okay, Jack. Thank you.
SC Jack, I got LM power on. Okay, you still with us Houston. Okay, Houston, are you reading 13?
CAPCOM Reading you loud and clear Jack. I've got a procedure for
SC Okay.
CAPCOM The guys in the LM.
SC You got another one?
CAPCOM I have an activation procedure, I'd like you to copy it down.
SC How long is it Jack?
CAPCOM It's just four lines. Go to activation one through step 3. Go to activation 11 omit step 1. Do activation 12, and then go to activation 13 and do step one. Do you copy?
SC Houston. That's activation one, do step 3. Is that correct?
CAPCOM That's affirmative, Jim.
SC Activation 11, omit step 1 do the rest. Is that right?
CAPCOM That's affirmative.

SC Do activitation 12 and activation 13 step 1.
CAPCM That's all correct.
SC Okay, Jack. Pressure tank 1 is approaching 100 psi. What's going to be the symptoms of this fuel cell starting to drop off?
CAPCOM Stand by, Jack. We'll get the word on that.
SC Okay.
CAPCOM And, Jim, when you get to the end of that procedure, we'd also like to have you put the demand regs to cabin.
SC Demand regs to cabin. Over.
SC Jack, was that activation 1 step 3 only or all of activation 1?
CAPCOM That's go all the way down to step 3, Jim.
SC Activation 1 - -

END OF TAPE

CAPCOM That's go all the way down to step 3, Jim.

SC Activate 1 through step 3. Roger.

PAO This is Apollo Control at 57 hours 46 minutes ground elapsed time. The black team of flight controllers is now stationed in mission control center looking at possible alternate missions. As we have an apparent serious oxygen leak in the cyrogenic oxygen in the service module. And now in the process of powering down the command module in less than 15 minutes remaining of electrical power to the CSM. The command module search tank has been charged with oxygen for entry.

CAPCOM 13, say again please.

SC We were curious about activation level on the VHF.

CAPCOM Omit the VHF.

SC - them too Jack. Okay.

PAO In this scheme of going across to the lunar module, still connected with the open tunnel, the lunar module would serve as a sort of lifeboat for the crew of Apollo 13. Sometime later in the mission it is expected that they would return to the prereturn trajectory, which they left yesterday in the midcourse burn number 2. At the pericynthion near the moon they would use the descent propulsion system of the lunar module for transearth injection burn at about 79 hours, 30 minutes Ground Elapse Time. This would produce a day early entry at about 142 hours. That is a day earlier than a nominal prereturn entry. We're continuing to monitor the situation and still live on air ground.

CAPCOM Jack, this is Houston. We want you to keep the IMU up and keep the lights on so you can see in there, and leave battery A off and at the appropriate time we'll put it on main A, and we're going to keep the IMU up so as we can put a course align in the LM.

SC All right. Real good. Right now we're charging battery A. Do you want to discontinue that?

CAPCOM Discontinue the charge on battery A, Jack.

SC Okay Jack. Discontinue charge on battery A. You give me the call and I'll turn just my AC on.

CAPCOM Roger, and we want you to keep the lights up and the IMU on.

SC Okay.

CAPCOM And Jack, we'd like you to leave the COM configuration as is until we get COM with the LM.

SC Okay.

CAPCOM And 13 this is Houston. I've got another

CAPCOM procedure for the LM. A short one.
SC Okay. Ready to copy Jack.
CAPCOM Okay. On panel 11 we'd like you to close the LGC DSKY circuit breaker. Then we want you to go to activation 25. Do steps 1, 2, and 3. Then go to activation 30, and that will give us a dock DIMU course align. Over.
SC Roger. Panel 11 close LGC circuit breaker. Activation 25, do steps 1, 2, 3, and then do complete activation 30. Is that correct.
CAPCOM That's affirmative. On panel 11 LGC DSKY circuit breaker closed.
PAO This is Apollo Control. We have confirmation now that 2 of the Apollo 13 crewmen are indeed in the lunar module.
CAPCOM And in the LM, lets go to panel 11 and close the SUIT fan circuit breaker and get SUIT fan cranked up.
SC Okay. Panel 11, close SUIT fan circuit breaker, and we'll get the SUIT fan cranked up.
CAPCOM That's affirm. And Jack in the CSM, go to by-pass on the radiators and try GLYCOL pump off.
SC Okay. Pull the by-pass, GLYCOL pump going off.
CAPCOM Roger.
CAPCOM And 13 in the CSM, we want to verify that all the fuel pumps are off and we want to have you turn off the 02 fans in tank 2.

END OF TAPE

CAPCOM And 13 in the CSM, we want to verify that all the fuel cell pumps are off, and we want to have you turn off the 02 fans and tank 2.

SC Okay, Tank 2 fans going off. Okay that leaves me with Tank 1 fans ON and Tank 1 heaters ON.

CAPCOM That's affirm.

SC Fuel cell 2 pump going off now.

CAPCOM Jack, leave them both ON in Tank 1.

SC Okay.

CAPCOM 13, Houston. Read that AOS on the LM again.

SC Okay.

PAO This is Apollo Control at 57 hours 58 minutes ground elapsed time. To recap briefly the situation here in Mission Control Center, we have an apparently serious problem with a leak in the cryogenic oxygen in the Service Module, which provides the electrical power system coming out of the fuel cells, and also, breathing oxygen for the crew. Now in the process of manning the Lunar Module. Standby.

CAPCOM We would like for you to go to Activation 12, Step 3, which is get the batteries in high taps. Over.

SC Okay. How you going there? Activation 12, Step 3.

PAO Under this alternate mission, the Lunar Module would serve as a lifeboat to bring the Apollo 13 crew back to Earth. That is its consumables, oxygen, electrical power -

SC Jack, have you reached Aquarias?

CAPCOM Aquarias, Houston. Say again please.

SC Okay, I was just making a COMM check here (garbled).

CAPCOM Roger, we see him, Fred, and I'm reading you loud and clear.

SC Okay. Didn't think I'd be back this soon.

SC Okay, what next, James? Cross the line?

SC Doing right. Take your time.

PAO The current thinking is to use the Lunar Module descent propulsion system, a big engine of the LM to propel the entire spacecraft stack to higher velosity as they go around behind the Moon to come back to Earth a day earlier than a normal free return trajectory would return the spacecraft.

CAPJOM We'd like you to - on your alignment - can you continue right on through the final line activation 31 - go right on through Step 7. Over.

SC Okay. You want to go on 31 through Step number 7. Check.

CAPCOM That's affirmative, and Odyssey, we have got another figuration for you. All 16 RCS AUTO selects OFF. All RCS heaters OFF. Over.

SC Okay. I can verify all heaters OFF. Jack, I've got to keep a fairly minimum dead band until I get through this course aline.

CAPCOM Roger.

SC Okay, Verb 41, Noun 20. Al plus.

SC Plus or minus?

SC Plus. 3 0 2 4 3. Is that right?

SC Okay. Do you want me to enter it? Okay, what's the next one?

SC Plus 347 78. 347 78.

SC Okay.

SC 081*3. Is that right?

SC Entered.

SC Okay.

CAPCOM Odyssey, Houston -

SC (garbled)

SC Battery A on now.

CAPCOM Go ahead, Aquarius.

SC Okay, I want you to double check my arithmetic to make sure we got a good course align. The roll cal angle was minus 2 degrees. The Command Module angles were 355 57, 167 78, 351 87.

CAPCOM Okay, Jim, we copy the roll cal at minus 2.0. The Command Module is 355.57, 167.78, 351.87.

SC Okay. Verb 41 we've done that. Okay.

CAPCOM Aquarius, Houston. Request High Bit Rate, please.

SC You want High Bit Rate?

CAPCOM That's affirmative. Fred won't pass us anything.

CAPCOM Odyssey, Houston. We'd like you to - on your Comm configuration, go to Primary Power Amp OFF, Low Bit Rate, and Down Voice Backup. Over. And Aquarius, we need your Suit Gas Diverter Decabin.

END OF TAPE

CAPCOM And Aquarius we need your suite gas diverter to cabin.

SC Alright you got it.

SC Houston. I've gone to primary power amplifier, off. Low bit rate, down voice backup.

CAPCOM Okay, Jack, thankyou. And Aquarius your arithmetic looks good on the coarse of liner.

SC Okay. Okay stand by for now.

SC Three - GT, we need the GT. What is it? What's that? 58, 5807. 58 what?

PAO This is Apollo Control. Apollo 13 crewmen Jim Lovell and Fred Haise are just completed -

SC Aquarius.

CAPCOM Go ahead, Aquarius.

SC Here are the gimbal angles. Command module 356 69 163 42 346 67. Aquarius is 302 26 345 92 011 79. Over.

CAPCOM Okay, Jim. I got Command Module 356 65 163 42 346 67. Aquarius 302 26 345 92 011 78.

SC I have 011 79.

CAPCOM Say again, please.

SC The LM middle gimbal is 011 79.

CAPCOM 011 79, got it.

PAO Those angles being read back from Aquarius and from Odyssey were from the coarse alignment of the Lunar Module guidance system platform. Returning to the alternate mission now being considered, the descent propulsion system trans earth injection burn would take place at about 79 hours 30 minutes ground elapse time. Producing an entry at about 142 hours. At this point in the translunar coast it is cheaper and swifter to coast on around the Moon and come back to Earth than it is to do a deep space abort. Continuing to monitor air-ground from Apollo 13, this is Apollo Control.

SC Houston. (garbled)

CAPCOM Odyssey, Houston. We need a command reset on your - on your COMM, and then we'd like you to power down to CMC, power down the IMU, heaters OFF on IMU, but leave the battery on.

SC (Garbled)

SC Yes.

CAPCOM Oddesy, Houston.

SC (Garbled) Read me? Are you reading, Houston?

SC Houston, this is Odyssey. Go ahead.

CAPCOM Okay, Jim.

SC Copy it down.

CAPCOM Okay, Jim. I think I'm reading Jack, now. But what we wanted to do is to get us a command reset. And then power down to CMC, power down the IMU, turn the IMU heater OFF, leave battery A ON. Over.

SC Got just about 80 speck 82 hours out of the two primary cartridges. That's two guys. 24 is what LC8 got for the 88 hours. We got a secondary. You're right. Over.

CAPCOM Odyssey, Houston.

SC Take it. Go ahead.

CAPCOM Yes, Jack. Did you copy down about the CMC IMU?

SC Yes, Jack. I read it back twice to you. Command reset which I've got. I'm about to power down the IMU, power down the CMC, turn the IMU heaters OFF, leave BAT A ON.

CAPCOM That's affirm, thank you.

SC Okay. I just got a master alarm and main BUS A undervolt and I'm starting to power down, now. The only advantage to doing this early if we can power back the LM back down. The only advantage doing it early is you can do a big burn now in the midcoarse and then power the LM down. Otherwise, we got to keep the LM powered up clear till we get around the Moon. Plus it will be inside in the burn. I just hope the G&N hangs up on (garbled) I sure would hate to do that one manual. Oh, boy.

CAPCOM Odyssey, Houston. Couple circuit breakers for you. On panel 276 on our instrumentation power controls, open CB number 3 and number 4.

SC Okay, Houston. That panel 276 instrumentation breaker - -

END OF TAPE

SC Okay, Houston. Panel 276, instrumentation (garbled) -
SC We've got a lot of lights.
SC - - PB3 and PB4 are open.
SC What?
CAPCOM That's affirmative, Odyssey, and also get your SCS electronics package and power off and your FDAI power slash GPI off and your auto jets select all 16 off.
SC Okay. Well, wait a second, let me get this CMC power down.
CAPCOM Roger, Jack.
SC I wonder how much that's going to drain the (garbled).
SC Jack, while he's doing that copy down what you just said again. I want to write it down.
CAPCOM Aquarius, we need to get your sublimator powered up, activation page 20, and activation page 21, step 3. Over.
SC Roger. Activation page 20 and activation page 21, step 3 sublimator.
CAPCOM Roger.
SC That's activation page 20. Okay, Jack. Now I have power down my IMU. I have no controller at all. I'm going to burn my 16 jets off filling in the other things you wanted.
SC That's that 02 tank 1 heaters and fans.
CAPCOM Okay, Jack. We'd like you to turn off your 02 tank 2 heaters and fans. Correction - tank 1. Turn the fans and heaters off
SC Okay. And, Jack, can we turn on the FDI circuit breakers so we could have a ball and see if we go to gimbal lock or not?
CAPCOM Stand by.
SC He's going to - he's going to give a 16 NOUN 20, Jack. And, okay, I've got 02 heaters and fans off in tank 1.
SC And, Jack, when it's over you approach gimbal lock would you?
CAPCOM Jim, we don't want you to power down the ball in the LM. We wanted you to power down the ball in the CSM.
SC Jack, they haven't powered down -
SC We don't have the balls powered up in the LM.
SC I have the CMC and IMU in the command module is powered down, the heaters are out.
SC And is that flow valve that's open now

SC and I've undone my suit hoses here and opened up the suit flow valves so we got air flowing in the LM now.

SC Okay, Jack, will you say again the SCS items you wanted me to power down?

SC Okay, Houston. Do you read Odyssey?

SC Hello, Houston. Odyssey.

SC His in gimbal lock and ours are different Jim.

CAPCOM Apollo 13, Houston. Say again please. You were cut out.

SC Okay, Jack. You want me to proceed by the SCS power down checklist? I did not copy the SCS items you wanted me to power down.

CAPCOM Okay, Odyssey. We want to go SCS electronics power off.

SC Okay, It's done

CAPCOM FDAI power slash GPI OFF. Auto jet select 16 OFF. And all your rotational control power OFF.

SC It's done. Rotation control power direct and auto coils OFF.

SC Okay, Jack. Tell me there, we need to know when we're getting close to gimbal lock in the LM. We have no balls right now.

CAPCOM Okay. We want you to power up y our 8 ball. We want you to get your RCS heaters on. Pressurize the RCS, open up the (garble). Over.

SC Okay, Jack. I got 2 commander SDI breakers in - ac and dc and the 2 (garble) breakers in ac and dc and next you'll want the RCS heaters all on with the pressurized RCS and then the main (garble) open. And I think they're already open.

CAPCOM Roger. And, Fred, get the TCA breakers in last. Please.

SC All right, Jim. I'm holding off on those until you give me further word any way. I'm just going to pressurize right now.

SC Jack, are you ready with the LM gimbal angles?

SC - - power off come down here (garbled)

CAPCOM Okay, Aquarius. I have some gyro torquing angles and the Odyssey is powered down attitude control wise, so LM's got attitude control now.

CAPCOM Aquarius, Houston.

SC Go ahead, Jack.

CAPCOM Okay, we want you to know that we have some gyro torquing angles for you. And we want you to tell us when you got attitude control in the LM.

SC Okay. We're still working on the pressurization. I'm getting Jim on the norn here so he can help out.
CAPCOM Roger.
SC Wonder why.
SC We got to get this pressurized.

END OF TAPE

SC Houston, Aquarius.

CAPCOM Standby one, Aquarius - Odyssey, we'd like you to go Direct RCS and hold your present attitude out the window until the LM gets RCS powered up. Go ahead, Jim.

SC Well, that's my question. Where are - I think you explained that (garbled). We went to API (garbled) We don't have our balls (garbled). We don't want to go into Gimball I.

CAPCOM Roger. How far are you from RCS Power - RCS Pressurization?

SC Okay, Jack. I'm right up to where it's past Roll ON. RCS fire (garbled).

CAPCOM Okay, 13. You're both talking at once. One at a time, please.

SC Okay. Who's first?

CAPCOM Close Logic Power A and B, Fred. Pressurize RCS.

SC Okay.

CAPCOM Go ahead, Odyssey.

SC Okay. I'm going to try to do the best I can. I've got a one attitude REFSMAT I'm going to fly according to the Lunar Terminator.

CAPCOM Roger, Jack. Just maintain attitude.

SC What am I doing? I can't do that anyway. Let's see (garbled) Nope. Now, and -

CAPCOM Aquarius, Houston. I'm going to have to get some ACF's so you can get a ball reading. Close your bus tie inverter circuit breakers. All four of them on panel 11. Close your AC bus volt circuit breaker on panel 11. On Panel 16, Inverter 2 CLOSED. Select Inverter 2. Over.

SC That's been completed, Jack.

SC (garbled) RCS is pressurized now.

SC Okay, Jack, do you want us to procede right on down the line with the RCS checkout and activation 37 now?

CAPCOM Standby, Fred.

SC Hell, is he still firing up there?

CAPCOM Okay, Fred. Negative on the activation on page 37. Go on to your RCS pressurize and then get your TCA breakers in and go to PING's attitude hold.

SC Okay, Jack I read.

CAPCOM Okay, Jim, this is Houston. We want you to load the Dap with 30120.

SC Load the Dap with 30120. Complete. Okay, we need to change that CSM weight.

CAPCOM Okay, Aquarius. Your CSM weight is 63400.

SC And Jack, the last thing to do on LM is(garbled). stay away from gimbal lock. Over.
CAPCOM Affirmative. Take control of the LM. PNGS attitude hold.
SC We are.
CAPCOM Odyssey, request you coordinate with Aquarius on attitude control.
SC Okay.
SC Roger.
SC OK. Let's see if we can fire these things. (garbled). Okay, I've got Direct.
CAPCOM And Aquarius, check your Att PNGS breaker on Panel 11 N.
SC Say again.
CAPCOM Close on Panel 11 circuit breaker Att Ca PNGS.
SC (garbled)
SC Come on. Let's take it easy now.
SC Okay. We've got Att Ca PNGS CLOSED.
SC (garbled)
SC Okay, is that okay?
SC Okay. Now we're looking.
SC How about thrust?
SC Okay. It's already open.
SC Okay. Set her down.
SC Okay, Jack, we got it.
CAPCOM Okay, Jim. How's the Attitude Control?
SC Okay, Jack. We're going to have control now in the LM. We're going to try to roaate up through (garbled).
CAPCOM Roger.
SC I'd like to (garbled) when you're (garbled) back to Earth.
CAPCOM Odyssey, Houston. I've got a procedure for you.
SC Okay, Jack.
SC I want to go up this way to get away from that -

END OF TAPE

SC Okay Jack I'm (Garbled)
SC Well I want to go up this way to get away from there.
SC The radios (Garbled)
SC No
SC Check your intercom.
SC Okay Jack. Odyssey is ready to copy.
CAPCOM Okay Jack. What we want you to do is close the reactants valve on fuel cell 2. Collar down your inverters. Collar down your battery relay bus. Battery ties off, and pull your entry circuit breakers, entry battery circuit breakers A, B, and C.
SC Check the control and make sure the (Garbled)
SC Okay Jack understand. Close react valve circuit breakers in fuel cell 2. Collar down inverters. Power down battery relay bus. Batteries off. Collar entry aboard running circuit breakers A, B, and C. All off.
CAPCOM That's affirmative Jack, and close reactant valve on fuel cell 2.
SC Okay (Garbled)
CAPCOM Okay Jack. On fuel cell 2 open circuit it.
SC Okay, fuel cell 2 is open circuited. Do you want me to go through the standard shutdown procedure for the (Garbled) valves and -
CAPCOM Odyssey, Houston. All you have to do is close the reacts valve on fuel cell 2.
SC Okay. C B reacts and vent react valves all closed.
SC Yes.
SC Yes.
SC (Garbled)
SC Okay.
SC Houston, Aquarius.
CAPCOM Go ahead Aquarius. Okay. Odyssey is completely power down according to procedure that you gave to Jack.
CAPCOM Roger. We copy. That's where we want to be Jim.
SC And Jack, have you all got good LM data down there now?
CAPCOM That's affirmative Fred. We're getting good LM data.
SC Okay, in that case I think I'll pull out my display breakers and just let you all keep an eye on things.
CAPCOM Roger.
SC He's turning his light now on too.

CAPCOM Stand by one on that Fred.
SC Okay.
SC What about these lights up here?
SC I've got it. Okay.
SC (Garbled) possible.
SC No.
SC (Garbled)
SC I'm watching it.
CAPCOM Aquarius, Houston. Stand by on opening your circuit breakers for displays. We're going to let you know what they are, and I have some gyro torquing angles for you.
SC Okay. What page is that gyro torquing?
CAPCOM Okay. What page is the, did we write the gyro torquing on Jack?
CAPCOM (Garbled)
SC Okay. We're there now Jim. Jim's got it. Go ahead with the gyro torquing angles. Over.
CAPCOM Okay. We'd like you to proceed with the final line and your gyro torquing angles are, X plus 00330 Y plus 02480, Z minus 01510. Over.
SC Okay. I read the gyro torquing angles as, plus 00330, Y is plus 023, I only have 4 numbers for Y, you'll have to give them to me again. I have Z as minus 01510. Read Y again please.
CAPCOM Okay Jim. X and Z are correct and Y is plus 02 480.
SC Okay. We read Y as plus 02 480. We'll proceed activation 3 to final line to platform.
CAPCOM Roger.
CAPCOM Okay Aquarius, proceed as on page 40 with the IMU final line.

END OF TAPE

PAO This is Apollo Control. 58 hours 46 minutes ground elapsed time. Lovell and Haise still powering up the lunar module, getting attitude control, aligning the platform. In preparation for what turns out to be an alternate mission in which no lunar landing will be possible. However, the spacecraft will fly around the moon. At this point in translunar coast, it is more economical and propellant and time to continue to coast on around the moon and come back to earth interssection trajectory. In about 20 minutes in the Houston New Center there will be a press conference in the small briefing room. Stand by.

CAPCOM Any stars out the LM window?

SC We'll have to wipe them off, Jack. They're coated with water right now.

SC Can I get a towel?

CAPCOM Roger. As soon as you get a chance to - while you're in position - to take a look, we'd like to know if you can see stars for alignment purposes.

SC Okay. Jim's going to be in trouble in their present attitude out his side. The sun's up. Wait one.

SC What have you got? How much you got left Battery A. OK. They said they (garloed) they were thinking right now

SC They're talking about powering down and doing a P51 here.

SC No. You're thinking about P52.

CAPCOM Aquarius, Houston. Negative on the P51. We want to stay just like we are, but we'd like to be able to correlate what you're doing with some simulator work we're going to crank up. And so if you can give us information as to what stars you can see out the window, we can make that correlation.

SC Would you say one more time? Repeat the top two.

CAPCOM Jim, what we want you to do is go with your current final line and disregard the P51. What we're attempting to do is to crank up some LMS simulations to correlate what we can get out your window with what we can get out the LMS window to see if that will help us any. So when you can see some stars, if you can, you think you can recognize them? And recognize constellations please let us know.

SC Okay. We'll check it. Stand by.

PAO Participants in the forthcoming press conference within the next 15 minutes or so will be Manned Spacecraft Center, Deputy Director Christopher C. Craft, Jr., Apollo Spacecraft Program Office Manager James A. McDivitt, and MSC Director of Flight Operations, Sigert Sjoberg. This will be in the small briefing room in the Houston New Center

PAO We'll be isolated from the air-ground which will be continually fed in real time to the News Center.
SC Okay.
SC Yeh. Unplug me.
SC Jack (garbled)
CAPCOM Aquarius, Houston. We noticed that the OZ pressure in ascent tank 02 is a little high, so we want to use some of it. So close descent 02 and open ascent 02, tank 2. Over.
SC Okay, Jack. Switch now on ascent number 2 02 tank, descent 02 is closed.
CAPCOM Roger, Fred.
SC Give us that.
SC Okay, Houston. Aquarius. How do you read?
CAPCOM Reading you 5 squared, Jim. Go ahead.
SC Okay. I'm looking out of Fred's window. I see a lot of particles out there, but a lot of good it's no good to lable them because a lot of it is splashing in the local vicinity and I don't recognize any constellations right now. In this particular attitude.
CAPCOM Okay, Jim. If that status changes please let us know.
SC Rog, we're continuing to drift, if you get GTTA are off.
SC GTTA are (Garbled)
CAPCOM And Aquarius, Houston. I've got some circuit breakers you can open to power down displays. In addition, I have a P30 maneuver pad. Over.
SC Roger. Stand by Houston. Get the - get the pad book.
SC Get the LM date. Get the LM book.
SC And say, are we getting the pad book now, Jack, and (garbled) powered up.
CAPCOM Okay. I have some circuit breakers that you can open up in order to power down displays.
SC Okay. Stand by one, Jack. I'm going to get my comm carrier on.

END OF TAPE

CAPCOM Okay, how do you read now Jack?
SC Loudly.
CAPCOM Yes, we're on.
SC Hello, Houston, Aquarius.
SC Back on, yes.
CAPCOM Aquarius, Houston, you're watching the middle gimbal there, aren't you? Go ahead, Aquarius.
SC Okay, go ahead with the breakers first, Jack.
CAPCOM Okay, you watching you middle gimbal there?
SC Tell them we are.
SC Your attitude is atraight pitch down, Jim. Okay, you're moving away.
CAPCOM Okay, Fred, I've got six circuit breakers for you.
SC Okay, go ahead.
CAPCOM Okay, they're all on panel 11. Row one under Ac bus B, open Helium PQGS for panel display.
SC It's open.
CAPCOM Fine. Row two, flight displays - open thrust, open mission timer, open range/range rate, altitude/altitude rate, and open the AC bus A range rate, altitude/altitude rate.
SC They're open.
CAPCOM Okay, on row four PNGS signal strength display.
SC It's open.
CAPCOM Okay. That concludes the power down of displays. I have a P-30 pad for you.
SC Okay. Go ahead.
CAPCOM The purpose is a pericynthian plus two hours DPS abort. Noun 33 079 25 2648 plus 163 30 minus 00145 minus 07515 apogee not applicable, perigee is plus 00205 17977835 268 264 plus 16410 minus 00145 minus 07338. COAS is NA. And I have two gimbal trim angles for you which will be updated. Right now however we wnat you to go with pitch 5.86, roll 6.75. Over.
SC What was that for?
SC Pitch and yaw, maybe, huh?
SC Okay, what was the last two things you gave me - a pitch and roll angle for what?
CAPCOM That's for your DPS trim.
SC Those were gimbal angles for pitch and yaw.
SC Roger. GDAs.
CAPCOM Yes, that's what I mean, sorry.
SC Pericynthian plus 2 at 07925 02648 plus 16330 minus 00145 minus 07515 HA , HA and flash A, HP plus

SC 00205 17977 835 268 264 plus 16410 minus 00145 minus 07338 - in flash A under COAS. And you gave me GDA angles of pitch, 586 and roll, 675.
CAPCOM Good read back, Fred.
SC Fill all the little bags you can with water
CAPCOM Aquarius, Houston, say again please.
SC Okay, we didn't answer back there, Jack. Check to see if you're on VOX. Neither am I, okay.
SC Why the hell are we maneuvering at all now? Are we still venting?
SC Well, we're at hold for one thing - I mean we're at bit of impulse.
SC I mean why can't you null them out somewhere?
SC Every time I try to - I can't

END OF TAPE

SC Well, we're at hold for one thing. I mean we're at bit impulse.
SC No. I mean why can't you null them out somewhere
SC Any time I try to - I can't take that dog gone roll out. I got to wait till they get around to the belly band.
SC Wait a minute. Do you fight roll by using the PTC left right. That's what you need to play with.
SC Okay. We'll try that.
SC Let me get around to this roll. We'll let it roll all the way.
SC You can't let it roll all away.
SC I know. I know. But I mean -
SC Okay. Then till it's upside down at least. Not until.
SC Okay.
SC Well, should I ask him what the return time on that one is? Are you interested?
SC Let's get the first things first.
SC Oh, you don't want to hear. Let me figure some times out here. That one's 79 and what are we at now? About - do we - do we even know any of our computer times do we?
SC No.
SC Hey, Jack. Do you still have a mission timer? You don't? Okay.
SC Odyssey, let's ask Houston to give us a mission timer. Computer time. They can uplink to us.
SC Go ahead.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC We don't have a - I don't think we have a computer clock going and why don't you uplink that stuff to us?
CAPCOM Roger.
CAPCOM And, Fred, I got some circuit breakers on panel 16 for you.
SC Okay. Go ahead.
CAPCOM Okay. Roll 1 under flight displays, systems engineer crosspointer, open. Under RCS B.
SC It's open.
CAPCOM Open attempt press display flags and PQTS displays.
SC Okay. They're both open.
CAPCOM Okay, Fred. On roll 3, under COMM Open displays and under ECS open displays.
SC Okay. COMMdisplays, ECS displays

SC both open.
CAPCOM Okay. And two more in roll 4, under heaters, open displays, and under EPS open displays.
SC Okay. Heaters display, EPS display open. And I've long since had all the lights off floods et cetera.
SC Where are those bags? Where are those bags for weighing water for the PLSS?
SC Why?
SC We're going to fill up command module water (garbled).
SC Yes. You need a QD - - Jim. No way to get ours in there. I don't think.
SC Hey, Jim. Why don't one of our waters (garbled) - Okay. Let's control - What else can we fill up there?
CAPCOM Aquarius, Houston. You're not going to be able to uplink you with time because of the IU and we have a frequency problem there. But what I'd like to do is give you a time to set up on your mission timer and give you a mark and then you can put it into the disky from there. Over
SC Okay. Stand by.
SC Wait a minute. Why do we need a mission timer right now anyway? I mean that bad, they can tell us.
SC Well, I'd rather have a timer going so that we can put it up on the disky. So we should have a mission timer.
SC Is that what he wants to do?
SC Yes.
SC Hey, OMNI.
SC Great.
SC Switch them.
SC Okay. Let's fire the mission timer.
CAPCOM Aquarius, we need 4 at OMNI.
SC 4 at OMNI.
SC Say again, Jack.
SC 4 at OMNI.
SC I am.
SC Okay, Houston. If that call was an OMNI switch, I'm in 4 right now.
SC Okay, (garbled). How do I get the mission timer up. I got the mission timer cranked in.
SC You got it on?
SC I got the mission timer and crcuit breaker in.
SC Okay. We're going to probably need numeric lighting. There you go. You got it.

CAPCOM Aquarius, Houston. I think we've got a better way of getting you a mission timer.
SC Go ahead with it.
CAPCOM Okay. We can do a VERB 55 enter and then put an R1. Minus 00088. In R2, minus 00059, R3 minus 03274.
SC What's the FRAPPIN' attitude.
SC We're okay.
SC God damn. I wish you get to something I know.
SC Well, as soon as we get over here, we'll stop it with the TVCA's.
SC Okay.
CAPCOM And, Aquarius, Houston. We've got you both on VOX.
SC You got what?
SC You want us on VOX, Jack?
CAPCOM We have you on vox. We're reading you loud and clear and the clock took good.
SC Okay. Looks like we're on the FDA route there, Jack.
SC Okay, Jack. How do you read me on normal voice now?
CAPCOM Reading you 5 squared, Fred.
SC Okay.
CAPCOM And, Aquarius, we're ready for VERB 74 when you can give it to us.
SC You got it.
CAPCOM Okay. And one other thing we noticed, when you pressurized the RCS, we got an increase in pressure in the ascent tanks and so we want to have you verify that the ascent feeds are closed. In order to do that, on panel 11, close the ascent feed 1 and 2 circuit breakers and cycle the parker valves and then open the ascent feed circuit breakers on panel 11.
SC Completed, Houston.
CAPCOM Okay, Jim. Thank you.

END OF TAPE

SC - and Jack Aquarius, what kind of return time is this maneuver given?
CAPCOM That puts you back in the water at 133 hours.
SC 133?
CAPCOM Affirm.
CAPCOM And that's an Atlantic landing site.
SC Altantic landing?
CAPCOM Affirmative. That's the pad that we've given you, but we may change our mind later on. We want you to have this info for now. And that's a minimum
SC Okay.
CAPCOM - minimum time return.
CAPCOM Aquarius, Houston. We've got to change the REFSMMAT to the one to which you're aligned. So, we'd like to have PU and DA and we'll ship that up to you.
SC Roger.
SC Okay, you got it Jack.
CAPCOM Roger. Coming up.
CAPCOM Aquarius, could you give us data please?
SC Okay I still got -
SC - the up data link, the DUA breaker may not be in Jack.
CAPCOM Okay Fred, and close the DUA breaker.
SC It's in now Jack.
CAPCOM Okay Jim, and it's coming up now. Thank you.

END OF TAPE

CAPCOM Aquarius, Houston. We're finished with the uplink. The computer's yours. We'd like to power down the DOA so pull the DOA circuit breaker please.

AQUARIUS Okay. Up data link breakers coming open.

CAPCOM Aquarius, Houston. We'd like to have aft OMNI and we're going to lose contact with you for about a minute here while we try to establish tracking and our latest data shows that your closest approach to the moon is going to be 60 miles perigee, over.

AQUARIUS Okay, closest approach 60 miles and I'm sitting on aft OMNI now.

CAPCOM Roger. We'll probably be going off the air here in about a minute.

END OF TAPE

SC Houston, Aquarius. Over.
CAPCOM Go ahead, Aquarius.
SC Okay. We're thinking about rigging up the urine dump to the side hatch. We're thinking about rigging up the urine dump to the side hatch and save urine heater power. What do you think?
CAPCOM Stand by one.
SC Better still so we won't freeze up our urine dump.
CAPCOM Roger. That sounds like a good plan, Jim. Why don't you go ahead with that one?
CAPCOM Okay, Aquarius. And down here we're getting regrouped, trying to work on your control modes and trying to set up something for PTC and taking a look at consumables as opposed to flight plan, etc., and as soon as we get all that information we'll pass it up to you. We also have the 14 backup crew over in the simulators looking at dock burns and also trying to see what kind of alinement procedures they can come up with for looking at stars out the window, so if you ever are able to see any stars out there and think you can do an alinement out the window, why, let us know.
SC Okay. Jack, right now we're not able, to - the floodlight's reflecting off the thrusters and whatever debris came away at the time of the mishap is still with us, but the stars are hard to find and why - in what respect do you want us to do the stars out the window - just to test the LM's run - is that correct?
CAPCOM That's affirmative. We like to correlate the information we get with your's so that if we can use it to update the platform we can. What we're really trying to do, Jim, is see if we can do a COAS aline so we can power down the platform.
SC This is Aquarius, we're getting an awful lot of static on the uplink now and we're not reading you at all. I have good signal strength and - -
CAPCOM How do you read now, Aquarius?
CAPCOM Hey, Jim, do you suppose that you could orient the LM so that the service module would be between you and the sun? I believe you could see - recognize constellations out you front windows then.

END OF TAPE

CAPCOM Aquarius, Houston, radio check.
SC Okay, Jack, how do you read now?
CAPCOM Okay. Hearing you five square now, Jim. And the question we have - is there some way you can orient the spacecraft so that the service module is between the LM and the sun so you can recognize constellations out the window? And secondly, can you see anything out the AOT?
CAPCOM Aquarius, Houston. How do you read?
PACE This is Apollo Control 59 hours 51 minutes ground elapsed time, continuing to stand by as we go through momentary loss of communication as the antennas and the spacecraft attitude drift past the point at which the ground tracking stations can receive from the spacecraft antennas. To back up and recap the earlier maneuver pad, or information regarding descent propulsion system abort for minimum return time - this maneuver, should it be done, would come at 79 hours 25 minutes 26 seconds ground elapsed time at an altitude above the moon of 205 nautical miles. The maneuver would be 1797.7 feet per second posigrade, burn time of 8 minutes 35 seconds, would produce entry interface at about 133 hours ground elapsed time. Apollo 13 is now 185 455 nautical miles out from earth, velocity showing on the display here in Mission Control 3118 feet per second. The spacecraft crew aboard Aquarius and Odyssey are now powering down, carefully husbanding all of the consumables aboard the spacecraft. We're continuing to stand by at 59 hours 53 minutes ground elapsed time. This is Apollo Control.
CAPCOM Aquarius, how do you read me now?
CAPCOM Aquarius, Houston, how do you read?
CAPCOM Aquarius, request forward OMNI please.
CAPCOM Aquarius, Houston, request forward OMNI. How do you read?

END OF TAPE

SC Okay, Houston. Aquarius. How do you read?

CAPCOM Hello there, Aquarius. Loud and clear. How do you read me?

SC There's an awful lot of background -

SC We get a lot of background static, Jack. You're down in the mud. You having a ground problem?

CAPCOM What we tried to do was to get the IU frequency shifted off a little bit so that we'd have less interference. I think it'll come up - what we want you to do is turn on your descent oxygen and turn off your ascent oxygen. Over. And request forward OMNI.

SC You're unreadable, Jack. We got a signal strength meter. Right now it keeps wavering up and down, and the best I'm getting is about 2.4 AGC.

CAPCOM Roger. Request forward OMNI.

SC I am on forward OMNI. I've been on forward OMNI.

SC Okay, how do you read, Jack?

CAPCOM I'm hearing you five square, Fred. How me?

CAPCOM Aquarius, Houston. How do you read?

SC Okay. We're up to about 2.6 ADC now.

CAPCOM Aquarius, Houston. Radio check.

SC Okay, everytime you transmit, Jack, the AGC starts to drop off and the static level turns up.

CAPCOM Okay, Fred, you're loud and clear.

SC I wish you were.

CAPCOM Fred, go to descent O2.

SC Descent O2. Roger.

SC Hello Houston, Aquarius.

CAPCOM Hello there, Aquarius. How do you read me now?

SC Hello, Houston. Aquarius.

CAPCOM Aquarius, Houston. Go.

SC Okay. That's the first clear word we heard from you, Jack. Do you think it could be my Pitch attitude that's breaking up your incoming? I guess you've been hearing us.

CAPCOM We have been hearing you and the problem is on the ground. I hope we have it corrected now.

SC Okay. That sounds good.

CAPCOM We're considering powering down the PNGS but we want to know what capability you have to do a course and fine align. We read your conversation about being unable to see out the window very good. How about out the AOT?

SC He's looking now.

CAPCOM Okay, and the other thing we thought you

CAPCOM - might try is to put the Service Module between you and the Sun and then to see if you can see anything out the window in that attitude.

CAPCOM The reason that we think that that would work is that it worked on Apollo 10. It made the constellations all recognizable when we put the Service Module - in our case a LM between us and the Sun.

CAPCOM AFT OMNI, Fred.

SC You're down in the mud again, Jack. It appears that some other ciruit is feeding through on there with you.

CAPCOM Roger. AFT OMNI.

PAO This is Apollo Control. John Young sitting in at the CAPCOM console with Jack Lousma giving the benefit of his experience in Apollo 10.

SC Okay, you're down in the mud again, Jack. Lots of background static.

CAPCOM AFT OMNI, Aquarius.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Okay, Houston. Aquarius. How do you read?
CAPCOM Aquarius, Houston. How do you read?

END OF TAPE

CAPCOM Aquarius, Houston, how do you read?

PAO This is Apollo Control, 60 hours 21 minutes ground elapsed time. At the present time, the Flight Dynamics Officer here in Mission Control is computing a maneuver to place Apollo 13 back on a free return trajectory within the next hour. The maneuver would likely come at about 61 hours ground elapsed time. The lunar module primary guidance and navigation system so call PNGS will be left powered up for the next hour, and then powered down to conserve water, which is used for cooling the electronics in the system. We'll stand by as this next maneuver is generated and passed up to the crew, having some communications problem as the spacecraft drifts through the various OMNI antenna look angles. The high gain antenna has not been powered up, to conserve the electrical power. At 60 hours 22 minutes ground elapsed time, standing by, this is Apollo Control.

SC Hello, Houston, Aquarius. How do you read?

CAPCOM Hello, there, Aquarius, loud and clear. How me, now?

SC Okay, we're reading you loud and clear, Jack. I hope it stays this time.

CAPCOM Okay. We'd like to brief you on what the plan is. We're, at this time, water critical in the LM. We'd like to use as little as possible. To do this, we're going to plan to make a free return maneuver of 16 feet per second at 61 hours, which is 37 minutes from now. Then we're going to power down the PNGS and then we'll, at 79 hours, we'll go ahead and make another abort maneuver to kick what we got. But we'd like to get that PNGS powered down as soon as possible. That would be after the midcourse and - so how do you feel about making a 16 foot per second burn in 37 minutes.

SC Well, we'll give it a try, Jack, if that's all we've got. That a 16 foot per second DPS burn in 37 minutes?

CAPCOM Roger. We're working up a pad for it, but we wnat to know what you think about doing it at that time.

SC Well, we'll do it. Could you give us a little bit more time?

CAPCOM Okay, Jim. We'd like to get a suggested time from you. We can figure out a free return maneuver for any time you want to give us, so if you'll give us the time you'd like to shoot for, we'll figure out a pad.

SC Okay, that sounds good. I think if we have a little bit more time - we want to do it right - stand by one.

SC Let's shoot for an hour if we can, Jack.

SC How's that?
CAPCOM Okay, Jim. How about 61 hours and 30 minutes? That's an hour and five from now.
SC Okay. We'll do it and we want to make sure we talk back and forth now to make sure we get this burn off right.
CAPCOM Affirm.
SC Okay, in the interim, Jack, I looked around again and I saw that we have a radar and a landing radar heater breaker in - can I pull those out?
CAPCOM Affirmative. Pull them both out.
CAPCOM And now we want to ask you a question about alignments, and so forth. We wanted to know if you can see any stars out of the AOT. We also wanted to know if you could use the service module to cast a shadow on the LM windows and then look out the windows to see stars for P51 COAS alinement.
SC Okay, in this attitude, Jack, that we're pitching around - I can not use the AOT to see stars. We're just not able to see them at all. Now we may be able to maneuver off in yaw or and/or roll and see stars. Right now we haven't been able to. The AOT is useless. The command module structure is just radiating too much light into the telescope.
CAPCOM Okay, and how about using the service module to cast a shadow on the commander's window? If you could do that, can you see stars for a COAS alinement?
SC We could give that a try, Jack, although I don't know how successful it will be. We tried to do it - the light shines off our quads which makes it difficult to see stars. We do have the earth and moon, if that can be of assistance.
SC Another problem - right now, Jack, I'm looking out the right window and it's pretty dark out that one but there are about a thousand or so foam stars out here from - left over from some of the debris - it's hard to discern what's the real and what's not real.
CAPCOM Okay. That's good information and during the time - we see you're continuing to pitch - if you ever get in a position where you think the AOT might be of some use, we'd like you to periodically look out of it and see if you can see some stars that would enable you to get a P52.
SC Okay, will do. And also - let me ask you a question. In this configuration, docked, you have to use the GTCA to control pitch and roll, and just how much can we use that without really changing our trajectory? We only have 60 miles to play with.
CAPCOM Roger, we'll put that to them

SC Okay, Jack, are you ready to go to work with me on the two-hour DPS activation in contingency book page one?

CAPCOM Roger, we're ready to go.

SC Okay. Item one, we - one throught five, we can scratch off as done. Is that correct?

CAPCOM Stand by one, Fred.

END OF TAPE

SC done. Is that correct?
CAPCOM Stnadby one, Fred. Okay, Fred, let's go ahead. Step 1, page 1. Everybody's listening.
SC Okay, I've looked around and I've essentially done Steps 1 through 5 with the exception of floodlights and utility lights and I think we'll just do without those.
CAPCOM Roger. Your choice.
SC Okay, on EPS activation, we're through step - we're through that bottom of that page. That's all done.
CAPCOM We concur. Page 2.
SC Okay, in essence, we've circumvented step 4 and we're now sitting with all 4 amps - our descent Batts on high voltage taps, so I'll scratch off Step 4.
CAPCOM Roger, and in Step 5 we want to leave Inverter 1 circuit breaker OPEN.
SC Roger. In Step 5, we'll leave Inverter 1 CB OPEN.
CAPCOM Omit Step 6.
SC Okay for the time being, our mission timer is the computer so, Mission Timer Activation scratch off.
CAPCOM Roger.
SC Okay. We've done the primary Glycol Loop Activation.
CAPCOM We verify.
CAPCOM Aquarius, we recommend that you leave the Caution Warning off on page 3
SC Okay. I was going to say that next. Page 3, we'll just scratch Item 1 and Item 2, I've already got the RCS ON. I don't know if I gave you the time or you got the time on the Primary Vat Flow number 1 OPEN.
CAPCOM We got the time.
SC Okay. Let's go to the CB pages now.
CAPCOM Fred-O, did you close the engine control breaker in Panel 11?
SC What control is that, Jack?
CAPCOM Did you close the S and C engine control breaker on Panel 11? As we got Step 1 there on Page 3.
SC Okay. Yes, the EPS descent ECA control breaker is CLOSED on 11
CAPCOM Roger, and how about the - on Panel 11, S and C engine control - CLOSED? AFT OMNI, Fred.
SC Okay. We're in OMNI and we have the S and C engine control breaker CLOSED.
CAPCOM Roger. Let's go on with the circuit breaker panel checkout.
SC Okay. I'll just give you - I think it'll

SC - be easier to give you what I got in. Okay in the top row on 11, we have the 4 AC Bus Tie breakers in and the AC Bus volts breaker in, and that's it. Second row, we have the 4 TCA breakers in. We have the (garbled) under flight displays and commander's FDAI. And likewise under AC Bus A we have a (garbled) and a commander FDI breaker in. That's it. On row 3, we have signal conditioner 1. We have the ATTCA PGNS. We have the engine control breaker, attitude direct control breaker, and the - under lighting A Non dock component breaker in. One other, ED logic power A - ED logic power A is also in.

CAPCOM Copy.

SC Okay, under - under the fourth row. We got all the Quad heater breakers in, E-band 1. Under ECS, glycol 1 and 2 and under COMM, we have commander audio in, and PGNS LGC DSKY IMU standby, IMU operate and that's it. Okay, in the bottom row, EPS, we have the backseat tie both in, and we have the cross tie balance loads in, the lunar, Bus time, descent ECA control, descent ECA and the DC Bus volts breaker.

CAPCOM Roger. We copy.

SC That does it for Panel 11.

CAPCOM Okay. Standby.

SC Okay. As I see it some of the short ones - we need to DECA gimball in sooner or later.

CAPCOM That's affirm. Close the DECA Gimball.

SC And probably - okay, DECA Gimball and sooner or later, we're going to need DECA Power igues also.

CAPCOM All right, DECA Power will come up later in a procedure, Fred-O.

SC Okay.

CAPCOM Aquarius, Houston. On your circuit breaker check list on Panel 11 and 16 we want you to configure the panels as outlined in a checklist.

SC Okay. You want us to configure in for a checklist. Okay. We'll do that.

CAPCOM That's right. Close the black ones and open the white ones.

END OF TAPE

SC - - checklist.
SC Okay. We'll do that.
CAPCOM That's right. Close the black ones and open the white ones.
SC Yes. I think we can manage that.
SC With the activation power up, we're starting right now.
SC Houston, we might as well leave our RCS DCA's in, right?
CAPCOM Affirmative, Jim. Leave your RCS TCV's in on panel 11.
SC Check that.
SC Yes. I just used my Pinte; pen and made those white ones black ones.
CAPCOM Roger. Same on 16, Fred.
SC Rog.
SC And you might look there, Houston, to see what circuit breakers are required, like the tape recorder.
CAPCOM We're looking.
CAPCOM Okay, Jim, on panel 11 over there, you can also leave open the rendezvous heater breaker and the landing radar heater breaker, in addition to the tape recorder.
SC They're out.
SC I'm leaving the fuel inject too. Like the suit fan 1 is still in, RCS system is still in, the GTA's. Attitude direct control is in.
CAPCOM Roger.
SC How about if I leave the VHF A and B on ?
SC Switch to forward OMNI.
CAPCOM Okay. We can leave the VHF power down too.
SC And do you want the secondary S-band?
CAPCOM Negative on secondary S-band. Leave them open.
SC Up data link is in. Do you want that in or out?
CAPCOM Leave the up data link open. We'll call for it when we want you to put it in.
PAO This is Apollo Control 60 hours 44 minutes ground elapsed time. Distance from earth 187 006 miles. Velocity 3 089 feet per second. Flight dynamics people still computing the midcourse correction to go back to a free return trajectory.. Here in Mission Control the coffee cup has become a appliance second only to the headset in usefulness here.
SC Then on the top row, do you really

SC the propulsion PQGS and ascent helium rigs in.
SC And also the system engineer - pointer breaker.
CAPCOM Roger. Negative on the PQGS. Negative on the ascent helium rig and negative on the cross pointer.
SC Okay. On the second row, I'm going to leave the floodlights breaker open.
CAPCOM Concur.
SC And we're again up to - do you want the CWEA enabled.
CAPCOM Negative on the CWEA.
SC Okay.
SC Okay. Since we're - are we going to power up the AGS or should I concern myself with the ATCA breaker?
CAPCOM Negative on the AGS. However, Fred, we need the ATCA breaker in.
SC Okay. ATCA breakers in. Yes. I guess for the backup power supply.
SC How about ATCA AGS?
CAPCOM Negative on ATCA AGS.
SC And I'm leaving the suit flow control breaker open.
CAPCOM Let's close the suit flow control breaker. It doesn't take any corrent.
SC And, Jack, OMNI over now.
SC Okay. Without suits it doesn't do us much good either.
SC Okay. And are we going to continue to be able to operate on the OMNI's, Jack. So can I leave the S-band antenna power down.
CAPCOM Okay, Fred. We don't plan to use the steerable antenna, although, we want to leave the heaters on. So it looks you ought to open up comm S-band antenna but leave S-band antenna heaters closed.
SC Thank you. Comm S-band is open, S-band heater breaker is still closed.

END OF TAPE

SC And on the bottom row, Jack I'm going to leave the heater display breaker out, which we had pulled before, and EPS display. But I question, do we wnat the ascent ECA breaker in as prescribed?

CAPCOM Stand by. That's a negative on the ascent ECA breaker. Leave it open.

CAPCOM And Aquarius we need (garbled)

CAPCOM We'll give you state vector and target load.

SC Okay, we need the uplink breaker in now.

CAPCOM That's affirmative.

SC And, Jack, will you give us that - how about the RDO breaker? Can I pull that? We don't need that, do we?

CAPCOM Negative on the RDO. Leave it open.

SC And how about the ascent ECA breaker on panel 11? Jim has it in over there.

CAPCOM And the panel 11 ascent ECA can be open.

SC It's open.

CAPCOM Okay, Aquarius, We're GO on the circuit breaker configuration as you have it now.

SC Roger.

CAPCOM And Aquarius, tests on the simulator just showed that if you want to let the PGNS damp hold your attitude for you, it will.

SC Okay, very well.

SC And, Jack, because it will take quite a while to get back to the attitude, I think we ought to think about going there very shortly.

CAPCOM Roger, I have a pad for you. I have a P30 maneuver pad.

SC Roger. Standby.

SC Go right ahead, Jack

CAPCOM Okay, we want you to hold your maneuver until we finish making the load. We haven't completed it yet. Are you ready to copy P30 maneuver pad?

SC That's affirm.

CAPCOM Okay. Here we go. The purpose is modcourse correction for free return. NOUN 33, 061, 29, 4284 minus 00213, plus 0004, minus 00312, HA and HP are N/A, DELTA V, 00380, 031, 120, 298, minus 00213, plus 00041, minus 00312; COAS N/A. And I have your LM GDA angles. Pitch, 5 point 86; roll, 6 point 75. Your dip throttling, five seconds at ten percent, burn the rest at forty percent. Your ullage will be tube jets for ten seconds.

SC Okay, Jack, we have a P30 maneuver pad, a midcourse for free return. NOUN 33, 061, 29, 4284, minus 00213, plus 0041, minus 00312, HA and Hp N/A, DELTA V, 00380, 031, 120, 298, minus 00213, plus 00041, minus 00321.

SC COAS N/A. GDA angles; pitch, 5 point 86; roll, 6 point 75. DPS throttle five seconds at ten percent, burn the rest at forty percent. And we need a tube jet, ten second ullage.

CAPCOM That's a good read back, Fred. I'd like to verify, however, in NOUN 81, in B sub y, it's plus three balls four one.

SC Okay, NOUN 81, B sub y is plus 00041.

capcom Good readback. Let's press on with the checklist.

SC Okay, and Jack, find out about using PTCA to maneuver with.

CAPCOM Okay, we're finished with the computer. It's yours and we recommend using the PTCA to maneuver with.

SC Roger.

SC Okay, I'm back on the checklist, page 6, Jack, under PNGS turn on and self test, we've done everything except the self test here on this page. Do you want to do that at this time?

CAPCOM Okay, Aquarius, negative on the PGNS self test. Page 7.

SC Okay. I'll scratch page 6 and on page 7, we're not goint to activate the - or rather we have the upband activated, ECS activation I have all done. And, at the bottom of the page, the docked IMU course alinement is done.

CAPCOM Roger.

SC Okay, we've also completed, I guess in essence, all of page 8.

CAPCOM That's affirmative and page 9 to boot. Scratch vhf. We've done the TFM.

SC Okay. You've updated it, that's right. We cranked in the time.

SC Houston, let's go to activation, or get into page 10.

END OF TAPE

SC Houston, let's to to activation - get into page 10 and see what we did there.

CAPCOM Okay, the only item on page 10 is to deploy the landing gear.

SC Okay, we'll do that now.

SC Okay, the landing gear are down and locked, Jack, and looking ahead now at page 11, we've done all of that.

CAPCOM We verify that. Page 12.

SC Okay, and I assume that among all the numbers you pumped up we've got a REFSMMAT and state vector, is that correct?

CAPCOM That's affirmative. You've got that. So you can delete page 12.

SC Hey, 13, you've read us up the final line angles and we'll CAPCOM Affirmative.

SC Okay, so now we're up to - we've got to do DAP SET and the gimball throttle test.

CAPCOM That's okay, Aquarius, we recommend omitting the DAP SET gimball throttle test - just make sure the DCA power and DCA gimbal circuit breakers are closed.

SC Okay, we're going to proceed with the DAP SET gimball throttle test - is that correct? Or did you say delete it?

CAPCOM Aquarius, delete the DAP SET gimball throttle test. Just assure that the DCA power and the DCA gimball are closed.

SC Okay. Houston, the DCA power is open at this time. Do you want me to close it?

CAPCOM Affirmative, Jim. Close the DCA power.

SC It's closed. We deleted that.

SC Okay, also out of that list, Jack, we need the commander's throttle set to throttle (garbled).

SC Houston, if I recall the launch set of the gimballs - the GDA's are not correct here. When are we going to get those set for the burn?

CAPCOM Standby one.

CAPCOM Okay, here's the word on the DAP SET gimball throttle test. Let's do step one and step two, and that'll get our gimball set.

SC Roger.

SC Okay, Jack, we're going to have to back up on this if we're going to follow the procedure here, which has us go mode control PGNS AUTO, we're going to have to pull the TCA breakers to keep from burning jets.

CAPCOM Standby, Fred.

CAPCOM Standby on step one, Fred. We're getting the word for you. How do you like this sim?

SC It's a beauty.
CAPCOM Okay, Aquarius, we recommend you do the DAP SET gimball throttle test as per the checklist. Go PGNS AUTO and proceed.
SC Well, we're going to fire a burst as soon as we go to AUTO because we've got those thrusters in - the thruster circuit breakers. Do you want us to do that and stop?
CAPCOM Okay, Aquarius, we're recommending you go to AUTO and let the thrusters fire and settle down and proceed with the test.
SC We're in PGNS AUTO.
CAPCOM Roger, your DAP is set, you're in wide deadband. That ought to do the trick.
SC Roger.
CAPCOM Okay, we're looking at it, Aquarius. We're ready to proceed with the test.
SC Okay, we're proceeding.
SC Okay, and Houston, you're looking at the weights now and they're still good, right?
CAPCOM You're GO on the weights.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/14/70,CST 2:23A,GET 61:10:00,199/1

CAPCOM Aquarius, Houston. We'd like you to recycle on the DAP load and change your DAP to 32021. Over.

PAO This is Apollo Control. We've got an ignition countdown clock running here now in Control Center showing 19 minutes - 19 seconds to ignition on the mid-course correction which will place Apollo 13 back on a free return trajectory. To recap the details of this maneuver, the ignition time would be at 61 hours 29 minutes 42 seconds ground elapsed time. The velosity change would be 38 feet per second. Burn time 30.7 seconds.

CAPCOM We notice that we got a 4 jet ullage loaded in the DAP and we gave you two jets on the PAD. Let's go with what we have loaded. It'll be a 4 jet ullage.

SC Okay.

PAO During this maneuver using the descent propulsion system, the throttle will be at 10 percent for the first 5 seconds of the burn and throttle up for the balance of the burn at 40 percent.
The GDA plug now.

CAPCOM The GDA's are go as they are. Press on.

SC Okay, Houston, we're going to do the DPS pressurization and checkout.

CAPCOM Standby one. Okay your gimballs are within 3/10 and we're ready for the DPS pressurization and checkout.

SC Okay, Houston, do you want us to follow up on page 15 RCS checkout? In essence, we've kind of already done that.

CAPCOM You're right, Aquarius. Let's delete the RCS checkout, and a DPS looks go.

SC Houston, we're going to do a PGNS yaw maneuver to the attitude.

CAPCOM Standby on that. Aquarius, we recommend driving it around there manually with a PTC.

SC Okay, we'll use the PTC. Roger.

END OF TAPE

SC We going to auto now Houston to try to damp the rates we are at the attitude.
CAPCOM Roger Jim. We verify the attitude.
SC Roger.
SC And Houston, we'd like to confirm, do you want the verb 65 entered in there?
CAPCOM Affirmative on the verb 65.
SC Okay.
Okay Jack. I've got another question on page 18. At one minute I concur with (Garbled) on, but I wonder why I have to have the abort stage breaker in. We sure don't want any staging now.
CAPCOM Aquarius, delete the abort stage circuit breaker close. Leave it open.
SC Roger. Will delete.
SC Okay also Jack, since we are 4 jet ullage versus 2 do you want, still want 10 seconds ullage or do you want 5 now?
CAPCOM Okay Aquarius we'll use automatic ullage.
SC Okay. We'll just let the 7 1/2 seconds auto ullage do it.
CAPCOM Roger, and we'd like to do this in manial throttles, so on page 17 about 2/3 of the way down throttle control, manual vice auto.
SC Okay. We're set to manual.
SC What's the 203, Houston?
CAPCOM Enter on to 203 Jim.
SC We've got 203 on the DSKY now and what's that required work, can we pass it?
CAPCOM Aquarius, enter on to 203.
SC Wait a minute.
CAPCOM Aquarius, we'd like to verify that your throttle is in the MIN position,.
SC That's affirm.
CAPCOM And in the event that you have to do a manual takeover, turn the engine gimbal off, remote control to attitude hold, and use the PTCA.

SC Roger.
SC Okay, 1 plus 30 to burn.
CAPCOM Roger.

END OF TAPE

SC OK, master arms on, 1 minute.
CAPCOM Roger, Aquarius. You're go for the burn.
SC 40 percent.
CAPCOM Okay, Aquarius. You're looking good.
SC All shutdown.
SC Okay. You're looking at 1685 now, Jack.
CAPCOM Okay. You're go in the residuals proceed.
SC Okay. When you say go in the residuals you mean don't trim them. Is that right?
CAPCOM That's affirmative. No trim required.
SC Roger.
SC Okay.
CAPCOM Aquarius, check your master arm off please.
SC Okay, Houston. Burn's complete. Now we have to talk about powering down and what do you want us to do with the PGNS.
CAPCOM Roger. We're looking at that right now and you'll be the first one to get the word.
SC And, Houston, it's doubtful right now whether we'll be able to see the stars in this configuration. The only way we could possibly get alinement is the earth and the terminator or the moon and it's terminator and should have you look at a powered down - keeping the PGNS if at all possible.
CAPCOM Roger, Jim. We'll get the word for you.
SC And, Houston, we're in an A/T hold mode, can we turn off the vector?
CAPCOM Stand by on that one, Jim.
CAPCOM Okay, Aquarius. We're working on what's going to happen next. In the meantime, we'd like to take some high power items off the line. so in - -

END OF TAPE

CAPCOM Take some high-power items off the line so in Panel 11, open DECA Power and open DECA gimball. On 16, open the ETCA breaker.

SC Okay, on 11, we got DECA power, DECA gimball open. On 16, we got the ETCA breaker open.

SC Houston, while you're thinking, see if you can come up with a procedure of matches in the Command Module optics with manual drive. Perhaps (garbled).

CAPCOM Roger.

SC Jack, Aquarius. While you're thinking - before we had our compounds, we want to know when to - or we should hook up the side hatch urine dump system. So it wouldn't freeze up the normal urine dump system.

CAPCOM Roger. We gave you a go on that earlier. Sorry, that you must have missed it. Use the side hatch for urine dump.

SC Okay.

CAPCOM How are the stars out the window now?

SC Well, I'll look again, Jack, but at this attitude, the Sun is reflecting off of the - off quad 4 so bright that it would ruin any night vision - we still got particles floating around us, I'll must take a long look and see if I can see any star patterns.

CAPCOM Roger. Aquarius, we're going to have to hand you over to a different site now, and we think maybe things will work better if this time we turn off the S-band transmitter receiver, and bring it back up in 5 minutes. You copy?

SC Okay. Standby one. Okay. I understand you want us to turn off the S-band transmitter receiver and bring it up in 5 minutes. Is that correct?

CAPCOM That's affirmative.

SC Tell us when. And you want us to maintain attitude control.

CAPCOM Affirmative on the attitude control.

SC That's AUTO attitude control. Okay, you maintain AUTO attitude control. Okay, Jack I'm back on the line now. On the S-band, you want me to turn off the transmitter receiver and the power amps are off for 5 minutes. Is that - will you give me the word - is that what you want?

CAPCOM Aquarius, leave the power amplifier the way it is. Just turn the transmitter receiver off for 5 minutes. Now.

SC Okay. You tell me when.

CAPCOM Okay. Turn it off now. See you in 5 minutes.

SC Okay. It's gone off. Gone off for 5 minutes.

APOLLO 13 MISSION COMMENTARY,4/14/70,CST 2:53A,GET 61:40:00,202/2

PAO This is Apollo Control at 61 hours 45 minutes ground elapsed time. The process of handing over from the Goldstone station to the Honeysuckle station in Australia. There will be a gap of about 5 minutes while this handover is taking place. Meanwhile the people here in Mission Control Center are looking at ways of setting up some sort of scheme for passing thermal control or Bar-B-Que mode of thermal balance for the spacecraft, during the remainder of the coasting flight using the abort guidance system of the Lunar Module to provide the attitude control to set up this slow roll. Apollo 13 now 188 863 nautical miles out from Earth. Velosity 3 084 feet per second. At 61 hours 46 minutes ground elapsed time and standing by, this is Apollo Control.

END OF TAPE

SC Say again.
CAPCOM Aquarius, Houston, how do you read?
SC Okay, you're loud and clear there, Jack.
CAPCOM Roger, same here. We're still discussing the next move.
SC I figured it. Let's just make it a good one.
CAPCOM We're looking real close at water usage profiles and right now things are kind of swinging toward leaving the IMU powered up and powering down the LGC, but we'll have more word for you shortly. And we recommend for sleeping that you leave one guy on watch. We recommend you don't make any urine dumps if you can help it because it'll make the debris problem worse than it is now. And we have some items that you might want to transfer to the LM, some towels, some penlights, some fecal bags, UTS. and do you have any more items that we can help you out with at the moment?
SC Okay, stand by on your latter list, Jack. I understand no urine dumps. I guess we'll work through the UCD and all the bags we've got and real quick here can you give a DAP load we want in here now to conserve the RCS.
CAPCOM Okay, for attitude control coordinates, we're recommending the manual control VERB 76 and watch your middle gimbal angle. Your DAP load that you have now looks good.
SC Okay, it's at hold VERB 76 for the guy on watch. And the DAP mode we've got right now is okay.

END OF TAPE

CAPCOM Aquarius, the decision for the time is to leave the IMU powered up, power down the LGC and power down other nonessential items. WE'll be coming up with a more precise checklist as soon as we can get it. Over.

SC Okay. The decision is to keep the platform, power down the computer, and we'll be standing by for further word on the power down, Jack.

CAPCOM Roger.

CAPCOM And, Aquarius, for your information we now have 136 mile perigee.

CAPCOM It's confirmed by Dopler.

SC Okay. 136 mile perigee now. That's very nice.

SC Wait a minute, Jack. Did you say pericynthion or perigee?

CAPCOM I meant pericynthion.

SC Ah. That's better.

SC And, Houston, we pulled out your up data link circuit breaker so if you want to update it for anything let us know and we'll put it back in.

CAPCOM Roger, Jim. We will.

END OF TAPE

CAPCOM Aquarius, aft OMNI, please.
SC Aft OMNI.
SC Houston, do you read Apollo 13?
CAPCOM This is Houston. Go ahead. Read you weakly.
SC Okay, Jack, we don't want to bug you, but you ought to be thinking - or what your thoughts are concerning what the next burn will be. I got to figure out watch schedule and the sleep schedule and how we can meet the next maneuver.
CAPCOM Roger. We're getting you a flight plan update. We're still computing on your next burn and we're getting ready to give you procedure for power down.
CAPCOM Aquarius, one idea on managing the OMNI antennas. Might make it easier on everybody if we disabled the uplink squelch and manage the antennas by switching when we hear the noise. Over.
SC Roger, will do.

END OF TAPE

PAO This is Apollo Control, 62 hours 24 minutes ground elapsed time. Under discussion here in the control room are the various means by which the spacecraft thermal balance can be maintained through the night with a minimum amount of propellant and electrical usage. One man will be on watch in the crew throughout the night and they're looking at the possibility of manual control attitude to arrive at some sort of passive thermal control mode. Apollo 13 now 190 026 nautical miles out, velocity 3064 feet per second. At 62 hours 25 minutes ground elapsed time, this is Apollo Control.

CAPCOM Okay, Aquarius, here's what we're going to do. We'd like you to point the LM X-axis either north or south, that's the positive X-axis. It appears to us that it would be closer to orient the LM plus X-axis toward the south. Do that with the LGC powered up and using the TTCA. After that, we propose to power down the LGC to save some power. However, this means that we lose the use of the TTCA and we'll have to control the spacecraft with the hand controller in the direct mode. Request your position on these two items.

CAPCOM Aquarius, Houston, how do you read?

SC Okay, Jack, understand you want us to -

END OF TAPE

SC Okay, Jack. Understand. You want us to place the LM plus X axis to the south due to the PTCA with the LGC powered up. Then by powering down the LGC we'll lose a PTCA. I wasn't to successful in controlling the spacecraft in attitude only, but I might be able to keep it out of gimbal lock.

CAPCOM That's affirmative, Jim. And keep your ball powered up and go to DIRECT on the hand controller. And maintain attitude in a direct position.

SC Okay, understand. Do you want some sort of a PTC mode, Jack?

CAPCOM Affirmative. We'll take whatever PTC mode you can set up, Jim.

SC Okay. Since you know our approximate attitude how about just getting me something to find you on the DSKY for a southernly plus x direction.

CAPCOM Roger. Stand by one.

SC And one other question, Houston. Did you say power down the DSKY or the LGCTB going into 06 or multiple circuit breaker?

CAPCOM Stand by on powering down the DSKY, Jim. We'll give you the procedure for that. The procedure that we -

SC Okay.

CAPCOM The procedure that we have is listed in several places. It's in the contingency checklist under power down, on page 1, second paragraph. And we'll give you the word when we want you to do that. That is LGC only not to power down the IMU, but we'd like to have you hold off on that till we send you the word.

SC Understand.

CAPCOM Aquarius, while we're working on this we have a proposed flight plan update for your working and resting cycles. And you ready to copy?

SC Okay. Do you want me to write this in the flight plan for stay, Jack?

CAPCOM You probably write this on a piece of scratch paper. This is pretty easy.

SC Okay. Go ahead we've got a lot of scratch paper.

CAPCOM Okay. We're suggesting that the LMP rest while the CMP and CDR are awake. LMP ought to hit the sack about 63 hours coming up in 25 minutes, and you get to rest for 6 hours. You get up at 69 hours. At 70 hours the Commander and the Command Module Pilot sleep for 6 hours until 76 hours. Around 76 and a half to 77 hours we'll do a P51 and a 52. At 78 30 we'll load P30 and align AGS to PGNS. Mission time for second burn will be presently 79 25 26.5 and we'll have a pad shortly. We suggest that all

CAPCOM of you eat after the burn. That'll be 81 to 82 hours, and the CMP, CDR eat while you are sleeping. And that you grab a bite as soon as you can. Over.

SC Okay, Jack. As I read that the LMP is to go to sleep at 63 00 for about 6 hours. During that period the CDR and CMP are to try to get a bite to eat. I'm to awake at 69 hours. CDR and CMP sleep at 70 hours and they are to awake at 76 hours. And we should plan on doing our P51, P52 at 76 hours or 76 30. At 78 30 we are to load a -

END OF TAPE

SC P52 at 76 hours and 76 30. At 78 30 we can load a P30 and align AGS to PGNS. Second maneuver is to take place at 79 25 26.5 mission time. Then we are all to eat at 81 to 82 hours.

CAPCOM Okay. With a minor modifications your P51 P52 will be about 77 hours and that's a period of darkness. Commander and the CMP ought to eat around 68 to 69 hours and you should eat between 69 to 70 hours just after you get up. We have left an hour in there where everybody is awake to together to talk things over. Go ahead.

SC Okay. I'll eat after I wake up between 69 and 70.

CAPCOM Alright we have a -

SC - correction -

CAPCOM Go ahead, Fred.

SC Yes, we got the word the P51, P52 is going to be done around 77 hours while we're in darkness.

CAPCOM That's affirmative. And we have a work-rest cycle laid out for further on which we can relay to you later.

SC Okay.

SC Okay, Houston. You have advice on what AGS you want me to go to.

CAPCOM Okay. That'll be the next bit of information. I'll get that for you, Jim.

SC Okay.

CAPCOM And Aquarius, just to get you thinking in that direction, we've run a very thorough analysis and we've found out that it's going to be cheaper to keep the LGC and the disky up and turn the inverter and the ball off. It's going to save us 1 amp, and also some water. So it looks like what we're going to do. And we'll have to monitor the middle gimbal angle. And we'll get the procedure on that, and it'll also be easier control mode. We'll be able to use the PTC through the dap.

SC That sounds great, Jack.

CAPCOM Aquarius, Houston. We've got a procedure for you. Ready to copy.

END OF TAPE

SC Ready to copy.
CAPCOM Okay. This is pretty easy. We see you've already got VERB 16 NOUN 20 called up here and so we want you to, in maneuver and PNGS attitude, hold, and use the PPCA. We want you to, on the commander's ball, pitch to 267.5 and yaw to minus 4.5. And when you do this, in VERB 16 NOUN 20, on the DSKY, you ought to read plus 00120, plus 26750, and plus 00450. Go ahead.
SC Okay. With the commander's ball to pitch of 267.5 yaw minus 4.5. And we should have a 16 20 at that time plus 00120, plus 26750, plus 00450.
CAPCOM That's a good readback. We'll watch the maneuver.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC You didn't mention roll on the ball. Do you want roll zero?
CAPCOM The roll ought to be plus 1.2, Jim.
SC Rog.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC Okay. We're just about there in pitch and in error middle gimbal angle, but that other gimbal angle didn't look like it pulled the right way. I tried both methods.
CAPCOM Yes. I been looking at that too and we're asking why and we'll get an answer for you.
SC Yes. Houston, I wonder if your accounting for being a bit off the belly band and I've gone through (garble)
CAPCOM And Fred, I know you're supposed to start sleeping here pretty soon. But we got a new PC plus 2 pad, P30 maneuver pad for you.
SC Stand by.
SC Okay. Go ahead, Jack.
CAPCOM Okay, Fred. P30 maneuver purpose is PC plus 2, DPS to this time we're going to the MPL. And NOUN 33 079, 27, 40 13, plus 08144, minus 00443, minus 02226, apogee is N/A, perigee is plus 00205, 08455, 420, 268, 261, plus 08155, minus 00443, minus 02187, COAS is N/A. Your GDA ought to be okay as it is from the last burn but pitch ought to be at 5.85, in roll it's 6.74. Your ullage will be 2 jets for 10 seconds. Your DPS throttle will be 10 percent for 5 seconds, 40 percent for 21 seconds, and the remainder at full throttle. And for your information, this will put you in the water at 142 plus 47. Over.

END OF TAPE

CAPCOM - and the remainder at full throttle. And, for your information, this will put you in the water at 142 plus 47. Over.

SC Okay, dip the pericynthion plus two into the MPL, 079 2740 13, plus 08144, minus 00443, minus 00226, N/A, plus 00205,08455, minus 00443, minus 021 2187 N/A. GDA should be okay as is, which hopefully is Pitch, 5.85 Yaw 6.74. Two jet ullage for 10 seconds, the DPS throttle 10 percent for 5 seconds, 40 percent for 21 seconds, 100 percent for the rest of the burn. And this should put us into the water at 142 plus 47.

CAPCOM Okay, Fred, I have a correction in Noun 81 - Delta V sub Z is minus 02226. Read back.

SC Okay, Delta V Z Noun 81, is minus 02226.

CAPCOM Okay, good readback.

SC Somehow htat didn't add up with the Delta V X to give a Delta V R of that magnitude. It seems like it'd have been bigger.

CAPCOM Okay, we'll take another look at it, Fred.

SC Okay, Houston, I'm not having too much luck holding this particular attitude.

CAPCOM Okay, Jim. Standby one.

CAPCOM Okay, Aquarius, when you get her pretty much in attitude, there, and it looks like you're as close as we need to be, we'd like to try a control mode and see if it will work. Sort of a semi PTC. We'll leave the ball powered up for this and if this doesn't work, why, we'll have to revert to attitude hold mode. But standby one, please.

CAPCOM We'd like you to think about this control mode, Jim, and see if you think it might work from what you know right now. We're a little skeptical but we'd like to put it to you. So once you get in a pretty good attitude, monitor in Verb 16, Noun 20, GO to PGNS man/man pulse, Verb 76, as we have, and set up a Yaw rate - a Yaw rate to the right, monitor the middle gimball on R3 on the DSKY and see if she'll kind of stabilize out. If not, the only other suggestion we've got is to go to PGNS attitude hold. We'll keep the ball up until you make this evaluation.

SC - you cut out -

CAPCOM Okay, where'd you lose me, Jim?

SC I lost you when you said try the control mode, you're a little skeptical.

CAPCOM Okay, from what you say, we had to be a little skeptical of this procedure, but we'd like to have you try it and have you evaluate it. You can monitor the middle gimball on R3. Before we power doen the ball we want your evaluation. The next best choice is PGNS attitude hold. Over.

SC Okay, I'll try it.
SC Okay, go ahead with the control mode procedure.

END OF TAPE

SC Hello Houston, Aquarius.
CAPCOM Go ahead Aquarius.
SC Okay, I'm not kidding you, I can monitor, register 3. I can probably keep it out of (Garbled) or go to the gimbal lock.
CAPCOM Roger. How are pitch and roll?
PAO This is Apollo Control.
SC if the line goes 16 20 with the compressors the way they are, but I'll have to try minimum volt, just a minute.
SC Okay Jack. I've a question, one more question about Odyssey.
CAPCOM Go ahead.
SC Okay. I still have the pyro A sequence A and pyro B sequence B circuit breakers in, Do you want those out?
CAPCOM Stand by one.
CAPCOM Odyssey, Houston. The two circuit breakers referred to, leave them in.
SC Okay. Copy. Leave them in.
SC Okay Houston, they can control yaw in minimum volt, the same way on pitch.
CAPCOM And Fredo the DELTA V R resultant computes with the components.
SC Fred's off the COMM now Jack.
CAPCOM Roger. Your pad is good.
SC And Jack, we didn't get that whole sentence there.
CAPCOM Okay. I said that the DELTA VR that Fred questioned computes well with the component, It's RMS.
SC Okay, copy.
SC Okay now, Jack let's go over this once more. You wanted me to try out the control of the spacecraft in the pulse mode. Is that correct?
CAPCOM That affirmative. Set up a yaw right rate and monitor the middle gimbal angle.
SC I'm going to do that. I'm not too sure whether I can control roll or pitch in pulse, but I can control
yaw in pulse, yaw in pulse on the ball.
CAPCOM Roger, and remember we're not going to have a ball there so that we're going to be monitoring CDU's on the DSKY and if we get it off it will be pretty hard to figure out where to fly back to, and, in addition, have to control the omni's while we're doing this.
SC Hello, roger.
CAPCOM Without the ball I still have use of the GTCA the control of the ar angle.
CAPCOM Affirmative. You'll have the TTCA for pitch and roll.

SC Okay. I think I can do that without the ball and if you just give the the GTCA's I think I can control the spacecraft using (garbled) 20. I've got a yaw light.

SC Okay Jack, I have now the register 1 is the decrease load.

SC And Houston, did you see anything wrong with this mixed up motion?

CAPCOM We had a data drop all right now Jim, we'll look at it as soon as it comes up.

CAPCOM Okay Aquarius. We're going to dispense with this control mode. We'd like you to fly the machine back to the original attitude that you had, and we'll go PGNS attitude hold and then we've got to get that ball off the line to save some power. And then in order to keep even heating every 15 or 30 minutes we'll give you a call to give us 90 or 180 degrees of yaw.

SC Okay. You want me to back to original attitude. I'll be going back to it now.

PAO This is Apollo Control, 63 hours, 26 minutes, Ground Elapse Time. Recapping the upcoming pericynthian plus 2 hours maneuver with the decent propulsion system engine. Time of ignition, 79 hours, 27 minutes, 40 seconds. The velocity change will be posigrade 845.5 feet per second or a burn time of 4 minutes, 20 seconds. The throttle schedule on the decent propulsion engine will be 5 seconds at 10 percent, 21 seconds at 40 percent and the remainder of the 4 minutes and 20 seconds at full throttle. This burn will produce a splash in the southwest Pacific at 142 hours 47 minutes.

END OF TAPE

PAO - - specific, at 142 hours, 47 minutes ground elapsed time. The tentative coordinates for entry interface or 400 000 feet is 28 degrees south latitude by 173 degrees 14 minutes east longitude. Splash down will be somewhat to the east of that, actually, across the international date line to about 173 degrees west longitude. The spacecraft presently 191 898 nautical miles out from earth, velocity 3 034 feet per second. And at 63 hours, 28 minutes ground elapsed time, and standing by, this is Apollo Control.

SC Okay, Houston. Aquarius. I'm flying back over towards the initial angles you gave me of a mentioned 257. I'm getting near the belly band invo and yawed then I'll go to PGNS ATT hold.

CAPCOM That's affirmative, Jim. And then we're going to have you go through a powered out procedure.

SC Okay.

CAPCOM And you'll need VERB 77 with that hold when you get there.

SC Will do.

SC Okay, Jack. Have I gotten your VERB 16 on yaw and roll then go to ATT hold.

CAPCOM Roger. And then we want to get the ball part down.

SC Okay. Stand by.

SC Okay. I'm now in PGHS ATT hold and do you read my DSKY angles?

CAPCOM Roger. We see them.

SC Now you want me to power down the ball or are you going to give me the procedure and I'll do it my way.

CAPCOM Okay. We'll but what you've got on the DSKY there and we'd just like to go through an overall power down procedure, and so doing we'll catch the ball and inverter and it will only take a few minutes. So are you ready to start on the panel 11?

SC Roger. Jack will copy and I'll do the work.

CAPCOM Okay. Panel 11, top row, open all the circuit breakers.

SC All circuit breakers on top row coming open.

SC They're all open, top row.

CAPCOM Okay. Second row, close the first six on the left, through the ISO valve and open all to the right of that.

SC Okay. First six on the left are closed that's through the ISO valve and I opened up every one from there on.

CAPCOM Okay. Third row, open up the next five.

CAPCOM Correction - open up the first five on the left, close AOT heater, close sink conditioner 1. Close attitude direct. And open the rest on row three.

SC Do you want active PGNS open?

CAPCOM Leave ACT PGNS closed, 4 breakers on the third row must be closed. AOT heater, sink conditioner 1, and ACT PGNS attitude direct control. My mistake. Good going.

SC Okay. I'm opening up engine start override right now. And that row's taken care of.

CAPCOM Okay. On the fourth row. Open - from the left, open the first five - correction - close the first five and open cabin FAN 1. Close the three glycol pump circuit breakers, open all the COMM breakers, except for commander's audio. Close it. All the PGNS breakers, open. Correction - open the first three PGNS breakers, close LGC DSKY, IMU standby, IMU operate.

SC That's complete, Jack.

CAPCOM Okay. And EPS, close BAT B ties, cross tie bell loads, and open the cross tie buss. Close the next three, open ascent ECA control, ascent ECA, and inverter 1. Close dc buss volt. Go ahead.

SC That's complete, Jack. Panel 11 is configured.

CAPCOM Okay. Let's go over to panel 16.

END OF TAPE

CAPCOM Okay. Let's go over to panel 16, top row, and starting from the left. Open the first 4.

SC Stand by, Jack.

SC Okay. Starting from the left, open the first 4.

CAPCOM Okay. And close the ISO valve, keep your TCA breakers closed, close the cross feed, open the next 2, displays. Close the main valve and the propulsion breakers should all 3 be open.

SC The main valves are closed, and the display engine override is logic coming open, and (garbled) breaker open.

CAPCOM That's affirmative. The second row, they should all be open except for 3 breakers on our instrumentation. Close SIG sensor, DCMTE and SIG conditioner 2. Over.

SC Roger. Do you want DSC load control open?

SC Engine arm coming open and ASA open. Is that correct?

CAPCOM We just got a change on that. Let's keep the ASA closed.

SC How about DSC load control and engine arm?

CAPCOM Okay, Jim. Suit flow control can be open, and engine arm, engine arm open.

SC Okay. Let's go to row 3.

CAPCOM Okay. Row 3 under COMM. Open displays, close SE AUDIO, open VHF A transmitter and B receiver, close the primary S-BAND circuit breakers, both of them. Open the S-BAND antenna, PMP closed, TV open, and all the rest of them opened under ECS except CO2 sensor closed.

SC Roger.

CAPCOM Okay. Under row 4. Under heaters, your SCS QUAD heaters should 4 of them be closed, open displays, open S-BAND antenna, open sequence camera. Under EPS open displays, close DC bus volt, open inverter 2, open ACCENT ECA control and SNECA, close descent ECA, descent ECA control, translunar bus tie, close cross tie bal loads, open cross tie bus, close pad feed ties. Over.

SC That's complete, Jack.

CAPCOM Okay, Jim. And we've already got a change to what I just told you. Under ECS close the cabin repress, and ensure that the ASA breaker is closed under S and C.

SC The ASA breaker is closed, but I closed the cabin repress.

CAPCOM Okay, Jim. Looks like what we have to do is, in order to maintain even heating, we just have to YAW the whole machine about 90 degrees per hour in increments. So we'll give you a call when it's time to YAW 90 degrees.

SC Okay. We have to yaw the machine as I understand it, Houston. And, you'll give it to me in increments of 90 degrees.

CAPCOM That's affirm.

CAPCOM Okay, Jim. Your present configuration has the following features. We got the flight control buses cross tied through the bal load circuit breakers. And we have AUTO cabin repress. One thing we'd like to do now is give you an uplink, so immediately we have to on panel 11 close the updata link circuit breaker. Go to P00 and DATA. Over.

SC Okay. We're going to P00 and DATA. The circuit breaker is closed.

END OF TAPE

SC Houston, Aquarius. Did you say that you had a new PAD for us to copy?

CAPCOM Jim, I passed that newest PAD that we have to Fred about 30 minutes ago. T hat's our latest. It's PC plus 2 and begins with Noun 33 of 79 hours 27 minutes and 40.13 seconds. Do you have that one?

SC Okay. We got that one. What kind of a attitude hold mode do you want us to do. Do you want us to do wide dead band (garbled)

CAPCOM Jim, the deadband is good the way it is. It's 5 degrees if you want to stay in it, and stay in the PGNS Att hold mode.

SC Okay.

CAPCOM Two things, Jim. We want you to know that there's some pretty big attitude errors in so if you go to AUTO, the computer is going to try to crank you around and the other thing is don't drink water out of the LM.

SC Okay. You might think about this. You know we lost the oxygen pressure in the Command Module.

CAPCOM Aquarius, we're finished with the uplink. The computer is yours, and you can open the updata link circuit breaker.

SC Okay. We've opened up the updata link and we've gone off of data, and I've got 15 20 in the computer.

CAPCOM Roger, Jim. I guess we're going to just kind of perk away here now.

SC Okay, Jack. One more question about Odyssey here.

CAPCOM Go ahead, Jack.

SC Okay, how about the Service Module 02 supply valve? Do you want that OFF?

CAPCOM Affirmative. Service Module 02 supply OFF.

SC Okay. On the way.

CAPCOM And Jim, we receive program arm in there. We think it's just got to do with pulling the updata link circuit breaker. Uplink too fast.

SC Roger. I don't see it. Should I reset?

CAPCOM Go ahead and reset, Jim.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC One thought that might occur here is that if we have low descent in water pressure, we might consider taking the PLSS water and fill it in reverse. If that works, you might look at a procedure for that.

CAPCOM That's a good thought. Let us bounce that around a little.

END OF TAPE

CAPCOM Okay, Jim. That's a good thought and we've looked at that and it looks like that's feasible. So if and when we need to do that we will.

SC I have something else, Jack. Were there plans made to make my 90 degree yaw, what I planned on doing was going to NOUN 76 hold and just (garbled) several times and compute the yaw start and hoping that pitch and roll stay with the limit.

CAPCOM Roger. It sounds like a good plan and you can use your TTCA in min impulse pulse to take care of pitch and roll.

SC Okay.

CAPCOM Aquarius, Houston. We see ascent 02 tank number 2 building up again so we'd like to use something out of it so turn on ascent 02 tank number two and turn off descent 02.

SC Roger. Open up ascent 02 tank number 2 and turn off descent.

CAPCOM And, Aquarius, Houston. We're starting to think about CO2 buildup up in the command module there so we've got a recommendation and what we're recommending is that you take the commander's hoses in the LM and put a cap over the red return hose and then figure out a way to fasten thoe hoses so they blow up in the CSM by extending them up as far as possible. And we'll get some flow off the blue side circulate up and around the command module and to keep the CO2 level down.

SC Roger. We agree with that too and one problem is that the comm is connected securely to the hose so we've got to get the comm cable off somehow to get that - we still have comm down here in the LM and have the hose up there.

SC Houston, we're trying to extend that commander's hose by use of the vacuum hose.

CAPCOM Sounds like a good plan if you can work that out, Jim.

CAPCOM Aquarius, if you can shake Jack loose there, I've got a - some procedures for him to write down.

SC Okay. Stand by.

SC Okay, Jack. Is this a long one?

CAPCOM Oh, it's about 12 - 15 lines. It's a matter of verifying some valves and so forth.

SC Okay. Go ahead.

CAPCOM Okay. We want you to go in, when you can and verify the following valves and leave them as we outline here. Repress package valve, off; emergency cabin pressure, off; direct 02, off; demand rig, off; both water accumulators, off; main rig A and B, open; water glycol -

CAPCOM correction - water and then glycol tank inlet and outlet, both. Now if you want to get some water, we recommend that you momentarily turn the surge tank on to pressurize the system and then turn it off and take out water as required. Over.

END OF TAPE

SC And take out water is required. That's it Jack, and another note on taking water. If you don't drain enough water so - (garbled) Aquarius

SC That wasn't it, Jack.

SC Okay. One more note on the water, Jack. If you don't bleed the pressure off when - don't take enough water to leave the pressure off completely. The pressure's at less down here is going to drain away in a period of 1 to 3 hours. So it's a small amount of oxygen, but we might as well save it. So if you want to eliminate that problem you could completely drain the pressure off by putting the water in a water bag and saving it that way.

SC Yes. That's a good idea.

CAPCOM So that's the end of my -

SC What I'll do - Let me repeat - Okay let me repeat it all back to you. Repress package valve off, emergency cabin pressure off, DIRECT 02 off, both the demand RGS off, both H2O glycol accumulators, water glycol accumulators off, main A and B open, water in glycol tank inlet and outlet open, for water momentarily pressure excert tank, take out water as required, you're recommending drain out all the water until I can't get any more water out of it in order to conserve the oxygen.

CAPCOM Okay. We just want you to turn off the water accumulators and not the glycol accumulator. Over.

SC Okay. These are the water accumulators on 382, right?

CAPCOM It's affirm. The accumulators 382.

PAO This is Apollo Control at 64 hours 28 minutes ground elapse time. Briefly the situation with Apollo 13. The crew in the last hour was passed up a pericynthion plus 2 hours maneuver which actually is primarily a speed up maneuver to get them back to Earth somewhat earlier than the normal free return would bring them. This maneuver would come at 79 hours 27 minutes ground elapse time. Would envolve 845 feet per second velocity change. Splash down would be in the southwest Pacific, north of New Zealand at about 142 hours 47 minutes ground elapse time. At the present time the LM oxygen quantity is 50.6 pounds and 300 pounds of water on board. Cabin pressure holding steadily and 4.7 up to 5 pounds in both spacecraft. The tunnel between the two is open so they share a common atmosphere. Apollo 13 now 193 700 nautical miles out from Earth, velocity 3005 feet per second. Missions here in the control room have to do with the power down procedures. How to conserve electrical power, the water used in the coolant, for cooling the various electronic systems in the spacecraft. How to husband all these consumables to get the most milage from them. And it's 64 hours 30 minutes ground elapse time and

PAO standing by. This is Apollo Control.
SC We going to Burn.
CAPCOM Aquarius, Houston. Go.
SC Roger, Jack. We're asking whether P51 or P52 are required in the back side of the Moon.
CAPCOM I think so, Jim, but stand by while I verify it.
CAPCOM We think we know where the platform is, Jim. The tracking looks real good from the last burn, we feel just a P52 will be required.
SC Okay. As your continued tracking changed our pericynthion altitude any?
CAPCOM Stand by. We'll get the latest on that, Jack.
CAPCOM Houston.
SC Go ahead.
CAPCOM Roger, Jack. We're still looking at 137 miles and Dopler's confirming it. We will have a good update after 67 hours.
SC Good. I want to say you guys are doing real good work.
CAPCOM So are you guys, Jack.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead Houston.
CAPCOM Okay Jim, we've come up with a COMM recommendation which we hope will save some power by powering down the power amplifier, if it works, and I'd like to read up the steps to you and have you think about them for a minute, and we recommend trying it before the first yaw maneuver. Over.
SC Okay. You can read us the steps.
CAPCOM Okay. Step 1, biomed off. Step 2 go to low bit rate. Step 3, go to down-voice backup. Step 4, power amp to fine. Step 5, panel 16, power amp circuit breaker open. Step 6, range function switch off. Read those back to me and then I'll have a remark.
SC Okay. Biomed off. Low bit rate. down voice backup power amp to prime. Circuit breakers, panel 16, power amp circuit breaker open. Range function switch off.
CAPCOM Okay, and the note says that you should be able to hear us if we can't here you in a couple of minutes, you should close the power amp circuit breaker on panel 16, and we expect to save an amp or more on this. It should work in the present attitude. When we go to the new yaw attitude we're thinking about powering up the sterible, leaving the power amp off and, if we can good COMM mode we'll still save some power. So if you concur, why don't you go ahead.
SC Okay. In this mode you should hear us or we should hear you but if you can't hear us then we ought to close power amp circuit breaker again. Is that right.
CAPCOM That's affirm. We'll just run a little COMM check after you get done and see how we're doing.
SC Okay, fine and if that all fails, we go back to our original configuration.
CAPCOM That's affirm.
SC All amps primary.
SC Power amps.
SC Yes, that's primary.
SC Okay. Circuit breakers 16 power amp circuit breaker open, COMM, power amp circuit breaker open.
SC There's only one
SC (Garbled) switch off.
SC It is off. (Garbled)
SC (Garbled)
SC Okay, (Garbled)
SC We (Garbled) there's a lot of noise (Garbled) down and hearing us better.
CAPCOM I (Garbled)
SC Okay Houston, Aquarius, how do you read us now?

CAPCOM Just the same Jim. You're readable but it's very hard to -
SC Okay we can read you if you want us to (garbled) these configurations.
CAPCOM Stay there for the next minute or two (Garbled)
SC Okay I'll tell you again Jack. (Garbled like a display (Garbled) again. (Garbled) fall off here.
SC Yes. Okay. You guessed it.
SC You're weak again.
SC (Garbled)
SC Oh here they are.
SC Why don't you put that rim there just like that. (Garbled)
SC (Garbled) I'll tell you that. It's built like a regular (Garbled)
SC Hey, look out of that window (Garbled)
SC (Garbled)
SC (Garbled)
SC (Garbled) in the command module.
SC Find a flight plan too while you're up there.
SC Okay.
SC Okay, Why don't you read me off (Garbled) on page 42.
SC (Garbled)
SC We ought to copy down the ones that have the water too, and (Garbled)
SC (Garbled)
CAPCOM Aquarius, Houston. Over.
SC Go ahead Houston.
CAPCOM Okay. Speak slow because there's a lot of noise and background. Have you completed your first 90 degree YAW manuever, and if you haven't we recommend it. Over.
SC Okay, we have not. We have not completed it. We will start. We want you to pilot the manuever. Over.
CAPCOM Okay, Jim. And I want to pass you up a short procedure for activating the S-band steerable antenna, which we'd like to do after you do the 90 degree YAW. Are you ready to copy? Over.

END OF TAPE

CAPCOM We'd like you to do after you complete the 90 degree yaw. Are you ready to copy? Over.
SC Ready to copy.
CAPCOM Okay. First on panel 11, close the S-band antenna circuit breaker. Then go to activation page 28 steerable antenna activation and complete steps 2, 3, and 4 of activation 28. You'll have to do a VERB 64 to get the pitch and yaw angles and the last step is on panel 16. S-band antenna heater circuit breaker to close. Over.
SC Joe, when you get over there, we just have complete steps 2, 3, and 4 of activation of that PTS 28.
CAPCOM Jim, that's - -
SC Then do a VERB 64 to get - -
CAPCOM Aquarius, Houston. The procedure I just passed you, please disregard it. Over.
SC Disregard it. Okay, Joe. I'm going to start my yaw maneuver now and I'll be yawing to my right. (garbled)
CAPCOM Roger. Right yaw is acceptable but wait one before you start the maneuver.
SC Roger.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay. You are go to commence the yaw maneuver, if we don't have comm after you complete the yaw maneuver, bring the power amplifier back on. Over.
SC Roger. Understand, will start the yaw.
CAPCOM Okay.
SC They're almost getting bigger and bigger Jack. It's over here now.
SC (garbled)
SC (GARBLED)
SC (garbled)
SC I've already turned that (garbled)
SC (garbled)
SC (garbled)
SC It's jumping now.
SC Get Jack and I'll (garbled)
SC We got to fix that.
SC (garbled)
SC Put on the SM tanks too.
CAPCOM Houston, Aquarius. Did you call?
SC Negative, Houston. We did not call. How do you read us?
SC (garbled)
SC And, Houston, could you give us an approximate time to turn off the ascent O2 in case (garbled).

CAPCOM Roger, Jim. We copy but can't use.
SC Roger, Houston. We'd like a time to go back to P742 in case we lose communications with you.
CAPCOM Jim, Houston. That's affirmative. You may go back to (garbled) 02. Over.
SC Roger. Going back now.
CAPCOM Copy that.
SC (garbled) upside down.
SC Yes.
SC Think we'll have any problems (garbled)
SC Well (garbled) not a very old (garbled)
SC (garbled) thank you very much(garbled)
SC Well, Jack, we're going to be ready to go.
SC We ought to be back (garbled)
SC (Garbled)
SC (Garbled)
SC Jerry, I think we ought to think about (garbled)
SC (Garbled)
SC (Garbled)
SC (garbled)
SC Well, (garbled)
SC (Garbled)
SC Yeah, I (garbled)

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/14/70,CST 6:36A,GET65:24:00,220/1

PAO This is Apollo Control. Rather noisy communications at the present time on the air-to-ground circuit to Apollo 13. Meanwhile the spaceflight meteorology group of the Environmental Service - Environmental Sciences Services Administration has issued - forecast that weather conditions will be satisfactory for Apollo 13's landing in the Pacific Ocean next Friday, April 17. Along the planned recovery line in the central south Pacific, skys will be partly cloudy with southerly winds at 15 knots. Seas up to 4 feet are expected. The temperature is near 80 degrees. Apollo 13 is now 195 375 nautical miles out from Earth. Velosity is 2 981 feet per second. At 65 hours 27 minutes ground elapsed time, this is Apollo Control standing by.

SC (garbled)

SC Houston. Go ahead for a new (garbled).

CAPCOM Aquarius, Houston. Say again, please.

SC Roger. We have a radio check at a new attitude.

CAPCOM Okay, Jim. We copy the angles. How are your receiving the voice now.

SC Your voice is excellent.

CAPCOM Okay. Real good. You are clear. We still have a lot of noise, but if you talk slow I can (garble) (garbled)

SC This is Aquarius. Go ahead.

CAPCOM Roger, Jim. We trying to improve our Comm down here. We'd like to try going function switch from down voice backup to voice. Over.

SC (garbled). Roger.

END OF TAPE

CAPCOM CAPCOM How do you read?
CAPCOM Aquarius, Houston. Request a short count. Over.
CAPCOM Aquarius, Houston. We're not reading you at all. Request you go back to voice hoist backup.
SC (garbled)
CAPCOM Yes.
SC Houston, Aquarius. Your down voice backup. How do you read? Over.
CAPCOM Okay, Jim, we read you now and you'd better stay in (garbled).
SC (garbled)
SC I'm sure going to get fuel (garbled)
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Okay, Jim, since we're in low bit rate now we cannot monitor the DSKY your program alarms, etc., and we recommend that in order for you to do so onboard you push in the following circuit breakers: On panel 11 and panel 16 the enunciator slash dot slash (garbled) circuit breakers That will allow you to monitor your DSKY warning lights.
SC Okay (garbled)
CAPCOM (garbled)
SC Roger, Houston, would you say one more time (garbled)
CAPCOM Okay, Jim. The circuit breakers are the enunciator slash dot slash component circuit breakers on panel 11, third row, far right under lighting, and on panel 16 also under lighting, second row, third from the left. Over.
SC Roger, Houston. We have those two circuit breakers engaged.
CAPCOM Okay, real good.
PAO This is Apollo Control 65 hours 45 minutes ground elapsed time. Communications are rathery scratchy at this time. Back over the past 8 or 10 hours of the mission the problem first cropped up at about 55 hours and 58 minutes ground elapsed time last evening when the crew first reported an under voltage alarm on the command module main bus B. This was their first hint that something was amiss, the pressure rapidly dropped in the service module liquid oxygen tank number 2 and fuel cells 1 and 3 failed shortly thereafter.
A decision was made to scrub any attempt at landing and continue on a lunar fly-by deep space abort type mission. The increased load on fuel cell 2 and the dropping pressure in the remaining liquid oxygen tank led to the decision to use the lunar module for a sort of lifeboat to come back to earth using its consumables for life support. The remainder of the evening was spent in trying to get the power and water profile pared down to get the most mileage out of these items.

PAO And at 61 hours 30 minutes groud elapsed time a 38 feet per second mid-course correction burn using the descent propulsion system of the lunar module put the spacecraft back onto a free return trajectory which, if nothing more were done, would cause the command module to enter in the - to reenter the earth's atmosphere in the Indian Ocean south of Mauritius at about 152 hours groud elapsed time. However, another DPS or descent propulsion system burn is being planned at approximately 79 hours 27 minutes ground elapsed time with a velocity change posigrade of 845.5 feet per second, which would bring the spacecraft home somewhat more rapidly, about 10 hours sooner, as a matter of fact, to splash down in the southwest Pacific at 142 hours north of New Zealand and that's where the situation stands at the moment. We'll be handing over to the Gold team shortly here in Mission Control, and at 65 hours 49 minutes ground elapsed time, this is Apollo Control standing by.

END OF TAPE

SC Houston, Aquarius
CAPCOM Aquarius, this is Houston; go ahead.
SC (garble) stars (garble) number 2 and 4. (garble) the rendezvous radar antenna is now in the way you might think of a procedure to get rid of it. with minimum power - and maybe we'll be able to see stars in a couple of minutes here (garble)
CAPCOM Okay, Jim, I think I understood the rendezvous radar antenna is in the way and you would like a procedure to get it out of the way, is that right?
CAPCOM That's affirm, at the proper time, and with minimum power.
CAPCOM Roger, understand; we'll work that.
CAPCOM Aquarius, Houston, over.
AQUARIUS Go ahead.
CAPCOM Okay, Jim, we have a hand over coming up on the hour, that's in a minute and a half; on the hour we would like you to turn the S band transmitter receiver switch to OFF; five minutes later turn it back to primary; over.
AQUARIUS Okay, Houston. Surely you want us to turn the S band transmitter receiver to OFF; 5 minutes later, turn it back to primary.
CAPCOM That's affirmative; Jim, after the hand over currently, they want to make sure that they lock up with you in FDIU.
AQUARIUS Roger - and let me know when you want me to turn it off.
CAPCOM Roger - you can turn it off now.
AQUARIUS And Houston, when do you want me to turn that S band transmitter receiver off?
CAPCOM Aquarius, Houston; turn it off now.
AQUARIUS Turning it off now.
CAPCOM Okay, Aquarius, Houston; we have data back and I assume we have comm; over.
AQUARIUS Houston, this is Aquarius; the comm is very, very, very noisy; over.
CAPCOM Aquarius, Houston. Copy that. Its noisy on our end too; stand by while we think about it.
AQUARIUS Houston, Aquarius; I am unable to catch (garble) now (garble)
CAPCOM Jim, Houston, I think you just called but I didn't copy you.
CAPCOM Aquarius, Houston; over.
AQUARIUS Go ahead Houston.
CAPCOM Jim, we recommend you put the power amplifier circuit breaker on over.
AQUARIUS Roger; power amplifier circuit breaker (garble) Power amplifier circuit breaker is IN.
CAPCOM Okay, Jim, how is the comm now; over.
AQUARIUS A lot of background noise; let me turn off the squelch.

CAPCOM Okay, you are quite a bit better.
AQUARIUS Whenever I enable squelch, I loose you; over.
CAPCOM Roger - stand by.
CAPCOM You are much better in downlink.
AQUARIUS (garble) 65; real good.

END OF TAPE

SC Come down 65
CAPCOM Okay, Jim. This is Houston. We recommend that you set the function switch from down voice backup to voice. Over.
SC Roger. Function switch go from downvoice back up to voice. Over.
CAPCOM Okay, Jim. How's the count now?
SC (garble) There's still a lot of background noise, Joe.
CAPCOM Okay. We'll look at it some more. Is your COMM down to (garble) now?
PAO This is Apollo Control. Hand over from the black team headed up by Glen Lunney to the gold team headed up by Flight Director Jerry Griffin is under way at the moment. We're anticipating within the next several minutes, change of shift press briefing in the News Center Auditorium or News Center Briefing Room, which will be localized to the briefing room only. The Air-Ground will be left up on the PAO release circuit. We understand it will be in the big Auditorium. And further advice of the time and participants of this press conference will be forthcoming. This is Apollo Control standing by.
SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC The noise we're experiencing is similar to what we had sometime before (garble)
CAPCOM Roger, Jim. EEcom is checking about what we can do about the noise. It may be a problem with the new site.
SC Roger.
CAPCOM Aquarius, Houston. Is the noise any better now? Over.
SC This is Aquarius. Negative.
CAPCOM Roger.
SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC Roger. Will you let us know when you want us to YAW another 90 degrees right?
CAPCOM Will do, Jim. Stand by 1.
CAPCOM Okay, Jim. We're ready now to YAW another 90 degrees to the right.
SC Roger.
CAPCOM Aquarius, Houston. We are going to try and improve the COMM and telemetry by temporarily breaking lock and reacquiring. You may hear some noise in your headset.
SC Just now.
CAPCOM Right.
PAO This is Apollo Control at 66 hours 37 minutes. Flight Director Glen Lunney is still in the controls

PAO center. We will notify newsmen on this line when he leaves for the MSC Auditorium. Apollo 13 now is 197 424 nautical miles from earth. It's velocity is 2953 feet per second.

END OF TAPE

CAPCOM Aquarius, Houston. Go ahead.
CAPCOM Jim, I didn't copy that. Your COMM is pretty good, though. How is it with us?
CAPCOM Okay.
SC Houston, do you want to reconfigure the down voice back up again?
CAPCOM Aquarius, Houston. I don't think so at this time. Our voice is good now. How's yours?
SC Ours is very good.
CAPCOM Okay, why don't we stay where we are for a few minutes.

END OF TAPE

PAO This is Apollo Control at 67 hours, 23 minutes. Flight Director Glynn Lunney is still in the Mission Control Center; there has been considerable discussions and meetings on the floor here since his shift changed, he and Flight Director Jerry Griffin. Director of Flight Operations, Flight Crew Operations, Deke Slayton, the Apollo Mission Director Chet Lee, the Apollo Program Director Rocco Petrone and other management officials have been holding some discussions. We have no estimate on when Mr. Lunney will be able to get away at this time. We will attempt to summarize for you some of the discussions that have been going on here. We are still leaning toward the burn at pericinthion plus 2 hours, that is the descent propulsion burn at 79 hours, 27 minutes, 850 feet per second; as an option, a number of people are taking a look at the what is being termed as super fast return, would require a larger burn at pericinthion plus and hour and a half; this would bring us to a splash time of 118 hours vs. 142 hours, however, to accomplish this, we would have to jettison the service module. Preliminary data indicates that we may have a thermal problem on the way back without the service module. There are also some other aspects that need to be looked into. This option is being held open and is being worked and will be for the next several hours, however, as I say, all the officials here are still leaning toward the pericinthion plus 2 hours, with a 142 hour return. In connection with the super fast return, Astronaut Gene Cernan has been doing some work in the trainer on star visibility problems, manual reaction control, manual throttle work, and this option will be kept open for some time. Another problem with the super fast return is that we can't stand as much misalinement with the inertial platform on a long burn as we can with the 142 hour return. At the present time, we would feel more comfortable with the 142 hours return. We expect to be able to get a program 52 or a platform aline, the program for alining the intertial platform with the alinement optical telescope in the Lunar Module, after the spacecraft arrives in the shadow of the Moon. There is a 30 minutes period where we can look at the spacecraft through telemetry and watch the - how the alinement goes prior to the time that we lose signal. We are 9 hours, 41 minutes away from LOS, but there is a half hour period when the spacecraft will be in the shadow of the Moon, and an alinement can be attempted. If we are unable to aline, we think that we can do the burn with the present alinement. The result so far of tracking since the last descent propulsion burn indicates that the present alinement is good. We are looking at a plan now that after the burn, we would power down to 17 amps; that's a minimum power down. With that power down, we have enough water to last to 155 hours, ground elapsed time. In addition to that, we would have the water from the portable life support systems. The water use rate at this

PAO 17 amp power usage would be 2.68 pounds per hour. These projections also include two power-ups for mid course corrections on their way home. And a procedure has been worked out to use the Command Module's lithium hydroxide cartridge for CO$_2$ removal and we are presently yawing manually 90 degrees every 8 hours for passive thermal control; after the burn, we may put a rate into the spacecraft, or roll rate into the spacecraft, and let it go and attempt to set up some type of passive thermal control that does not require complete manual operation. The Flight Dynamics Officer reports that if the burn is a reasonable one, that they would schedule mid-course probably at 24 hours out, instead of 12 hours. That would be an elapsed time of 4 hours. Stand by please.

PAO And we expect communications to improve a little bit after SIVB impact on the lunar surface; the SIVB frequencey is giving us a little trouble with communications after the impact we will not have to turn the transponder in the spacecraft off, during handovers between tracking stations. That's the situation as it stands now; we will keep you advised as to Flight Director Lunney's availability. This is Mission Control Houston.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Okay, Jim. In order to save on the an ampor 2 of power here, we'd like you to go to the downvoice backup comm configuration, which is pulling the power and circuit breaker and going to downvoice backup. If we get into a comm problem all you have to do is reverse that configuration and it should be good again. Over.
SC Okay, we'll go to downvoice backup and pull the power amp circuit breaker and if we get into trouble, we'll come back again.
CAPCOM Okay, real fine and we estimate the next yaw maneuver should start at about 68:02. Over.
SC Okay. Could you give me that in minutes?
CAPCOM I sure can. That's going to be in 29 minutes from now, Jim.
SC Okay. Thank you.
CAPCOM Okay.
SC (Garble).
SC Okay, Houston. We've downvoice backup and (garble).
CAPCOM Jim, Houston. Roger that. You are readable through the noise. How are we? Over.
SC You are loud and clear.
CAPCOM Very good.
SC (garble)
SC You're going to get (garble) configuration (garble)
SC (garble)
SC (garble)
SC Okay.
SC (garble)
SC (garble)
PAO This is Apollo Control at 67 hours 38 minutes. President Nixon talked with NASA Administrator Dr. Thomas O. Paine at 7:45 am CST today. Dr. Paine, who arrived in Houston by NASA aircraft at 6:40 am CST from Washington was in Mission Control and gave the President an update on the Apollo 13 Mission. Mission Control is in direct contact with the White House. We'll continue to stand by now for live air-to-ground transmissions.
SC How are the weather conditions?
SC (garble)

END OF TAPE

SC (GARBLE)
SC Roll. WE had battery power for a while (GARBLE)
SC Dock?
SC (GARBLE)
SC I don't think that was (GARBLE)
SC Garble
SC GARBLE time for egress. Ready to go? All power is GO.
SC GARBLE
SC I said we're going to get a (GARBLE)
SC GARBLE
SC Garble
SC We couldn't get the burn (GARBLE)
SC GARBLE
PAO This is Apollo Control. It's 67 hours 43 minutes. The lunar module is configured in a vox mode of communication and what you are hearing is the crewmen talking among themselves. They are not calling Houston. We are not in air-to-ground transmission but you will be able to hear the crewmen talking among themselves when they are in this mode.
SC GARBLE
SC Garble
SC GARBLE
SC (GARBLE) to get all this water out of here.
SC I'll set up (GARBLE)
SC (GARBLE)
SC (GARBLE)

END OF TAPE

SC (garbled)
SC I'll wake you up.
SC (Garbled)
SC Joe, I'm afraid this is going to be the last moon mission for a long time.
SC (garbled)

END OF TAPE

PAO This is Apollo Control at 68 hours 13 minutes. Flight Director Glynn Lunney and 4 of his Flight Controllers are on their way now to Building 1 for the News Conference. Flight Director Glynn Lunney and 4 of the flight controllers from his team are enroute to the Building 1 Auditorium for a News Conference. Accompanying Glynn Lunney will be Tom Weichel, the Retrofire Officer, Clint Burton, EECOM, Hal Loden

END OF TAPE

PAO - and Merlin Merritt,
SC (garble)
PAO This is Apollo Control at 68 hours, 17 minutes. An additional participant of the news conference will be Major General David O. Jones, United States Air Force, who commands the Department of Defense Recovery Forces.
SC (garble)
SC Yeah. There it goes through the (garble) now. Go the other way that you were doing. (garble) Is that back or forward?

END OF TAPE

SC GARBLE
SC GARBLE
SC GARBLE
SC GARBLE
PAO This is Apollo Control at 68 hours 21 minutes Apollo 13's distance from earth now is 200 thousand 396 nautical miles. Velocity 2919 feet per second.

SC GARBLE
SC GARBLE
SC ON.
CAPCOM Aquarius this is Houston. Go ahead.
SC Maneuver complete.
CAPCOM Roger, Jim we show you on telemetry. Looks solid at the new altitude. Just by way of information the latest tracking data shows Aquarius to be holding somewhere above 136 miles. The pad you have is still good, over.
SC Roger, understand.
CAPCOM Okay, and Jim we wonder whether you've attempted to get drinking water out of the command module proto tank yet it's a - is that going all right or do you have any questions on it. Over.
SC (GARBLE) Well the computer (GARBLE)
SC (GARBLE)
SC Yeah, 23 hours (GARBLE)
SC (GARBLE)
SC Yeah.
SC (GARBLE) out here nobody will do it.
SC GARBLE
SC GARBLE
sc You got a PLSS up? (GARBLE)
CAPCOM Houston to Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC As we approach the burn you want to go through the same check that we did for the last burn. That is we want to make sure we have everything powered up (GARBLE) direction. (GARBLE) we ought to have the procedures for powering up the command module again with the end of the (GARBLE)

END OF TAPE

SC (garbled) command module (garbled)
CAPCOM Okay, Jim. We copied that. First of all you want to go through the circuit by circuit breaker careful powered up procedure for the next DPS burn and we're working on that. (garble) want a procedure for powering the command module up again after we enter to power it up and (garbled) and we'll get both those for you (garbled)
SC Roger.
SC Joe, can you also get us an idea about how far out we can expect to make it for the command module batteries
CAPCOM Okay, Jack. It sounds as though we probably don't want to power up the command module before EI minus 2 hours. That doesn't mean we can't start our procedure a good deal before that, but we don't want to power it up much before EI minus 2. Over.
SC Okay. I was just thinking in case something we had the sort of problem here about how we would go about getting in the command module (garbled) we need to power up (garbled) in order to make it back into earth.
CAPCOM Right, Jack. It's quite clear that we're going to have to very carefully make up a full checklist for you on that, we'll do it.
SC (garbled)
SC I will, I think I have (garbled) get into the LM (garbled)
SC (garbled)
SC He had it figured out that splashdown (garbled) 133 hours (garbled) I think he had it (garbled)
CAPCOM Aquarius, Houston, over.
SC Go ahead Houston.
CAPCOM Roger, Jim. We just thought of something, namely that we probably should get the lithium hydroxide canister out of the command module reasonably soon just to make certain that they don't stay in there and possibly swell up till they'd be hard to get out. I wouldn't wake up Fred for that, but it's something you should do possibly before you go to sleep.
SC Roger, will do.
CAPCOM Okay.
SC Okay, (garbled)
SC Good morning, Fred-o. We're 68 hours (garbled) Did you sleep good?
SC (garbled)

END OF TAPE

SC How much water (garble)
SC (garble)
SC Residuals - (garble)
SC 33 (garble)
SC (garble)
SC We ought to be able to get on (garble) the other way (garble)
SC Should be checked out (garble)
SC Kinda wondering why (garble) 80 (garble)
SC (garble)
SC Well, they've all gone bad here.
SC (garble)
SC Hey Joe? (garble) Hey Joe, before this burn I want to get a 3-2 check (garble)
SC (garble)
SC That's getting a little better.
SC (garble) Jack, how you coming?
SC How is my intercom?
SC (garble) water out of here - (garble)
SC (garble) Okay.
SC (garble)
SC (a lot of garble and static)
SC Well, we don't (garble)
SC (garble)
SC (garble) we gotta go back into (garble) bach here (garble) and then come back (garble) let down.
SC (garble)
SC Hey, you know something? (garble) Man, that's out.
SC (garble) It'll drop there. (garble) We've done one just like it. (garble)
SC Hello, Houston; Aquarius.
CAPCOM Aquarius, Houston; did you call?
AQUARIUS Okay, you hear me Joe?
CAPCOM Not very good Jack; suggest that for communication here, we go to power amplifier circuit breaker in and function switch to voice.
AQUARIUS Okay, I didn't want to get through or anything - I just wanted to check and see if we had you at all in this mode.
CAPCOM Oh, yes we do have comm, but you are extremely noisy but if you read loud and slow we can copy.
AQUARIUS Okay. Joe, I read you loud and clear.
CAPCOM Rog, we understand, it is strictly a down link problem and you can stay in the down voice back up mode if you want, (garble) conversation (garble)

AQUARIUS How you doing Jack?
AQUARIUS Do you have an hour on your clock for Hey Joe, this is Aquarius; wonder if you can give me the GET time for initial power up?
CAPCOM Fred, Houston. Understand you'd like to know the GET of your initial power up, is that correct?
AQUARIUS Yeah, the second time
CAPCOM Okay, stand by.
CAPCOM (garble) in flight.
CAPCOM Aquarius, Houston; over.
AQUARIUS Go ahead.
CAPCOM Okay, we don't have a precise time for the starting of that procedure yet; we are working on it real hard. It won't be for several hours; but we'll pass it up to you just as soon as we get it. Over.
AQUARIUS Okay, and Joe you wanted to the (garble)
CAPCOM Stand by and I'll check.
CAPCOM Aquarius, Houston.
AQUARIUS Go ahead.
CAPCOM Roger Jim; we would like the next yaw maneuver in about 6 minutes; over.
AQUARIUS Roger
CAPCOM Okay.
AQUARIUS Hey Jack? (garble) antenna (garble)

END OF TAPE

SC (garbled)
SC Keep working at it.
SC (garbled)
CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay. Our estimate is that we will start powering up for the DPS burn at about 76 hours elapsed. This is about 6-3/4 hours from now.
SC Roger, Joe, understand.
SC Okay, Joe, about 76 hours or so and I guess (garble) good. The question was what was the GET way back when when I first came across to the LM and transferred to LM power? How long have we been living on the LM now?
CAPCOM Oh, roger. (garbled)
SC (garbled) over, Joe.
CAPCOM Aquarius, Houston. Over.
SC Go ahead Houston.
CAPCOM Okay, the time of transfer to LM power was 57 hours 11 minutes. For your information we seem to be reasonably fat on power. In fact, we are looking at a procedure that we might recommend to you later on after the burn and so forth of powering up one of the command module main buses via the LM umbilical. This would enable us possibly to charge up the command module batteries. Over.
SC Okay, Joe. That's great. I just thought that to pass the time I'd do a little back seat photographing here.
CAPCOM Roger.
SC (garbled)
SC How's the water doing?
SC How are you going to get it? Press the tank
SC How am I (garbled) Jack?
SC Take a check, Jack, and see how and see how we can (garbled)
SC (garbled)

END OF TAPE

SC (garble)
CAPCOM Aquarius, Houston, over.
AQUARIUS Go ahead Houston.
CAPCOM Roger — we request aft omni at this time; over.
AQUARIUS Aft omni.
AQUARIUS (garble)
AQUARIUS (garble) That search out is looking pretty good. (garble)
AQUARIUS (garble)

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 11:21A GET 70:07:30 236/1

PAO This is Apollo Control at 70 hours 12 minutes. Apollo 13 now 203 670 nautical miles from Earth, velocity 2910 feet per second. We'll continue to stay up live for any air-to-ground transmissions.

PAO This is Apollo Control at 70 hours 24 minutes. A decision has been made to perform the pericynthian plus 2-hour maneuver. This will be a DAP descent propulsion burn of approximately 900 feet a second, and will bring landing in the Pacific Ocean at 142 hours elapsed time. We'll be passing up to the crew a procedure shortly for them to perform a sun check in the alinement optical telescope of the lunar module so that we may better understand what the present LM inertial platform alignment is. If, as a result of this suncheck, the platform looks good, we will perform the maneuver without a platform re-alinement. If it does not look good and the limits on this have been defined as plus or minus 1 degree, we will do what is termed an earth-sun option alinement before going into the dark behind the moon, and setup the attitude of the space-craft so that the crew can mark on a good star while they're in the dark to check the earth-sun alinement that they will perform previously. Apollo 13 now is 203 957 nautical miles from earth; velocity is 2894 feet per second. Jim Lovell, the spacecraft commander, and Jack Swigert the command module pilot have just started a 6-hour rest period. Lunar Module Pilot Fred Raise is awake at the present time. We will be passing information on this decision up to the crew very shortly. This is Mission Control, Houston.

END OF TAPE

PAO the spacecraftt Commander, and Jack Swigert, the command module pilot, have just started a 6 hour rest period. The Lunar Module Pilot, Fred Haise, is awake at the present time. We will be passing information on this decision, up to the crew very shortly. This is Mission Control Houston.

PAO This is Apollo Control at 70 hours 32 minutes. The elapsed time of this planned lunar module engine manuever is approximately 79 hours 25 minutes. We expect to do the sun check at about 74 hours, elapsed time. We're now 6 hours 36 minutes away from loss of signal, when the spacecraft will go behind the moon. We'll stand by for any air-ground now.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead Houston.
CAPCOM Okay, Fred. I have a few words for you on some things we want to do in a next few hours and in order to get good COMM for that and also in order to get FIDO a few minutes of ranging I want to have you put the power amplifier circuit breaker in panel 16 in, the voice function switch to voice, and the range and function switch to ranging. Over.
SC Now I'm in normal voice and ranging is up.
CAPCOM Okay, Fred, and you're loud and clear down here now. Okay, what we're getting a procedure ready for you is to do a AOT sun check at approximately 74 hours or in just a little over 3 hours. That will be a detent 2, we'll have a detail procedure up shortly and it will include a rendezvous radar redesignation to get it out of the way and a P52 maneuver to the attitude. It's our feeling that if that checks out within 1 degree that your platform will be okay for the burn without a subsequent P52. If it's not within 1 degree, we are working up an earth/sun alignment procedure to align the platform and we'll have that up to you later. Okay, assuming that the sun check is okay, we will then give you a star for a confidence on the backside during the darkness. We'll be updating the burn pad to you prior to LOS going around the moon. We'll have another look at you after AOS and we'll update the pad if required. Right now that update should be very small. Over.
SC Okay, stand by one.

END OF TAPE

SC Okay, Joe, as I read that at 74 hours we're going to do a AOT sun check at descent 2, which is going to require the rendezvous radar out of the way and we do P52 auto maneuver to get there, or at least the angles on to that, and if this passes within 1 degree you're saying the platform is okay for the maneuver and we won't need a subsequent P52. But even if it is okay you'll give us a star which we can use for our check when we're in darkness. If this check flunks, you'll pass us on up then an earth/moon aline procedure.

CAPCOM Okay, Fred, that's correct, except the aline procedure we're working on is an earth/sun alinement, and other than that that's correct. Incidentally, this PC plus 2 maneuver looks like it will still be around a 900 foot per second maneuver and it will get you back to the mid-Pacific line at 142 hours.

SC Okay, that was an earth/sun check. We're getting a little close to the moon now, and the PC plus 2 maneuver still looks like about 900 foot per second to get us at mid-Pac at about 142 hours.

CAPCOM That's right.

END OF TAPE

CAPCOM Aquarius, Houston.
AQUARIUS Go ahead Joe.
CAPCOM Okay, Fred, we got a good batch of ranging and now we'd like you to reverse the configuration, ranging to off, voice (garble) to down voice backup, power amplifier circuit breaker out; we'll be talking to you.
AQUARIUS Stand voice backup with the power amp-- breaker open how do you read?
CAPCOM We read you satisfactory at present.
AQUARIUS Okay.
AQUARIUS Jim and Jack are in upstairs bedroom taking a nap now.
CAPCOM I didn't know that was upstairs.
AQUARIUS We have the first space station.
CAPCOM (laughter)
AQUARIUS Houston, Aquarius.
CAPCOM Aquarius, Houston; go ahead.
AQUARIUS Uh - one other thing you might have somebody look at - I don't want to bother Jack upstairs - the drain hose that we got in the command module, I wonder if there is some way it will plug into the PLSS later on and the command module water in to the LM via the PLSS
CAPCOM We'll see Fred. You're almost up with us; we are looking real hard at getting water from the command module waste tank into the PLSS, (garble) dump from the PLSS into the LM ascent stage. We think it is feasible, but we are checking it out to make sure.
AQUARIUS Okay.
AQUARIUS Okay, I have time to do another maneuver here Joe.
CAPCOM Okay, Fred; let me verify that.
CAPCOM Fred, Houston. That is verified. You can go ahead with the omni maneuver.
AQUARIUS Roger.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 12:28P GET 71:15:05 241/1

ALL DEAD AIR

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 12:52P GET 71:44:50 242/1

All Dead Air

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 1:08P GET 71:55:07 243/1

ALL DEAD AIR

END OF TAPE

WOMAN'S VOICE Hello, hello, je t'entendre.
COMM TECH Madrid COMM TECH Net 1.
SC Roger. Madrid COMM TECH. Read you loud and clear. How me?
COMM TECH Read you loud and clear.
SC Okay, thank you.

END OF TAPE

COMM TECH Madrid COMM TECH Net 1.
SC Roger. Madrid COMM TECH. Read you loud and clear. How me?
COMM TECH Read you loud and clear.
SC Okay, thank you.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Joe.
CAPCOM Roger, listen, Charlie Duke wants to talk to you about the AOT star check and so that we can have good COMM I'd like to reconfigure with the power amplifier circuit breaker IN, voice function switch VOICE. While we're at it we'd like the ranging function switch to ranging.
SC Okay, (garbled)
CAPCOM Aquarius, Houston. Over.
SC Houston, Aquarius.
CAPCOM Roger, Fred-o, reading you -
SC (garbled) Houston, Aquarius, go ahead.
CAPCOM Okay, Fred-o, reading you 5 by. The procedure I'm going to read up to you is the sun check for the — to see if we're going to need an alignment or not. If you'll get out your G&N dictionary and open it to P52, page 34, we'll start at the bottom. Over.
PAO The CAPCOM is Charlie Duke.
SC Okay, stand by one.
SC Sounds like you broke out, Charlie.
CAPCOM Yes, finally, Fred-o. I've no longer got the red spots. Okay, stand by Aquarius, we'll be back with you momentarily.
SC Okay.

END OF TAPE

CAPCOM Aquarius, Houston. You ready with your G&N diction aerial?

SC Okay, I'm on page 34 now looking at P52.

CAPCOM Okay Fred-o at the bottom of the page we want step 1. From the flashing 0406 we want option 3 and that'll pull us over to 6 and on the 5025 we want you to do an enter on the 5025 and that'll bring up flashing 0170 and load in R1 200. Over.

SC Okay, let me see if I'm with you. We call them P52 and on the flashing 0406 we pro on a 3 REFSMMAT which leads us to a flashing 5025. We enter on that on the flashing 0170 we want to enter a 200.

SC That's affirmative and after that you pro on that and you come up with a flashing 0688 and we'll have to load NOUN 88 and if you're ready to copy I have the sun half unit vectors at 74 hours GET. Over.

CAPCOM Okay. Go ahead.

SC Okay, sun at half unit vectors. Next R1 is plus .45498 Y plus 19024 Z plus 08250. Over.

CAPCOM Okay. We pro on after entering the 200. We'll get a flash in 0688, we then load the sun unit vectors for 74 hours which are R1 plus 5 correction plus 45498, R2 plus 19024, R3 plus 08250.

SC Roger. That's good. Is that all? And that'll bring you to step 8 and you get a flashing 5018 when you prow on the NOUN 88. Okay, at 5018 we want to do an AUTO maneuver to the attitude so just do the pro with the status control PNGS, mode control PNGS to AUTO and we'll take up the attitude and that's going to put us at - at attitude for the sun check. Now we're being a 1.4 degree deadband in this program in a docked configuration so to help you out you could call VERB 62 to get your needles - and when the needles go through 0 or no out and in that deadband then you take a look in the AOP and see how close the sun is and we want within plus or minus 1 degree. Over.

SC Okay so we have PRO on the NOUN 88 and we end up with a flashing 5018 and you want an AUTO maneuver rather than use the PTPA so we have PRO at the guidance PNGS. Mode control AUTO. We've got a 1.4 degree deadband. VERB 62 will give us the needles to try to zero them in and at that time I looked through the AOP and if it's like Apollo 11 sun check, all we've got to have is the sun somewhere in the - out there somewhere undecided as it passes, is that correct?

END OF TAPE

SC - somewhere in the - cross there, somewhere under the sun, and it passes, is that correct?

CAPCOM I think that is a little tight; that's about a quarter degree; we could go a little bit out of that; stand by one.

CAPCOM Fred, we'll get you an answer on that one, and also if you will stand by, we will give you a DAP load for this maneuver. Over.

SC Okay, we'll - you'll give us the DAP load.

CAPCOM Right. Stand by.

CAPCOM Aquarius, Houston; Fred-o, to pass that check, the sun is at - will set in an arc of one half degree in the AOP, so you can be 2 diameters off and still pass the check. Over.

SC Okay, just half a degree, and so we can be 2 sun diameters off and go past.

CAPCOM That's affirmative. And we want you to maneuver with a DAP of 2/10ths of a degree a second; over.

SC Okay, you want us to use the DAP of 2/10ths.

CAPCOM Okay, that DAP load Fred-o is 31120; over.

SC Okay, 31120.

CAPCOM Rog. Now if we pass that check, you can just terminate P52 right there, and we'll give you an atitude to go to a burn attitude and from this we can get a star check, if you don't pass, we would like you to do an alinement at 75 hours. And if you are ready to copy, we have some sun half unit vectors and some earth half unit vectors at 75 hours; over.

SC Stand by one.

CAPCOM Okay, go ahead for 75 hours - sun and earth half unit vectors.

CAPCOM Rog. First with the sun, for X plus 45 483 for Y, plus 19053, for Zebra, plus 08262 -

END OF TAPE

CAPCOM Plus 08262 earth half unit vector at 75 hours. Plus 32120 minus 34155, minus 17370 over.

SC Okay, sun data half unit vectors R 1 plus 45483 R2 plus 19053 R3 plus 08262 earth half unit vector R1 plus 32120, R2 minus 34155, R3 minus 17370.

CAPCOM Rog, Fred-o, good read back. Now on the Earth, we estimate if you have to do this alinement, that the Earth will be about a 2 degree turn, and it will be approximately three quarters lighted. Now to mark on the Earth, we would like you to take an imaginary line between the horns of the cresent, and mark mid way between the horns. Over.

SC Okay - we got a 2 degree Earth three quarter lighted and we are to imagine a line between the horns of the Earth and mark right in the center of that line.

CAPCOM That's affirmative. Now on this star check - correction - the sun check Fred, on the 5018 I got some FEAT angles for you if you are ready to copy over.

SC Okay, you are talking about the check at 74 hours GET right?

CAPCOM Roger - okay, its 74 hours, when you start this maneuver, the 5018 should look like R1 of 2703 degrees, pitch R2 is 0903, and R3 of 2908 over.

SC How about making all those 5 digit; readout read them again Charlie.

CAPCOM Okay. Pardon me. It's 27030, 09030, 29080.

SC Okay, the 5018 should look like R1 plus 27 030, R2 plus 09030, R3 plus 29080.

CAPCOM Rog. Good read back. Now we got one more procedure for you and right now we got the rendezvous radar stowed and we won't be able to see anything out of detent 2, so we would like you to position the radar to 0283 and we have a procedure for that - and we would like you to do that right before you get the attitude. Over.

SC Okay, stand by.

SC Okay, go ahead.

CAPCOM Stand by.

END OF TAPE

CAPCOM Aquarius, Houston. On those 58 teen angles we had at 74 hours, Fred, that was based on a VERB 49 to this attitude and they will be incorrect for the 2 axis maneuvers so you can just scratch them over.

SC Okay, you're saying the angles you gave me for the 58 teen, that was for a VERB 49, so they won't be good for the 58 teen and we should scratch them.

CAPCOM That's affirmative. Okay, if you're ready to copy I've got this rendezvous radar procedure. Over.

SC Okay, go ahead.

CAPCOM Okay, it's about a 10 stepper, but real easy. Okay, on CB 16 EPS inverter 2 CLOSE. CB 11 AC Bus A Bus Tie inverter 2 CLOSE. Panel 14 verify inverter switch 2. CB 11 rendezvous radar 2 CLOSE. Rendezvous radar RELEASE. Rendezvous radar to LGC on panel 3. Are you with me? Over.

SC Roger, I'm right up with you at step 6. Go ahead.

CAPCOM Okay, Fred, good show. Step 6: VERB 41 NOUN 72 ENTER, plus all balls plus 28300. Step 7: Monitor movement with VERB 16 NOUN 72. Step 8: CB 11 rendezvous radar 2 OPEN. Are you with me? Over.

SC Stand by one.

SC Okay, go ahead now.

CAPCOM Roger, step 9 is a VERB 44. Step 10: CB 16 EPS inverter 2 OPEN. Over.

SC Okay, I got it.

CAPCOM Okay.

SC Do you want a readback now?

CAPCOM I've got one more for you. You'll copy this and give me it all on the readback. Okay, once you get the attitude and you want to use the - you want to get the AOT lamp, we got to go CB 16 EPS inverter 2 CLOSE, CB 11 AC bus A AOT lamp CLOSE. After the P52, you can open CB 16 EPS inverter 2 and open CB 11 AC bus A AOT lamp and AC bus A bus tie inverter 2. Over.

SC Okay, stand by one.

END OF TAPE

SC Okay. Let's see if I got it all. Rendezvous radar in parking. First of all we want CB16, EPS Inverter 2 CLOSED, CB11, AC plus A, Inverter 2, CLOSED. Then on panel 14, verify inverter 2, select A. And CB11 rendezvous rad release panel. On panel 3 we want rendezvous radar to LGC, and then 41 down 72 ENTER with plus all zips plus 28300 in registers 1 and 2. Go on AGS. Then we monitor movement with the 1672. After it gets in PARK, CB11 rendezvous radar 2 OPEN, followed by VERB 44 ENTER. And CB16 EPS Inverter 2 OPEN. Now, when it comes time for the alinement to get an ALT AMP ED16, ECS Inverter 2 CLOSED EC11 18 BUS A ALT lamps CLOSED and after the alinement is completed at CB16, EPS Converter 2 OPEN, CB11 AC BUS A ALT lamp open, CB11 AC BUS A BUS 5 Inverter 2 OPEN

CAPCOM Good read back, Aquarius. To get those needles on the VERB 62, we got to power up the commanders FDAI and we'll have that procedure for you shortly. Over.

SC Okay.

SC Charlie, Jim here.

CAPCOM Roger. Go ahead.

SC Have you run a earth realinement on the simulator with docking simulation.

CAPCOM Is the question "Have we run an alinement in the dock configuration?" That is affirmative.

SC Okay. Did you have any trouble controlling the vehicle and what techniques did you use?

CAPCOM Briefly, to control PITCH and ROLL, use the TCCA, as we've practiced, for YAW you can use the ACA. Over.

SC Okay. You have no special technique going back and forth between the YAW and the X and Y lines. Over.

CAPCOM Not right now, Jim. Dave Scott's been running these things and we'll get them up to you shortly. Over.

SC Okay.

CAPCOM We think the alinement's going to be okay, so we don't have to do this P52 pull up alinement. We think the check is going to be okay. Like to remind you since you are in attitude, if check does not pass, since you are in attitude for the sun that we want the sun half unit vectors for us. Over.

SC Roger. Understand.

END OF TAPE

SC Roger. Understand.
SC Okay, Houston, it's been over an hour since we did our last PTC. You want us to go below now?
CAPCOM Stand by one. Over.
CAPCOM Aquarius, Houston. We'd like you to go ahead and yaw 90 for the PTC. Keep a close eye out on your middle gimbal angle. You're about 30 degrees from gimbal lock and we'll call you in OMNI switch about half way through the maneuver. Over.
SC Roger.
SC Okay, Houston, Aquarius, we'd like to know when you've had enough ranging so we can get the power amp back up again.
CAPCOM Roger, Fredo, we've got one more procedure and we can shut it down and that's to get the needles and the FDAI for this maneuver. That 5018 could take you to gimbal lock and we think it's a good idea to power up the Commander's ball. We've got a four stepper if you're ready to copy. Over.

END OF TAPE

SC Okay, go ahead.

CAPCOM Okay - verify that you got AC power, in other words, inverter 2 selected and the bus tie inverter 2 AC bus 8 closed. We'll be under flight displays, (garble) to closed, commander FDAI, closed. On the AC bus A, CB's gas to closed, commander FEAI, closed, over.

SC Okay, its verify we have AC which is panel 16 inverter 2 closed. CB converter 2 closed. There's a panel 11 on the flight displays - we want the (garble) to and the commanders FDAI breakers closed, also under panel 11, AC bus A again in commander FDAI breakers closed.

CAPCOM That's affirmative; over.

CAPCOM Aquarius, Houston, after the OMNI switch, we would like you to get the ranging off, the voice switch to down voice backup, and the power amp CB on 16 open; over.

SC Okay - after the OMNI switch, we'll get the power amp off and go back to down voice backup SPA and the ranging off. It's your call.

CAPCOM Okay, stand by. Fred-o, we got about 2 minutes to the OMNI switch, you can go ahead and power the ranging down to down voice backup and we'll give you a call on OMNI switch over.

SC Okay.

SC How do you read Aquarius?

SC Rog Aquarius, we are reading you about the same, about 2 by.

CAPCOM Aquarius, Houston; select 4 OMNI over.

SC (garble)

CAPCOM Roger.

END OF TAPE

SC Do you read down there Houston?
CAPCOM Apollo 13, Houston. We read you weakly. Go ahead.
SC OK Van if Buzz or Neil around you might ask them if they had to use the AOT lamps to shoot (garbled) I can't get them below (garbled)
SC Well, where's the (garbled)
CAPCOM Fred, breaking in. You're very weak. Understand if Buzz or Neil or down here you'd like to ask them if they used the AOT lamp to what? Over.
SC To see the (garble) Van, if might be possible to see the reticle without even having the light on.
CAPCOM Oh, I see, to see if it's possible to see the reticle with -

END OF TAPE

SC (GARBLE)
CAPCOM Oh, I see. See if it's possible to see the radical without the light on. Okay, we'll make a check. And one other thing, you might move that rendezvous radar antenna to PARK anytime now. You can start any time you want.
SC (GARBLE)
CAPCOM Apollo 13, Houston.
SC Go ahead, Ben.
CAPCOM Jim, Neal is here. He advises that you will not need the lamp on for the sun check but that you will need it on for the earth check. Over.
SC Understand.
SC Okay, let's PARK the radar. How long will it take?
SC Here Hold the light for me Jack (GARBLE) be able to go here. That's going down. That's ready. Let's build them up. Next plan. Let's - okay looks like we have all the (GARBLE) we can take.
SC You're holding like -
SC (GARBLE)
CAPCOM (GARBLE) Jim (GARBLE)
CAPCOM (GARBLE)
SC Okay, burn 2.
SC Okay, upside, burn 2.
CAPCOM Upside, burn 2. (GARBLE)
SC (GARBLE)
CAPCOM Okay, on 3B11 give me the ground to air breakers. 30 seconds spread (GARBLE)
CAPCOM (GARBLE)
SC (GARBLE)
SC Okay, go ahead.
SC (GARBLE) 30 seconds (GARBLE)
SC But you've got to think through.
SC (GARBLE)
CAPCOM Good.
SC (GARBLE) full.
SC Okay, valve 3 (GARBLE)
SC Still going good, right?
CAPCOM (GARBLE)
SC (GARBLE) by the way.
SC (GARBLE) dock. Command Module docking. Okay. Dock. Over there (GARBLE)

END OF TAPE

SC (garble) and verb 2 coming over.
SC Joe (garble)
CAPCOM Apollo 13, (garble)
SC (garble)
CAPCOM Roger. What direction; we think that the cheapest way for you to maneuver - change attitude is with minimum pulse. ATA. That's to do the star mark.
SC (garble) attitude for the stars (garble)
CAPCOM Roger.
SC And uh - just out of curosity, we got rid of the radar very nicely and (garble) aboard the digit is the docking light on the command module to do that. (garble) I don't think it will hurt our sun check; But it'll sure meke it easy to do.
CAPCOM Sorry, Jim, we are only reading you about 1 by 1.
SC Look at that big thing out there.
SC (garble)
SC Hey Joe.
SC It looks like a piece of wrapping for line.
SC (garbled)

END OF TAPE

SC (garbled)
SC Okay, I guess they can close it.
SC Okay, did you read your figures (garbled)
SC Yeah.
SC Okay.
SC (garbled)
SC Okay, (garbled) P52. What's our next (garbled)
SC (garbled) 73:30 (garbled)
SC Okay, Houston, Aquarius.
CAPCOM Go ahead Fred.
SC Okay, Jim thinks he heard something different than I copied on the DAP load. (garbled) REgister 1 supposed to be 31120?
CAPCOM That's correct, Fred. That was to be 31120.
SC Okay.

END OF TAPE

SC Okay.(garble)
SC (garble)
SC Well, we probably don't know what to do there (garble)
SC And Houston, Jim.
CAPCOM Go ahead, Jim.
SC Just want to get a time check with you. When do you want us to start powering up the ball (garble)
CAPCOM I understand you'd like to know when to power up the -
SC We seem to take about 15 -
CAPCOM - the ball.
SC Yeah. The ball inside the maneuver, we think it will take us about 15 minutes to get there. We want you to confirm that.
CAPCOM Stand by one.
SC (garble)
SC (garble)
SC The (garble) the command module or what?
CAPCOM (garble)
SC (garble)
SC (garble)
SC Okay, Houston, Aquarius

END OF TAPE

CAPCOM Okay, Houston, Aquarius. I'd just like to do a little sun check. Do you want me to do it now?

CAPCOM Jim, roger - we just came up with maneuver time of approximately 15 minutes so if you start anytime between now and about the next 2 minutes it would get you to ATTITUDE by 73:15. Over.

SC Roger. We'll start the maneuver at this time.

SC Okay, let's go.

SC (GARBLE)

CAPCOM Did you gas it?

SC Okay.

CAPCOM (GARBLE) on your (GARBLE) because a (GARBLE)

SC Okay. Adjust that OFF.

SC (GARBLE) 25 (GARBLE)

SC 4543. (GARBLE)

SC Houston, are you going into our P52 technique?

SC (GARBLE)

CAPCOM That's Apollo 13.

SC (GARBLE)

CAPCOM Jim, that's negative we don't have any data on you. Low bit rate.

END OF TAPE

CAPCOM - we don't have any data on you.
CAPCOM Low bit rate.
CAPCOM We don't have high bit rate.
SC Houston, do you read Aquarius?
CAPCOM Rog - reading you Fred; go ahead.
CAPCOM Aquarius, Houston, do you -
AQUARIUS Houston, Aquarius.
CAPCOM Reading you loud and clear; go ahead.
AQUARIUS Are you monitoring our P52 technique?
CAPCOM That's negative Jim; we do not have high bit data on you now. Over.
SC Okay, thank you.
CAPCOM Rog.
SC And be advised that we are getting several echos in our comm down link here.
CAPCOM Rog - we'll check into it.
AQUARIUS We are all AOK; no alinement.
CAPCOM Apollo 13, Houston.
AQUARIUS Go ahead Houston.
CAPCOM Jim - request you give us high bit rate now; we might be able to fix you up on 120 antenna.
AQUARIUS Okay — high bit rate.
CAPCOM Rog.
SC (garble) Yep.
SC And - zero, zero, zero.
SC Yep.
CAPCOM Apollo 13, Houston.
SC Go ahead.
CAPCOM Fred, we can't lock up on your high bit rate; request you go back low bit rate.
SC Hey we lost you there.
CAPCOM Rog - advise we are not locking up on your high bit rate so you can go back low bit rate; over.
SC Low bit rate.
SC (garble)
SC (garble) right here Jim. There it is. (garble) looks like (garble)
SC I don't have all the confidence in the world in this earth-sun.

END OF TAPE

SC and I have all the confidence in the world in (garbled)
SC You know how many times I screwed up on my arthmetic.
SC Yeah, don't count your chickens before they hatch.
SC I'm not.
SC We're only going to be 2 diameters out, huh?
SC Yeah.
SC Okay, tell me when that JV gives to get the lamp on in case I don't need it.
SC They'll have to give you AC again and you punch in your breaker (garbled) I've still got HP ON for the FDIs. It's not sensing now. All you need is to throw lamp breaker in (garbled). The ac bus A (garbled)
SC Let me know when he starts going.
SC There's the sun. Give me the - give me the AOT. Okay, never mind - I don't need it. Go ahead. I got it. Never mind.
SC Radical brightness oneend up. Got the radical?
SC I got the radical up.
SC (garbled) Call it Jack, you can see it better.
SC (garbled)
SC Okay.
SC (garbled)
SC Show that we got it take a look.
SC Yeah, I showed about maybe a third of a diometer to the left.
SC Okay, take it look.
SC Check your needles, you're off in roll, Jim.
SC Roger.
SC (garbled)
SC It brings it in. Say when.
SC Okay, we got it. I think we got it, say of 1 diometer of it.
SC Yeah.
SC Put it back in.
SC (Garble)

END OF TAPE

sc Yeah, you all come back here.
SC (garble)
SC (garble) just about it.
SC (garble)
SC What have you got?
CAPCOM (garble)
SC We've got it.
CAPCOM (garble)
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Okay, it looks like the (garble) checked out.
CAPCOM We understand it checks out. We're kind of glad to hear that.
SC It's not quite centered, but it's got a diameter a little bit to the left - roll the diameter just to one side.
CAPCOM Sounds good.
SC Now, let's get the (garble)
SC Okay.
SC (garble)
SC Okay.
SC (garble)
SC (garble)
SC (garble)
SC And, Houston, can we proceed with our power down now ball back off and (garble) etcetera at (garble)
CAPCOM Stand by on that one for a minute please.
SC The ball (garble)
SC Okay, we're holding right now and get to the next (garble) to go to, Vance, and we will work on getting there while we still have the ball.
CAPCOM Roger. We copy.
SC It's hard to hear you.
SC Okay. 74 loaded.
SC Garble
Sc Yeah. We're not there yet, really. I've got 11 minutes to check ceilings out.
SC Garble
SC Yeah. Bring your foot down. (Garble)
SC It's low.
SC Get set.
SC Keep talking. It's better in here. I can control now (garble).

END OF TAPE

CAPCOM Apollo 13, Houston.
SC 13; go ahead.
CAPCOM Jim, in a moment we will have an attitude for you to go to and recommend that you keep your FDI up while maneuvering to that attitude. After you get there, then we will have you widen the dead band and eventually go into a PTC about the burn attitude.
SC You were cut off.
CAPCOM Rog. We will have an attitude for you to maneuver to in a moment. And you should leave your FDI up for that.
CAPCOM The attitude is as follows if you are ready to copy; over.
SC Got the book? Go ahead Vance.
CAPCOM Okay, this is FDAI attitudes for the maneuver. Yaw 060 degrees, pitch 083 degrees, roll 272 degrees
SC Let's read that in the R1, R2. I don't want VERB 69 twice. I want VERB 49, 58 (garble) so I can fly the needle.
CAPCOM Jim. Those are not VERB 49 angles. Those are strictly FDAI attitudes, over.
SC Okay. I understand Vance. It's much easier if the ball is up, to fly the needle, then that would get to be a drift of VERB 49, 58 G maneuver. We could fly that manually.
CAPCOM Stand by. We'll try to get you the Verb 49 angles.
SC Flying on maneuvers. (garble)
SC On that last check, what did it look like?

END OF TAPE

SC This is the first 3-man LM we've had.
CAPCOM Apollo 13, Houston.
SC What hack you've got now on GET.
CAPCOM Okay, stand by on that, Fred. First, let me read up your VERB 49 attitude if you are ready to copy
SC Go ahead
CAPCOM Okay.
CAPCOM YAW 27100 PITCH 35500, ROLL 33000. Over.
SC Keep it AUTO maneuver there.
SC Okay. VERB 49 plus 27100, PITCH plus 35500, ROLL plus 33000. And do you think it's cheaper to manually make that maneuver or take the .4 degree range and go in AUTO maneuver.
CAPCOM Fred, we're recommending AUTO maneuver. Over.
SC Okay. AUTO maneuver and could you give me a GET right now.
CAPCOM Okay. I understand. You want GET of the burn. Stand by one.
SC Hey, Vance, what is your clock reading right now?
CAPCOM Okay. When I give you a hack, it will be 73:59 and that's about forty seconds away.
SC Okay. I think we will make one last check there with the half-unit vectors for 74 hours before we leave this attitude.
CAPCOM Okay. And I'm going to calculate in the two seconds in giving you the time hack coming up on 735900 when I give the mark. Okay, stand by, MARK.
SC Looked good.
CAPCOM Okay. I understand you. Good.
SC Want me to Proceed one more time on that check?
SC Roger. Yes. Go ahead.
SC Pitch is on.
SC Oh, it's on, it's a sinner.
SC That's it, she's right on film. Okay. I have too. That's better than I expected.
SC Okay. Let's do a VERB 74 and get out of here.
SC If we can. Go to P00? Okay, I'm going to go to -
SC Okay. Let me see.

END OF TAPE

SC Well it didn't show it pitching, here (garble). I think I'll proceed (garble) that's roll, pitch and yaw.
SC Roll, pitch and yaw.
SC (Garble) - yaw.
SC Yes.
SC The roll's starting to go in here. but the yaw will be off the (garble).
SC Yes.
SC (Garble) procedure, or don't you have a procedure list?
SC Roll, pitch and yaw, but drift for one. That would be gimbal log if it wasn't for being off (garble).
SC And, Houston, I see that this maneuver gives us a roll of 27172; a pitch of 08301. You know what they gave us?
CAPCOM This is Houston. Please repeat.
SC That was Houston. Please repeat.
SC Houston. Did you give us VERB 49 in yaw, pitch, and roll; or register 1, 2, and 3?
CAPCOM We gave it as yaw, pitch, and roll.
CAPCOM We gave it as yaw, pitch, and roll.
SC Okay, we read it as roll, pitch and yaw.
CAPCOM We copy that.
SC (Garble).
CAPCOM Okay, Jim. We read it to you as yaw, pitch, and roll, and we should have given it to you registers 1, 2, and 3; but we did not. So register 1 is 33000; register 2 is 35500; and register 3 is 27100.
SC 234, Jim.
SC Okay, Vance. Register 1 will be 33000; register 2 35500; register 3 27100.
SC Okay, (garble).
CAPCOM Hey, Fred? Standby on this -
SC Okay.
SC Plus 27100.
SC Okay, standby (garble), you can enter - the (garble).
CAPCOM Okay, Apollo 13, Houston.
CAPCOM Okay, Apollo 13, Houston.
SC Go ahead.
CAPCOM Okay, Jim, we sorted it out, and it is correct the way we gave you the first time. So, R1 27100; and in the LM that's yaw. R2 35500; and that's pitch; R3 33000; and that's roll in the LM. Over.
SC I heard you. Okay, 58D, it's there; and 58D and that's what it will be. Okay.
CAPCOM That's right. That's VERB 49.
SC That's right VERB 49.
SC There're 25.
SC Yes, I get -
SC 25, ENTER.

SC Okay, plus 27100, plus 35500, plus 3300 —

END OF TAPE

SC (garble)
SC Yeah. Okay.
SC Set.
SC So far we're (garble)
SC What can we do about it?
CAPCOM Apollo 13, Houston. You better watch that middle gimbal. Over.
SC Roger. We're watching that middle gimbal. We have as a roll 271 72. Our yaw is - punch register 3.
SC 3300. How did we get this?
SC (Garble)
SC (Garble)
CAPCOM And Apollo 13, we have a procedure for you describing how to widen the dip end to 5 degrees later on. But stand by for that.
CAPCOM Apollo 13, you're heading for gimbal lock. You better stop everything.
SC Yeah we're back in AD HOLD now. We're trying to stop it.
CAPCOM Rog.
SC We're having to roll it -
SC Can you give me roll (garble) now, Jim.
SC Yeah.
SC That's great.
SC I don't understand why we got that.
SC (Garble)
SC Pitch.
SC It's down.
SC Yeah.
SC What?
CAPCOM Apollo 13, Houston. It looks like VERB 49 maneuver. Will just take you right through there. You're going to have to go around it. Over.
SC Okay. That's what we're in the process of doing.
CAPCOM Si, Si.
SC We're manually working over here on the vents.
CAPCOM Okay.

SC Pitch is 083.

END OF TAPE

CAPCOM Okay.
SC 6083.
PAO That's John Young talking to Apollo 13 now.
SC 58 G's. That looked good. Yaw 231. I think they screwed up on our, our numbers again. Zero out the needles, we're heading that way, and then we'll stop and talk about it. (garbled).
SC (garbled) Dick should be up here. Then particularily (garbled). What's the number, valve temperature.
SC (garbled) Going the wrong way. (garbled) yaw 62. 30 yaw 0 yaw.
SC I can roll. Okay. What's that read, there's 180 low. (garbled) over here. Houston, 13.
CAPCOM Go ahead, 13.
SC There's something screwed up in our burn attitude. We're not getting the proper readings on the ball and the needles are centered. I'm not too sure what's wrong. Let's go through this procedure again.
CAPCOM Okay. Stand by one, let us look at it...
SC It was (garble) angles you gave us on correlating the VERB 49 numbers.
CAPCOM Okay, we'll check into it.
SC We know the ball is good. Why don't we just go to forty?
SC You better watch out, it's getting that way again. Yes.
CAPCOM Apollo 13, Houston.
SC Go ahead, Houston. Okay, Jim, to answer your last question, do you have PGNCS checklist number 57 handy?
SC Alright, we do, I'll check it.
CAPCOM As soon as you open up to that, I'll explain it.
SC Okay, Go ahead, Vance.
CAPCOM Okay. Under VERB 49, crew defined maneuver, the flashing 0622 are the angles that we gave you that...

END OF TAPE

CAOCIN - 2 of the angles we gave you that were loaded. The flashing 5018 actually represents FDAI angles and so what you read on 5018 should not correspond with NOUN 22.

SC Yes. We appreciate that, Vance. It's just that right now we're trying to follow (garble) that appear to be possibly taking us away from the place we know we want to be in the ball.

CAPCOM Okay. You're tending toward the gimbal lock again.

SC Roger.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM 13, request you put in the power and circuit breakers so that we can take a look at your angles.

SC We got it.

CAPCOM Thank you. And now your high bit rate.

CAPCOM Okay, 13, we're getting your high bit rate now and taking a look at your angles.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Okay, Jim, we just took a look at your angles and you're looking good here and your PGNCS is looking good. We can't yet explain the attitude air needle thing, but I suggest you continue on in your maneuver.

SC Roger. Okay. We've just about gotten roll

CAPCOM 13, Houston. We see you now in the AUTO maneuver and how are your air needles looking now?

SC Okay. They look like they are working their way in, Vance.

CAPCOM Okay. You think maybe they are working right, eh?

SC Yes. Because they got a 270 degree roll, I think the YAW needles are reversed.

CAPCOM Okay.

CAPCOM Fred, you are starting to fade out. Request AMP OMNI, OMNI AMP.

SC Okay. You've got AMP OMNI.

CAPCOM Thank you.

END OF TAPE

CAPCOM 13, Houston.
SC Okay, Houston, Aquarius. We appear to be there - at the burn attitude. And now do you want us to continue the DAP.
CAPCOM Roger, Jim. We have a procedure to give you for widening the DEADBAND to 5 degrees for the PTC in the next 3 or 4 hours, if you're ready to copy.
SC Okay, standby.
SC Go ahead.
CAPCOM Okay, VERB 21, NOUN 01; ENTER. 3011; ENTER, 44; ENTER. Now, that's the procedure for widening the DEAD-BAND to 5 degrees with the DAP. Later on, prior to the burn, you would return the DEADBAND to 1.4 degrees, and if you're ready to copy I'll read you that.
SC Standby.
CAPCOM Okay.
SC Go ahead.
CAPCOM Okay, to return the DEADBAND later to 1.4 degrees: VERB 21, NOUN 01; ENTER. 3011; ENTER, 200; ENTER. Over.
SC Okay, Vance. To widen the DEADBAND, we'll ENTER a VERB 21, NOUN 01; ENTER; 3011; ENTER; 44; ENTER. Before the burn to go back to narrow DEADBAND; VERB 21, NOUN 01; ENTER, 3011; ENTER, 200; ENTER.
CAPCOM Roger, readback correct.
SC And, Houston, I'll guess we'll do this PTC and yaw, and do you want the ball powered down?
CAPCOM Standby.
CAPCOM Okay, Apollo 13. Over.
SC Go ahead.
CAPCOM Okay, that's affirm You'll be doing the PTC in yaw, and we'll give you a call at each time you change yaw attitude. Aside from that, request low bit rate off; then downvoice backup off; then power amp off; and then FDA off.
SC Okay, Vance. On the power down we go low bit rate; downvoice backup we'll pull the power amps breaker; and we'll power down the FDI and the AC.
CAPCOM That's affirm. And the AOT, too.
SC Okay, you all set for a (garble).
SC Okay, Houston, Aquarius. How do you read downvoice backup?
CAPCOM Reading you loud - loud and clear now, Fred.
SC Okay.
SC Vance. Do you want to stay at this attitude, for a certain length of time before we start maneuvering?
CAPCOM Roger, Jim. We'll keep you there for about an hour, and then we'll have our first 90 degree rotation.
SC Okay.
SC How light do I leave the DEADBAND?
CAPCOM Say again.

END OF TAPE

SC ..work yet on the LM. Stand by forward, I'll need you to...
CAPCOM Apollo 13, Houston. Forward OMNI should be best.
SC (garbled)
SC while we're at it (garbled) and it depends on where I find (garbled). Got it.
SC Ohhhhh. (garbled)

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Fred, one point on the PTC requests that about an hour or less from now when you make your 90 degree change that you do it in PGNCS AUTO as opposed to AT HOLD. The reason is that if you're in an AT HOLD, it establishes a new NO POINT each time you stop the maneuver component.
SC Okay. You want us to make the maneuver with PGNCS AUTO rather than the PGNCS AT HOLD. Is that right?
CAPCOM Yeah. That's correct.
SC Okay.
CAPCOM And Fred, advise that it is a manual maneuver.
SC (Garble)
CAPCOM 13, Houston. You'll be using X axis override. It will be a manual maneuver but with the PGNCS AUTO mode.
SC Okay.
CAPCOM And if you're ready to copy Charlie is going to be on in a minute with some recommended checklist changes for your upcoming burn.
SC Okay. Stand by 1.
SC Are you ready (garble).

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 4:06P GET 74:53:00 271/1

PAO This is Apollo Control, Houston, it's 74 hours, 53 minutes. In Mission Control we've had a change of shift. Gene Kranz White Team now aboard. Presently our space digital display -

CAPCOM HOuston, do you read us?

SC Okay. Which book do you think you'll be putting words in, Charlie.

SC Houston, Acquarius, which book do you want us to have out? (Garble) the contingency QR.

CAPCOM This is Houston, Aquarius, say again over.

SC Houston, Aquarius, which book do you want me to update here, Charlie, the contingency QR dips.

CAPCOM Okay, Fred-o, we'd like you to get out the contingency checklist, turn to page 1, two hour activation. Over.

SC Okay. Right now.

CAPCOM Okay. On page 1 the only thing we have to do is EPS activation, step 2, CB16, DPS display closed. Over.

SC Okay. On page 1 DPS display closed under EPS activation step 2.

CAPCOM Okay. Turning over to page 2, we'd like you to complete steps 5 and step 6 with the following changes. Power temp monitor, AC bus, inverter 2 then inverter 1. Fourth line CB11, EPS inverter 2 open. Over.

SC Okay, on step number, page 2 we should do step 5 and modify step 6 to read inverter 2 then inverter 1, to the last line of step 6 CB11, EPS inverter open.

CAPCOM Okay. That will be on CB16, Fred-o old buddy. It's inverter 2 open. Okay, on the mission timer activation. Do step 1, correction, lines 1 and 2. Omit set mission timer on CSM mark and insert VERB 16, NOUN 65, set mission timer. Over.

SC Okay. We'll do the mission timer activation except we'll set it on VERB 16, noun 65.

CAPCOM Okay. Proceeding on to step, correction, page 3, CWEA checkout. Step 1, perform step 1. Warning lights will be -

END OF TAPE

SC (garbled). Perform step one. Warning lights will be basset press CES AC and CES DC. Under the caution lights we may have a heater light, and that's all. Okay, perform, under the circuit breakers, 16...

SC Switch to OMNIS.

CAPCOM Say again, over.

SC Switch to OMNIS.

CAPCOM Understand. Switching OMNIs over.

SC How do you read me now?

CAPCOM Okay, you're a little better. How me? Over.

SC Okay, Houston. Coming in loud and clear I got you caution and warning check out. Step one, the warning lights we will have will be access press CSAC CSDC. The only caution lights that we have will be heater lights and go ahead with C from there.

CAPCOM Okay, good. The component lights, we won't have the H2O SEP. Okay, on CB-16 right under that, heater display close. You can scratch that out. Perform all of step two and perform step four with the following changes. On panel 11, under AC bus B, are you ready to copy? Over.

SC Go ahead.

CAPCOM Okay, under AC BUS B, S-band antenna open, 4-D open. Under AC BUS A, tape recorder open. Row two under RCS systems A main off. Starting with a quad TCA's all four closed. Under flight displays, cross, commander cross pointer, open. (garbled) open, 4-D, open. Row three, under heaters, rondevous radar standby open, landing radar open. Under staff control, additude direct control close. Under ED, logic power A open, and under lighting utility open. Are you with me? Over.

SC Yes. I'm still with you, Charley, go ahead.

CAPCOM Okay, putting on a good show. On roll 4 starting with ECS suit fan 1, close. Block off auto transfer close. Under calm, VHF B transmitter open, VHF A receiver open. Under PGNCS signal strength display, open. IMU operate close. Under EPS row 5, cross tie BUS open. And, inverter 1 close. Over.

SC Okay, stand by just one.

PAO That's Charlie Duke at the capsule communicators position, passing up contingent, changes to the contingency procedures, to Fred liaise aboard Aquarius. We're at 75 hours 02 minutes now into the flight continuing to monitor this is Apollo Control.

SC Okay, panel 11 configuration, top row AC BUS B, I want the S-band antenna open, RD open AC BUS A tape recorder, open. Second row, under RCS system A on main quad zero quad one...

END OF TAPE

SC under the RCS system A on main (garble) through quad 1 TCA ALL CLOSED. Commanders X-pointer on the flight displays OPEN. Quads OPEN, (garble) OPEN. Third row, rendezvous radar standby heater OPEN, landing radar heater OPEN. Under staff control attitude direct breaker CLOSED. ED logic power A OPEN, lighting utility OPEN. Under ECS (garble) 1 CLOSED. AUTO transfer CLOSED. Under COMM VHF B is trasmitter OPEN, VHF A receiver OPEN. Under PGNCS, signal strength display OPEN, IMU operate CLOSED. Bottom row, EPS crossside button OPEN; inverter 1 CLOSED.

CAPCOM Roger, Fred. Good readback. Starting with panel 16. Under flight displays row 1. SE cross (garble) OPEN. RCS system BRAVO. QUAD 1, TCA's CLOSED. QUAD 2, CLOSED. QUAD 3, CLOSED. QUAD 4, CLOSED. Second row. Under lighting. Flood is your choice. You can either use them or not. Under ED, logic power BRAVO OPEN. ECS suit flow control, OPEN. Third row. Under COMM. Display OPEN. VHF A transmitter OPEN. VHF B receiver OPEN. S-Band antenna, OPEN. Fourth row. Under heaters, display OPEN. Under EPS, inverter 2, OPEN. And that's it. Read back. Over.

SC Okay, panel 16. Top row. Flight displays System Engineer Crosspointer OPEN; RCS system B, QUADs 1 through 4 TCA's all CLOSED. Second row, lighting. Flood, we'll probably have open - our choice. ED logic power B, OPEN. ECS suit flow control, OPEN. Under COMM, display OPEN. The VHF A transmitter OPEN. The VHF B receiver, OPEN. S-band antenna OPEN. Bottom row, heater display OPEN. Under EPS, inverter 2, OPEN.

CAPCOM Rog. Good readback. Okay, continuing on. Nothing on page 6, nothing on page 7. Nothing on page 8 or 9. Nothing on page 10 or 11. On page 12, we went to -

SC Hold on just a minute, Charlie.

CAPCOM Okay.

PAO We're now at 75 hours 6 minutes in shore distance away from the moon of 5828 nautical miles. 13 now traveling at 4497 feet per second relative to the moon.

SC Okay. Go ahead, page 12. I'm there.

CAPCOM Okay Fredo. On page 12, we want the MSFN update. We've got some vectors for you and a P-30 pad. And when you get to that state, we'll let you know when we want to uplink. Okay. Under AGS activation inself test, perform the entire procedure. On page 13, under AGS aligned. Do step 1 under DAP SET Gimbal Throttle

CAPCOM Test. Do step 1 with the following change. Under throttle control, we want it AUTO. Over.

SC Okay. I'll catch up here on page 12 -

END OF TAPE

SC Okay. I'll catch up here on page 12. You'll give us a MSFN update, some vectors and a P30 and we're to do the entire AGS activation and self test. On page 13 we'll do the AGS align amd imder DAP set gimbal throttle test, step 1, changed thrttle control manual to throttle control AUTO.

CAPCOM Good readback. Turning over to page 14 step 2. We want you to change the DAP NOUN 46 to 31021, then after the NOUN 47 insert VERB 34 ENTER. Over.

SC Okay. On page 14, a VERB 48 dap load, NOUN 46 changed to 31021. I assume you will give us any updated weights if we need any and after the NOUN 47, a VERB 34 ENTER. So, you say our gimbals look all right.

CAPCOM That's affirmative on the gimbals, Fred. Nothing else on page 14, proceed to page 15 and under RCS checkout, we'd like to scratch that wording and just say verify the following switches. Guidance control PGNCS, step 3, correction, it's line 3 change attitude control 3 to mode control. Mode control both to AUTO. Verify ACA prop, LMP enable, ACA 4 jet, LMP enable, TTCA translation LMP, enable. That is all on page 15. Over.

SC Okay. On page 15, we'll change the heading RCS checkout to verify following switches and those switches are guidance control PGNCS, third line attitude control 3 to mode control now, and then mode control both to auto and ACA prop, LMP enable, ACA 4 jet, LMP enable, TTCA translation , LMP enable.

CAPCOM Roger. Now stand by one.

SC Okay. Hand me the Ip's, I've got Scorpio.

SC You have.

SC Yes. In the Antares.

SC Where's the other one. I'll put it back in here.

CAPCOM Hello, Acquarius. Houston. On activation page 16 if you are ready. OVer.

SC Okay. Stand by just one, Charlie.

SC Jim is going to fish around. He thinks he's got Scorpio. I'm the AOT now. Okay, Charlie, go ahead I'm on 16 now.

CAPCOM Okay. Fred. On page 16, perform the dot DIPS burn PGNCS that entire sequence down through the end of the page except cross out that CSM maneuver to burn attitude then CMC free. Over.

SC Yes. I got introduced to that one, Charlie, page 16 dot DIPS burn PGNCS except we'll forget the CSM maneuver.

CAPCOM Okay. And you can forget the APS followup too. Okay, on page 17 perform all of the AGS entries and at four minutes we've got a change first line CB16 inverter 2 closed, line 2 scratch out select inverter 1. AT proceeding on down the page after attitude monitor, we'd like you to place the rate scale to 25 degrees a second. Okay.

END OF TAPE

CAPCOM - to 25 degrees a second. Okay, proceeding on down four more lines to balance couple, we'd like to turn balance couple off, that's to keep the upfiring jets off of the CSM; in case we have to damp any rates in AGS; though we don't think we will. Then perform the rest of that page as written. Over.

SC Okay, on page 17. Do the AGS load at minus 4 minutes; it's CB11 inverter 2 closed; and scratch select converter 1. Rate scale changed to 25 degrees a second. Balance couple we'll turn to off; and incidentally, on the AGS dampen rates point, it brings up the discussion we'd had before Charlie on takeovers. You might discuss what it's going to cost us DELTA-V wise, if we get a control problem, to just shut her off and it take 30 minutes to regroup for a good manual burn.

CAPCOM Fred, we already got that story for you, pretty well in hand. We're reviewing it right now. And I'd like to defer that question until later on. Basically, we're just going to shutdown and take what we got, and we got a midcourse of about - the maximum of 5 foot per second, any where in the burn to get back to a free return. That - that's basically the story, we'll give you the mission rules for this burn, momentarily. I'd like to proceed on to page 18, at minus 1 minute, scratch MASTER ARM, ON. Standby.

SC Okay, on page 18, and I've already done that at 1 minute, MASTER ARM, ON; I'll scratch.

SC Flip (garble) the way you do.

SC I've already scratched and CB16 abort stage closed for the previous burn.

CAPCOM Okay. Now, we want you to close the CB16 abort stage. Over.

SC Okay. You got some special reason for that?

CAPCOM Yes, sir. We'd like - in case we don't get a manual ON - I mean, a auto, ON, we're going to backup using the abort stage in the descent engine command override at a ignition plus 1 second. Backing up to page 17, at minus 4 minutes; you read CB11 inverter 2, it should be CB16 inverter 2. Over.

SC Okay, I got that, Charlie. 17, CB16 inverter 2 closed.

CAPCOM Okay, back to page 18. We'll continue on as is at 30 seconds, 10 seconds, 7 seconds, minus 5 seconds. At ignition, no ignition and we'll add here; no ignition start pushbutton, push; still no ignition; descent engine command override, ON. Over.

SC Yes. I got out there, but I can't get this hose (garble).

SC Okay, channel on page 18, right on down the line; everything holds until after ignition; if no ignition start pushbutton push; still no ignition, keep the engine command over at switch ON.

CAPCOM Okay, good readback, Fredo, at plus 15 seconds, scratch MASTER ARM, OFF; and at - proceeding on down to at engine cutoff. It's after the mode control PGNCS to at HOLD, we'd like a VERB 76, and then damp excessive rates via the LM Y-Z translation. Over.

SC Okay, scratch MASTER ARM, OFF at plus 15, and an engine cutoff after mode control PGNCS, at HOLD, we want a VERB 76; ENTER, and damp excessive rates via LM Y-Z translation. And a question on the - propellant quantity, we expect it to get down below a 37 percent on this burn and -

END OF TAPE

SC We expect it to get down below that 37 percent (garble).

CAPCOM That's negative. In this burn we're looking at not reaching 37 percent so I don't think we'll have to perform that step but we will verify that for you Okay. One other step at engine cutoff. Get manual start then at 30 feet per second to go throttle to 40 percent at DELTA V equals zero stop pushbutton push. Over.

SC At manual start that was throttle to 40 percent at, was that 30 feet per second to go?

CAPCOM That's affirmative. 30 foot per second to go.

PAO This is Apollo Control, Houston,

SC Stop push button at V going for zero?

CAPCOM That's affirmative. What we want to do, if we got a manual start, we're going to have to shut down manually and to get a better guided cutoff at 30 foot per second to go, we want you to throttle a 40 and acceleration is within reason there and we feel like we can get a good manual cutoff. Over

SC Okay.

CAPCOM Okay. Now, Fred, that was good in the checklist. That's all. We'll have the power down checklist for you momentarily and we'd like to ask you if you plan to use the DPS burn for it. If you do, we have some changes to that. Over.

SC (garble).

CAPCOM Let me know when you are ready to copy. Over.

SC I'm ready.

CAPCOM The first two lines are okay. CB, third line, CB11 and 16, staff control all closed except CB11, AEA open, abort stage open, AELD open. CB16, AELD open. Over.

SC Okay, on the DPS burn chart third line should read CB11 and 16 staff control all closed except CB11 AEA open abort stage open, AELD open CB16, AELD open.

CAPCOM Okay. Good readback. Proceeding on down the page. Balance couples switch, balance couple OFF. Okay, down to the TTCA, the last line before minus 2 minutes TTCA commander throttle minimum, LMP TTCA to jets at minus 2 minutes, scratch 400 plus 1. At minus 1 minute scratch master arm ON. At minus 10 seconds add manual ullage. At plus 5 seconds scratch descent engine command override ON, add TTCA 40 percent. Okay, the same comments apply about the manual START. At the ignition time if no start, manual start pushbutton push, there's still no start, descent command engine override eN. And the same comments apply to shutting down at manual start. Over.

SC Okay. the same comments. I'll start at the top here. Okay. Balance couples should be changed to off. Under TTCA it should be on TTCA -

END OF TAPE

SC the balance couple should be changed to off. Under TTCA it should be LMTTCA to jet scratch 400 plus 1 minus 2, scratch master arm on minus 1, add minus 2 seconds manual ullage. Add ignition, add the comment about the no start, start push button push still no start, descent engine MAN override on. That's a plus 5 second point, scratch descent MAN override on and add TTCA to 40 percent and the same comment applies at engine stop performing. Confirm.

CAPCOM Confirm. Roger, Fred on that. We aren't also at minus 30 seconds, we aren't looking at an AGS burn so you can scratch, abort push button push, and at Delta V equal to zero, scratch abort push button reset. Over.

PAO We estimate the change of shift briefing to start in about 10 minutes. Dr. Paine will be available to meet with newsmen in the auditorium immediately after the change of shift briefing.

SC abort push button reset, scratched.

CAPCOM Okay, you got it Babe. We'll have some Mission Rules for you momentarily and the power down checklist and also a PTC set up. Over.

SC Okay. Houston, Aquarius.

CAPCOM Go ahead, Jim, over.

SC Roger. Be advised I am now seeing Antares and Nunki in the AOT and I just wanted to know what you want me to try to do (garbled)?

CAPCOM Roger. Stand by. We copy the stars you are seeing. Stand by on the P-52.

SC Not very far apart. Put the card back up Jim. Better than Antares (garbled). Yes. Sure is.

PAO That's Jim Lovell reporting star sightings through the eyepiece of, in the lunar module. We're at 75 hours 24 minutes...

SC We have pretty good (garbled) in AUTO P-52 piece to Antares, if we ever get it up there.

CAPCOM Hey, Houston. Correction, Aquarius, Houston, we're satisfied with our present alignment, we don't want you to waste anymore RCS gas trying to do this P-52 and be advised that you guys are hot mike, if you haven't heard. Over.

SC Okay, understand. How's your memory though Charlie.

CAPCOM Okay, we're putting Vance back on. Stand by.

SC What was that....

SC Okay, let's go back (garbled) burn altitude. Burn attitude of (garbled). Are you straight off? Yes. You want the numbers from Houston pads, SPS G&N (garbled).

PAO Apollo Control, Houston, 75 hours 26 minutes. Apollo 13, now 4968 nautical miles out from the moon traveling at a speed of 4631 feet per second.

SC up here.
SC Great.

END OF TAPE

SC One on
SC And Houston, Aquarius.
CAPCOM Go ahead, Fred.
SC Oh, about how long we got before we have to go to work here, Vance. Kind of like to get a bite to eat, maybe.
CAPCOM Okay. We have a couple of pads to give you and stand by. We'll check to see if we have anything else.
SC Hold on to that baby.
SC Where's that G&N book? Got it over there?
SC Here we go.
SC Here, you want to start copying down there.
SC Here, it's at the back.
CAPCOM Acquarius, Houston.
SC You've got it right here.
SC Go ahead.
CAPCOM Okay. About all we have to do is to send up your state vectors and target loads and that will have to wait a couple of minutes till we get ready to do so. And if you're ready to copy, I can give you the P-30 maneuver pad for PC plus 2 and after that probably you should eat and then we'll regroup again to send up other things. Over.
SC Okay. I'm ready to copy a P-30, a PC plus 2.
CAPCOM Okay. Okay, this is a preliminary P-30 LM maneuver PC plus 2. Starting NOUN 37, 079274007 plus 08192 minus 00200 minus 02189 NA plus 00209 08482 420 274 082 plus 08203 minus 00200 minus 02150. Comments. Ullage is 2 jets for 10 seconds. CSM weight 62480. LM weight 33576. And the following is the DPS throttle profile 5 seconds at minimum followed by 21 seconds at 40 percent and the remainder at max. Over.
SC Okay. A PC plus 2. 079274007 plus 08192 minus 00200 minus 02189 N/A plus 00209 08482 420

END OF TAPE

SC - 00209; 08482; 420; 274; 082 plus 08203 minus 00200 minus 02150; the rest N/A, under a MARK. Ullage 2 jets 10 seconds, CSM weight 62480; LM weight 33576. Dips throttle profiles 5 seconds at idle; 21 seconds at 40 percent, remainder at MAX.

CAPCOM Roger, that's correct, Fred. If you'll take out a maneuver pad, I'll give you some landing information. Over.

SC Okay, you're talking in the CSM Update Book?

CAPCOM Yes, That's affirm.

SC You can get it right here.

SC Make sure and scratch the (garble) window.

SC Okay, which — which ones we want?

SC 37.

SC What kind of maneuver pad do you want, Vance?

CAPCOM This is a CSM maneuver pad for - to monitor PC plus 2. And it's going to be mainly blank except I want to give you your NOUN 61 lattitude and longitude range to go for the EMS and that sort of thing.

SC Okay, go ahead.

CAPCOM Okay, at the top, purposes monitor PC plus 2; everything is blank until you get down to NOUN 61. Lattitude as follows: minus 2147 minus 16500, 11660, 36291, 1423920. Over.

SC Okay, monitor PC plus 2 pad. NOUN 81 minus 2147 minus 16500, 11660, 36291, 1423920.

CAPCOM Roger, that's correct, Fredo, and we now would like to get you in a configuration to uplink your state vector and target load. So, if you're ready to copy I have some circuit breaker changes for you. Over.

SC Okay, go ahead.

CAPCOM Okay, circuit breaker panel 11 updata link close. Primary power amp panel 16 close.

PAO We have a reminder announcement, the change of shift briefing is be - ready to start right now. The participants are in the Auditorium. Ready to start right now.

CAPCOM - P00 and DATA.

SC Okay, we're now in P00 and DATA, and the switches and breakers are configured. You got it.

CAPCOM Okay, thank you. You're coming in loud and clear.

PAO Apollo Control Houston, 75 hours, 37 minutes. That preliminary PC plus 2 hour pad indicated a time of ignition for the dips burn of 79 hours, 27 minutes, 40 seconds. Burn duration 4 minutes, 20 seconds. DELTA-V 850 feet per second. Standing by continuing to monitor, this is Apollo Control, Houston.

END OF TAPE

PAO Apollo Control, Houston, 75 hours, 38 minutes. Our LOS clock in Mission Control shows we're 1 hours 29 minutes 45 seconds from time of loss of signal from 13 as the spacecraft passes over the back side of the moon. This is Apollo Control, Houston, continuing to monitor.

CAPCOM Aquarius, Houston. Over.

SC Go ahead, Houston.

CAPCOM Hey, Jim, I have about 3 things. First, thing, the computer is yours again. The second thing, no PTC maneuvering will be required from now till burn, so you can just sit in burn attitude. The third thing, we'd like to back out of this procedure we just put you into to updata link which would mean going from TM bit rate high back to low, ranging to off, voice to down voice, primary power AMP to close.

SC Hold up, Vance.

CAPCOM Okay

SC We have a program alarm, Vance. 1106.

SC You may want that high bit rate. Okay, that apparently was just my pushing the up data link switch off that set that bit.

CAPCOM Roger. We concur on that. And I'll read this back to you a little more slowly, Fred. Okay, are you ready to copy.

SC Yes. Go ahead

CAPCOM Okay. TM bit rate to low, ranging to off, voice to down voice, power amp to off, that's on panel 16 and or open and circuit breaker 11 updata link to close, or to open. Over.

SC Okay, Vance, how do you read on down voice backup now.

CAPCOM Okay, Fred, reading you loud and clear now.

SC Okay. I've got the power amp off, down voice back up, PCM to low bit rate and the updata link breaker on 11 is closed.

CAPCOM Okay. Copy. Thank you.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Okay. On this last readback we'd just like to verify that the primary power amp was fold opened. Over.

SC That's affirm. I used the breaker on 16, primary S-band power amp breaker is open.

CAPCOM Okay. Thank you.

PAO The program alarm 1106 is in the computer and it's for uplink too fast. The indication was there when Jim Lovell took over the computer that possibely he flipped a switch too fast. Looking at our DSKY - our computer displays in Mission Control, we noticed that a program alarm has been showing from an earlier event that occurred yesterday evening. It was not unexpected. We're at 75 hours, 48 minutes into the flight and this is Apollo Control, Houston.

END OF TAPE

PAO - 75 hours, 49 minutes Apollo 13
SC (garble)
SC Is it (garble) back in (garble
SC Okay. Bring me down one of the (garble)
SC Another one (garble)
SC Two of them (garble)
SC (garble)
SC Yeah.
SC I didn't hear a thing about that yet.
SC You want us to pour water?
SC Han½
SC You want us to pour water?
SC Where?
SC In the LGC.
SC (garble)
SC (garble)
SC Pretty close.
SC How's the (garble) coming?
SC That (garble) 3 goes on — Fred, HOLD?
SC Yeah. (garble)
SC Let's not forget to hold these out of here.
SC Okay.
SC Can you hold three?
SC Yeah.
SC I'll continue with the dumping —
SC Houston, Aquarius how do you read?
SC Hello Houston. Aquarius. How do you read?

END OF TAPE

SC Houston, Aquarius, how do you read?
CAPCOM Aquarius, Houston, loud and clear.
SC Okay. Vance, I guess I understood you all were amassing a couple of list of things that you were thinking about later we'd be taking back from the LM across into the CSM. A couple of items to add to that list we've pilfered the, the intake hose screens out of the CSM that we have them mounted on the LM hoses now to catch the debris in here. We probably ought to take those back.
CAPCOM Okay. We got that. Intake hose screens.
CAPCOM I guess that item isn't going to change your CG too much Fred-o.
SC Let's hope not.
PAO This is Apollo Control Houston, 75 hours 58 minutes now into the flight. Apollo 13 presently at 3573 nautical miles out from the moon traveling at a velocity of 4943 feet per second. Our clock in mission control shows we're 1 hour 10 minutes 30 away from time of loss of signal as Aquarius and Odyssey pass above the backside of the moon. 75 hours 58 minutes continuing to monitor, this is Apollo Control, Houston.
SC Yes, no I haven't.

END OF TAPE

SC Yes.
SC Was that you, (garble).
SC Get off of those big jet bags.
SC To much debris in there?
SC Yes.
SC Trying to put debris in?
SC Yes.
SC Roger, Jim, (garble) now.
SC What's that Fred? Fresh fish.
SC (Laughter)
SC (Garble).
SC (Garble).
SC Oops.
SC Not sure.
SC (Garble).
SC (Garble).
SC Well, what I'd like to do is find out how many, yes, what happened to the two little midcourses that's got to be with this vehicle.
SC Yes. (Garble).
SC Now we just take the - CSM and strip it down.
SC Yes.
SC Start putting the feature stuff in here.
SC Well, I ain't worrying about that. Why are you worried about stripping down the vehicle?
SC That's why you don't want to be in there with the drogue and the probe bit.
SC Oh, yes.
SC And, you do want room for the PLSS'es.
SC I'm going to (garble) suit (garble) put them in there.
SC General (garble).
SC The altitude (garble) puts oxygen into this cabin.
SC (Garble).
SC Oh, no.

END OF TAPE

SC We're not planning to reenter with (garble)
SC You're really amusing. We can help you out in this discussion.
SC Yeah, but (garble) down there.
SC (garble)
SC They work on the RESET valve.
SC Yeah but (garble)
SC I get you.
SC (garble) forget it.
SC Breath through the canister.
SC (garble)
SC Yeah, breath through the canister.
SC My job is to maintain (garble)
SC We've got a couple here.
SC Did you cut all the (garble)
SC Roger.
SC (garble)
SC Yeah. I think they just cut that.
SC Some must be coming back.
SC Yeah. (Garble)
SC Yeah, I got two stars, circling back through here. (garble)
SC See if you can get it back up again.
SC (garble)
SC Huh?
SC What?

END OF TAPE

SC (Garble).
SC That's the one you put up there, (garble).
SC I would like to (garble).
SC Ready to trade it in.
SC Right.
SC Isn't that awful sitting this big container back here.
SC (Garble).
SC That's a little (garble).
SC I wouldn't mind - dumping this. (Garble).
SC (Garble).
SC Is that it?
SC (Garble).
SC (Garble), it seems to me.
SC The (garble) seem to work.
SC Okay, (garble).
SC Hey, can't you go for more there?
SC Yes. Yes, (garble).
SC (Garble) what you do - then what do you do, you pressure -
SC Now, let's see the Sun's positioned to our back, Vance, so - for what it's worth.
SC (Garble).
SC (Garble).
SC Now, let's see. What should we be doing right now?
SC (Garble).
SC We'll get a nice (garble) and power up for the burn.
SC They give you a time to start power up?
SC No.
SC You know we ought to get a (garble) of this thing. (Garble). You know, we ought to get a (garble)
SC Very well.
SC - (garble).
SC Apollo, Houston, Aquarius.
CAPCOM Go, Aquarius.
SC Let's just recap this situation now, we're not going to do anymore PTC, we'll maintain this attitude. You have already updated us on P30 load. We would like from you an LOS time, and a power up spot time for the PC plus 2.
SC And an AOS time.
CAPCOM Okay, we copy that.
CAPCOM We're going to also get back with you shortly, Jim, for - with some burn guide lines for PC plus 2.
SC All right. Very well.
SC Ahh.

PAO Apollo Control, Houston, 76 hours, 18 minutes. Apollo 13 now 2623 nautical miles away from the Moon. And traveling at a velocity of 5277 feet per second. Our display shows an altitude -

SC What is that timer?

PAO - at a closest approach of 137.5 nautical miles.

SC (Garble).

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Go ahead, Houston.
CAPCOM Jim, we were just discussing burn star monitoring and we were curious to know if you can see Nunki in decant 2 at this time. Over.
SC That's affirmative. I can see Nunki in descent 2.
CAPCOM Okay, thank you. Roughly, in what part of the field of view.
SC Nunki is in the upper right hand corner.
CAPCOM Okay. Thank you.
SC And Scorp and Antares is barely visible in the bottom of the field of view.
CAPCOM Okay.
SC Yup, Jerry.
SC Hey, I bet - I know how I could get an alignment.
SC (garble)
SC Instead of maneuvering the spacecraft I'll give them (garble)
SC Give that for AGS and you'll hear (garble)
SC You done? How's the earth?

END OF TAPE

SC Houston, for what it's worth, we can probably give you a cursory mile angle on Nunki, and possibly Antares or more than likely (garble).

CAPCOM Roger, Jim. According to our calculations Nunki should be, at burn time, pretty close to the center of the AOT. We've been talking that possibility over.

SC Rog.

CAPCOM Also, as a matter of general interest, the sun should be in the bottom part of the CDRs window at the bottom of the LPD vertical line.

SC (Garble) at TIG, which is (garble)

CAPCOM That's afirm at TIG.

SC It must be that, your right, because if you heard those...wait a minute we're holding on inertial attitude. No, we're not on the TIG attitude.

CAPCOM Apollo 13, Houston.

SC Go ahead.

CAPCOM Jim. Whenever your through reading and ready to copy the info, I can send you the burn rules.

SC Do you want them? I've got them right on...would you rather read...

PAO This is Apollo Control, Houston. 76 hours 30 minutes now. We show 13 at 2074 nautical miles away.

SC We're all set to go.

CAPCOM Okay. Okay, first of all, general philosophy is these rules should be similiar to LOI code 1 abort would be tight limits. Now I'll go through them one by one for you to copy. Okay, you should shut down if any of the following...

END OF TAPE

CAPCOM - Okay. You should shut down if any of the following happen. Thrust monitor readout 77 percent or below. DPS propellant tank pressure, that's inlet pressure, onboard readout 160 or below. Fuel to OX DELTA P greater than 25 psi and that would have to be a ground call to you. Attitude error plus or minus 10 degrees with the exception of the start transient. Attitude rates limits plus or minus 10 degrees a second. And you should shutdown if you get any of the following alarms: engine gimbal, ISS plus program alarm, LGC, CES DC, and if you get an inverter light after switching inverters. Are you with me?

SC Roger.

CAPCOM Okay.

SC That will do.

CAPCOM And proceeding on. If during the burn the engine stops, give a flashing NOUN 97. You should proceed then ullage. Engine start to PUSH, and descent engine override ON. Okay, now this general information. If you didn't burn PC plus 2, probably PC plus 4 would be the earliest MCC. AGS is going to back up in a rate fail mode only, which you know. We're talking over the star check. Will have to get back with you on that. If, for some reason, there is no PC-2, you have a free return trajectory with the landing at 1520200 and that would be after a small midcourse 5. Which would probably be around 4 feet per second at 93 hours. And you have recovery forces in the Indian Ocean - you're in good shape there. And the Indian Ocean is where this landing would be. Okay. Still with me.

SC Roger.

CAPCOM Okay. After -

SC Yeah. I'm with you.

CAPCOM Okay. After PC-2, there are no trim requirements and if you have a shutdown during PC plus 2, subsequent midcourse maneuvers required with - well, the earliest one would be PC plus 4.

END OF TAPE

CAPCOM - it would - Well, the earliest one would be EC plus 4. If you don't do a PC plus 2, but we still want to do one MCC later, at PC plus 4 the increase in Delt — DELTA-V or the penalty would be about 24 feet per second. With a landing in the mid-Pacific at - 142:46:30. Now, you should expect new pads, state vectors, and targets for PC plus 2 at about GET 78. Over.

SC (Garble) standby. Standby, Vance.

CAPCOM Okay.

SC Okay, how do you read?

CAPCOM Loud and clear.

SC (Garble).

SC Okay, burn roll, I was to shutdown for the following: if we have the thrust monitor at 77 percent or below. Number 2, if the DPS propellant ullage pressure is less than 160 psi. 3, if the fuel oxidizer DELTA-P is greater than 25 and that'll be a ground call out. 4, if the attitude error is plus or minus 10 degrees except for starting transients.

SC Okay, rate limits are plus or minus 10 degrees per second. And we're to shutdown with the following ALARMS: an engine gimbal light, an ISS with a program alarm, an LGC, a CESDC, and an inverter light if it's still on after we've tried switching inverters. If during the burn the engine shuts down when the NOUN 97 flashes we should proceed and do manual ullage and start pushbutton push, and descent engine command override, open. If we don't do a PC 2 our next burn will it be at - PC 4 for an added 24 foot per second, we'll land mid-Pac at 142:46:30. Okay, we'll have the AGS up for backup rate command, or rate damp rates, I guess. And the free return that we're on, if we don't - that we're on now if we don't do PC 2 or 4, lands us at 152:02:00 in the Indian Ocean. And there's no trim requirements on this burn, and we should expect a new uplink at a new final maneuver pad from you at 178 hours.

CAPCOM Ah, 78.

SC Okay. I'm sorry - What - Yes, 78 hours, it only seems like it's been that long.

CAPCOM I can understand.

PAO This is Apollo Control, Houston, 76 hours, 39 minutes. You heard Capsule Communicator Vance Brand passing to Apollo 13 the mission rules worked out -

CAPCOM - readback was corrected.

SC Okay.

PAO - the mission rules for this burn worked out by Gene Kranz with his flight control team and support rooms in Mission Control. These rules are akin -

SC Did you ever have any LOS - AOS times, and - and a startup time for us to jump into this activation checklist?

CAPCOM Okay, let me - let me pole the house again on that one.

SC What?
CAPCOM Okay, one word is in the - in an optimum fashion, there -

END OF TAPE

SC Okay. One word is that in an optimum fashion, going through that two-hour activation generally took somewhere from about an hour and 15 to an hour and 20.

CAPCOM Okay. Then I guess we ought to allow you a little more than that, eh?

SC I was thinking that since we don't have to do about four pages of it, that we probably would need just about that and that will make up for the difference of any added time we need maneuvering, etc.

CAPCOM Okay.

PAO The mentioned rules for the burn are akin to those on an LOI-1 with a surface propulsion system mode 1 abort assuming that we had no burn, no burn on the engine. We are at 76 hours, 42 minutes into the flight. This is Apollo Control, Houston.

SC We'll need a - John got a flashlight. Got a flashlight. We might need a spare flashlight - yes. Okay. We might need a spare flashlight, have you got one? The sun has all gone down.

SC Man, look at those stars.

SC Houston.

CAPCOM Go ahead, Aquarius.

SC Roger. We are in the shadow of the moon now. The sun is just about set as far as I can see and the stars are all coming out.

CAPCOM Okay. If you are ready to copy, we have LOS, AOS times for you.

SC Go ahead, Vance.

CAPCOM Okay. LOS 770835, AOS 773310. Sunrise - first I'll give you sunset which is past, but that was supposed to be at 763245 and sunrise 771648.

SC Okay. LOS is 770835, AOS is 773310. Sunset is 763245, sunrise at 771648.

CAPCOM Roger. We'll get back with you on the power up time and if you are ready to copy, have angles to load into NOUN 22 for your VERB 49 maneuver to burn attitude. Over.

SC Okay, go ahead with the VERB 49 value.

CAPCOM Okay. R1 plus 27210, R2 plus 35570, R3 plus 33010. Second item, as you know, due to maneuver with the proceed and a proceed and after your attitude a reminder that P-40 will not set you back to a narrow deadband to get back to the 1.40 degree deadband, you have to use the procedure I gave you which is VERB 21, NOUN 01 ENTER.

END OF TAPE

CAPCOM which is 21 NOUN 01 enter. 3011 enter. and 200 enter.

SC Okay, VERB 49, register 1 plus 27218, register 2 plus 35570, register 3 plus 33010 and to get the narrow dead-band back we want VERB 21 NOUN 01 enter 3011 error 200 enter.

CAPCOM Roger. A correction on your first number for register 1. That should be plus 27210. And another comment after you get into the narrow dead-band at that attitude, why you might tell us where you see Nunki.

SC Roger. Will do Vance.

CAPCOM Thank you.

SC Okay you corrected register 1 it's plus 27210.

CAPCOM Rog.

SC And would you like us to make that maneuver at this time.

SC (Garble) down below us

CAPCOM Stand by.

SC Can we have some more light in here now?

SC I have a way.

SC What do you see out your upper window?

SC Stars.

SC Yes, it looks like the light is coming from out above the stars.

SC Well you won't get AOS, LOS till 77.

PAO Apollo Control, Houston, 76 hours 49 minutes less than 20 minutes now away from LOS. Apollo 13 now 1184 nautical miles away from the moon traveling at a velocity of 6218 feet per second.

SC Okay, that's (garbled). Just about.

CAPCOM Apollo 13, Houston.

SC Go ahead, Houston.

CAPCOM Jim, we recommend you go ahead and make your VERB 49 maneuver, but just stay there in VERB 49 and don't go ahead to narrow the dead-band just yet. And, when you're in that attitude, why first thing, you can make your star check. And one other item is I don't think we got back with you but that hour fifteen for power up sounds fine with us.

SC Okay. At time I'll start my VERB 49 maneuver, but I will not get on the dead-band and will take a look at Nunki. Okay, then.

CAPCOM Rog.

END OF TAPE

SC Almost, huh?
SC Jim?
SC Yes.
SC (Garble).
SC (Garble).
SC (Garble).
SC It shouldn't.
SC I was below that - when that good one was reported.
SC (Garble).
SC That's a good idea.
SC (Garble).
SC Take out any lights you're going to see.
SC You can coach Jim on that.
SC Sure.
SC We're there.
SC Hey, (garble)?
SC Hey, I can just barely see (garble), the terrain much better.
SC Why is the wide DEADBAND ON? Standby (garble)
SC (Garble) and move it down.
SC (Garble).
SC Great.
SC What's that cloud I see over there?
SC No, it looks like a Milky Way.
SC Just a minute.
SC Look.
SC Houston, Aquarius.
CAPCOM Aquarius, Houston, go ahead.
SC Okay, we have completed our maneuver, we're at that wide DEADBAND and (garble) here is close to the top of my display of the AOG, right now I (garble) seem to be more closer towards the center, however, we - we're in that wide DEADBAND.
CAPCOM Right, understand. We'll have to make a better check later on, I guess.

END OF TAPE

SC I can't for the life of me figure out what that dark stuff is.
SC Did you look at it, Jack.
SC Yes. I didn't recall what (garble) in the dark.
SC It is rare. Like two black clouds.
SC (garble) 10 hours.
PAO Less than 10 minutes away now from predicted time of LOS. We're at 76 hours, 59 minutes into the mission and we see the velocity on our displays for Apollo 13 really building now. Now reading 6736 feet per second, relative to the moon. Apollo 13 now 750 nautical miles away from the moon.
PAO Seven minutes away now from loss of signal. Gene Krantz going around the room checking with his flight controllers as to a status of systems. We now show 77 hours, 1 minute into the flight of Apollo 13. This is Apollo Control, Houston.

END OF TAPE

SC I know what that is.
SC That might be the debris that was thrown off there.
SC (Garble)
SC It's all dark now.
SC From the explosion.
SC (Garble)
SC No, from our explosion.
SC Take a look.
SC It covers a wide area.
PAO Less than 5 minutes away now from Loss of signal, 77 hours, 4 minutes into the flight.
SC There's a pair of contrails.
SC Only if you switch to descent, they're going around.
SC How long to LOS?
SC (Garble).
SC I'd sure like to try the descent too, but I guess our (garble) platform's okay, isn't it.
SC Yes.
SC Yes.
PAO 77 hours, 4 minutes, Apollo 13 526 nautical miles away from the Moon traveling at a speed of 7122 feet per second. Four minutes now from time of loss of signal with Apollo 13 as it passes over the backside of the Moon.
SC What was that?
SC (Garble).
SC Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Okay, Jim, we have a little over 2 minutes til LOS, and everything's looking good here.
SC Roger.
SC Yes, I take it that we don't have to start our activations until we receive AOS with you.
CAPCOM Roger, that's correct.
PAO Apollo 13 now 421 nautical miles above the Moon. Just a little over 1 minute now from time of loss of signal with the spacecraft. This is Apollo Control, Houston, 77 hours, 7 minutes.
SC (Garble).
SC (Garble).
SC You given up eatables? Is that water? We've got (garble). (Garble).
PAO We've had loss of signal with Apollo 13 as it passes above the backside of the Moon. We're at 77 hours, 9 minutes now into the flight of Apollo 13.

END OF TAPE

PAO Apollo Control, Houston. We're two minutes now from time of reacquiring Apollo 13. Meanwhile, we have an update in the impact of the third stage of the Saturn, the S-IVB. Our latest estimate indicates impact at 77 hours 56 minutes 27 seconds ground elapsed time. The predicted coordinate for impact 26 degrees 57 minutes, South Longitude, Lattitude, 28 degrees 27 minutes west. Coming up now on one minute to AOS we'll stand by and continue to monitor, this is Apollo Control, Houston. Standing by now for acquisition.

SC Houston, (garbled)

SC (garbled)

CAPCOM Aquarius, Houston.

SC (Garbled).

SC Houston, how do you read the Aquarius?

CAPCOM Aquarius, Houston. Reading you about 3 by 3.

SC Houston, (garbled)

SC Houston, Aquarius, I hear you.

CAPCOM Okay, Fred. I read you fairly well now. How do you read?

SC Okay. I read you loud and clear.

CAPCOM Roger.

SC That view out there is fantastic.

PAO This is Apollo Control, Houston, 77 hours 38 minutes into the flight. Apollo 13 has now rounded the corner headed back towards earth. We show a velocity of 7062 feet per second and a distance from the moon of 566 nautical miles.

SC Ah, we're going this way. Okay we're going up on Mare (garbled).

END OF TAPE

PAO Seventy-seven hours, 40 minutes now into the flight, we show Apollo 13 at 630 nautical miles away from the moon. Our ignition clock shows 1 hour, 47 minutes time remaining until start of the descent propulsion system burn.

SC You can see where we're zooming off.

SC Yes, we're no longer 139 miles. We're leaving

SC (Garble)

SC That might be (garble) over there, I think.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Roger. We still want an activation start time for a burn.

CAPCOM Understand. You want a power up time, is that affirm?

SC That's affirm.

CAPCOM Okay. Stand by.

SC Okay. Let's get the cameras squared away. Let's get all set to burn. You got one chance, now. You're not going to hack it at 152 hours.

CAPCOM Aquarius, Houston. Over.

SC Go ahead, Houston.

CAPCOM Jim, regarding the start time for the power, you mentioned an hour and fifteen minutes. We think that is adequate. This is crew preference depending on how much time you think you need. We would go along with an hour and fifteen minutes.

SC Okay.

END OF TAPE

CAPCOM We would go along with an hour (garbled)-
SC Okay. Okay, sounds good.
PAO That's the power up activation time for the descent propulsion system engine burn. We're now at 77 hours 46 minutes into the flight of Apollo 13. Apollo 13 now 872 nautical miles away from the moon. Meanwhile, in Mission Control Center, one of our special purpose clocks is counting down to the predicted time of S-IVB impact. We show 10 minutes 30 seconds remaining.
SC Okay, let me look at the checklist for our, (garbled).
SC Hey, Jack. Do you have the (garbled) back up there yet? Okay.
PAO Apollo Control Houston, at 77 hours 49 minutes now into the mission. We presently show Apollo 13 at 1007 nautical miles away from the moon, its velocity slowing down now relative to the moon. Now reading 6399 feet per second.
PAO Apollo Control, Houston, 77 hours 52 minutes now into the flight. We show five minutes away now from time of the predicted impact of the S-IVB.
CAPCOM Aquarius, Houston, Over.
SC Go ahead, Houston.
CAPCOM Okay, Jim. We have about three items for you. We have a maneuver pad, P-30 LM maneuver, again and the maneuver pad for the CM for splash down. We also have a check list change in the contingencies, contingencies check list. I'll stand by while you're gathering the books.
SC Okay, I got the contingency book so give me that one first.
CAPCOM Okay. Page 18...

END OF TAPE

CAPCOM Okay. Page 18.
SC Okay. Page 18.
CAPCOM Okay. About half-way down. When propellant quantity equals 30 percent, or rather 37 percent, we would like to change that line to read - When time to go is equal to 10 seconds - Of course, the line under that remains the same then, Descent HU REG 1 to close.
SC Okay, when time to go equals 10 seconds, descent helium REG 1 to close.
CAPCOM That's affirm. Before I start on the pads, another comment. The general indications that we gave you before about the sun being in the Commander's window and about stars in the AOT, such as that might be used as general indication for your attitude for the burn, that's all out the window. We are just going on the sun check that we made earlier and we don't feel that we have information that is good enough to give you the star and the sun in the window information.
CAPCOM Okay. You're very weak now. When you are ready to take the P30 maneuver pad, I'll be reading it up.
CAPCOM Okay. This is P30, LM maneuver pad, PC plus 2 hours, starting with NOUN 33, 079273830, plus 08330, minus 00509, minus 02139, PAD A plus 00205, 08615, 424272081 and the rest is N/A except for comments as follows. Ullage 2 jets 10 seconds, CSM weight 62480, LM weight 33452 and the DPS throttle profile is the same as before, 5 seconds at minimal, 21 seconds at 40 percent and the remainder of the time at max. Over.
SC (Readback but inaudible)

END OF TAPE

CAPCOM Okay, Aquarius, Houston. You're coming in about 1 by 1, now. Advise that I heard everything except the beginning of NOUN 33 values, and the comments. Please repeat the readback on those, please.

SC Okay, I'm going to up to the far end here, Vance.

SC Houston, how do you read Aquarius, now?

CAPCOM Hey, you're loud and clear now.

SC Okay, I got the power amps now, PC plus 2 hours, 07927; 38030 plus 08330 minus 00509 minus 02139, N/A plus 00205, 08615, 424, 272 081; rest N/A. Ullage 2 jets 10 seconds, CSM weight 62480; LM weight 33452; dps throttle profile the same, 5 seconds idle, 40 percent at 21 seconds. Remainder at MAX.

CAPCOM Roger. 40 percent for a 21 seconds, I believe is what you read back. And all the rest is correct Now, for the maneuver pad for the CSM. Over.

SC Okay, standby.

SC Okay, go ahead.

CAPCOM Okay, Fredo, this is maneuver pad monitor PC plus 2 hours; all NA until you get to NOUN 61, latitude minus 2165 minus 16500, 11635, 36292, 1423922. Over.

SC Monitor (garble) plus 2; NOUN 81 minus 2165 minus 16500, 11635, 36292, 1423922.

CAPCOM Roger. That was starting with NOUN 61, and that's correct. By the way, Aquarius, we see the results now from 12's seismometer, looks like your booster just hit the Moon and it's rocking it a little bit. Over.

SC Well, at least something worked on this flight.

CAPCOM And I just want to verify one thing, we could -

SC (Garble).

CAPCOM - go ahead.

SC I say I'm sure glad we didn't have a LM impact, too.

CAPCOM Right. Just wanted to verify, we had poor reception when I was talking to you before. I wanted to verify that you understand that the Sun check you made earlier in the AOT was good and that's what we're riding on, anything that we told you in the past about looking at the Sun in the front left window or looking at stars - like Milky through the AOT, why we want to forget.

SC Roger. Understand, Vance. I think Milky would be kind of hard to see anyway with the Moon right here.

CAPCOM Right.

PAO Apollo Control, Houston, 78 hours, 4 minutes. Apollo 13 now 1704 nautical miles away from the Moon. Velocity now reading 5768 feet per second. Vance Brand passed up a

PAO - new PC plus 2 hour maneuver pad which reflected a -

END OF TAPE

PAO - the new PC plus 2 hour maneuver pad which reflected a time of ignition of 79 hours, 27 minutes 38 seconds. -

SC - plan to start powering up at 78:12. Is that a good time or do you think we ought to hold off a little longer?

CAPCOM Jim, we think that's very good.

PAO The descent propulsion system burn should produce a posigrade DELTA V of 861 feet per second with this pad. Burn duration 4 minutes 24 seconds. We're at 78 hours, 5 minutes now into the flight. This is Apollo Control, Houston.

CAPCOM Apollo 13, Houston - oh, Aquarius, Houston.

SC Go ahead.

CAPCOM Fred, after the burn, we'll get the power down instructions or checklist changes to you. At the same time we'd like to get a consumables status to you. All I'll say right now is that we think you are looking in reasonably good shape.

SC Okay. Very good. Okay. Houston, Aquarius.

CAPCOM Go ahead.

SC Okay. One caution and warning light here showing and that you didn't call out in the prelims. I suppose because we don't have the (garble) breaker in yet.

CAPCOM Okay. That's okay.

SC Houston, are you planning to give us a state vector update.

CAPCOM That's affirm, Jim. All we need is updata link circuit breaker closed on panel 11 and P00 and ACCEPT and we can ship it up to you. P00 and DATA.

SC Okay, Vance, we're in DATA and P00 and the circuit breakers closed. Go ahead.

CAPCOM Okay. We'll ship up to you.

PAO This is Apollo Control, Houston, 78 hours, 20 minutes into the flight of Apollo 13. At present the Apollo 13 spacecraft is 2461 nautical miles away from the moon and traveling a speed of 5343 feet per second. We show one hour and 7 minutes away from time of ignition of the descent propulsion system burn.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Jim, request verify ranging functions switches in ranging. We need that, if it's not there now.

SC You got it, Babe.

CAPCOM Thank you.

PAO Apollo Control, Houston. At 78 hours, 23 minutes now into the flight. The crew of Apollo 13 continuing to proceed on their activation checklist.

CAPCOM The computer is yours.

PAO Flight Dynamics advises Flight Director Gene Kranz that there will be no requirement to update the PC plus 2 hours maneuver pad.

CAPCOM Aquarius, Houston. Did you call?

SC We didn't call, Houston.

CAPCOM Okay.

CAPCOM Aquarius, Houston. Over.

SC Houston, are you calling Aquarius?

CAPCOM Roger, Fred. I would like to confirm that you are getting drinking water out of portable water out of the command module and, if you can make any estimates of how much you use as time goes on and how much you have used, we will appreciate it for our conumables analysis.

SC Okay.

PAO This is Apollo Control, Houston, at 78 hours, 30 minutes. We now show Apollo 13 at 2900 -

SC - tried the procedure and out of that pressure, we got 10 drink mates. That's roughly 80 ounces

END OF TAPE

PAO We now show Apollo 13 2958 nautical miles away (garbled).

CAPCOM We had a little static on that one, but I think you said that 80 ounces of water has been used out of the CM. Is that right?

SC Yes. Jack worked the procedure and filled as many of the drinks as he could and he made up ten bags of approximately 8 ounces a bag.

CAPCOM Okay. We copy that.

PAO Apollo 13, now traveling at a speed of 5129 feet per second.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Jim, just a bit of information, if for any reason you had to slip TIC, our people here feel it wouldn't do much harm if you slipped it up to 30 minutes. The procedure of course as you know is not to pro on the flashing 99 and we thought you might like to be aware that TIC time isn't all that critical.

SC Rog. Understand.

PAO That discussion between Vance Brand and Jim Lovell was concerned with the time of ignition for the para-synthian plus two hour burn. We're 78 hours 37 minutes now in the flight of Apollo 13. This is Apollo Control in Houston.

PAO At 78 hours 38 minutes, we now show Apollo 13 at a distance of 3268 nautical miles away from the moon and at a velocity of 5030 feet per second. Our count down clock shows 49 minutes 30 seconds from time of ignition. This is Apollo Control, Houston.

SC Okay, Vance. Aquarius.

CAPCOM Go, Fred.

SC Okay, I think it's finally coming through to us here, what you said just a little while ago. Are you suggesting that we move TIC up 30 minutes?

CAPCOM No, not at all. We're just giving you excess information. Just saying if you had any problem at all it could be slipped.

SC Oh, Okay. Slip 30 minutes. That's better.

CAPCOM Right. You guys are pretty fast though.

SC Yes. It kind of surprised us.

CAPCOM I guess that's what happens when you cut a lot out of a check list.

SC Yes. Yes, we're taking about a thousand pictures inbetween steps there too. Okay, Houston, Aquarius radio check.

SC Loud and clear Fred.

CAPCOM Okay, I had a change in the background noises, wondered if you were still there.

CAPCOM Right.

PAO This is Apollo Control, Houston at 78 hours 46 minutes now into the flight. We're 41 minutes away from scheduled time of ignition on our parasynthian plus 2 hour burn of the Apollo 13. Apollo 13 now 3664 nautical miles out from the moon. Velocity now reading 4913 feet per second. Apollo Control Houston, at 78 hours 57 minutes into the flight. Flight Director Gene Kranz just advising his team that it will come, go around the room at about minus 10 minutes for a final go no go for the burn. We now show Apollo 13 at 4146 nautical miles away from the moon and at a velocity of 4791 feet per second.

END OF TAPE

CAPCOM Apollo 13, Houston.
SC Houston, Aquarius. Go ahead, Houston.
CAPCOM Okay, Aquarius. We have some new information regarding what you should see out the commander's window at TIG. Over.
SC Okay. Go ahead.
CAPCOM According to calculations, you should see the moon. It'll be a full moon. You should see most of the disc and it should be somewhere on your vertcal LPD line, probably at about 14 on the LPD scale. Over. Roughly centered on 14.
SC Okay, Houston, I concur. I'm looking at 14 on the LPD and the angle is just about centered. It's south of (garble) but the line is just slightly to the north of center.
SC Okay, Jim, that sounds very good. We see that you have a slight YAW angle so it should be north of center.
PAO Apollo Control, Houston, 70 -
SC (garble).
PAO The reference that Jim Lovell made there was one of the mountains that he named during his flight on Apollo 8. This is Apollo Control, Houston. We're 79 hours, 10 minutes now into the flight, 18 minutes away from time of scheduled ignition. On our pericynthion plus 2-hour burn. This will be programed in computer program 40 aboard the lunar module. The DPS thrusting program using the primary navigation and guidance system. Lovell and Haise will be in Aquarius at the time of the burn with Jack Swigert in Odyssey. We'll stand by and continue to monitor. We now show Apollo 13 at 4717 nautical miles out from the moon and traveling at a speed of 4675 feet per second. This is Apollo Control, Houston.
pao Apollo Control, Houston. 79 hours, 13 minutes. Less than 15 minutes away now from time of scheduled ignition. WE show 13 at a distance of 4839 nautical miles out from the moon and at a velocity of 4651 feet per second. Within the next several minutes, Flight Director Gene Kranz is expected to go around the room for GO/NO-GO status from each member of his flight control team. We're at 79 hours, 14 minutes into the flight continuing to monitor. This is Apollo Control, Houston.
PAO Apollo Control, Houston. 79 hours, 17 minutes. Flight Director Gene Krantz now going around the room for GO/NO-GO status from each member of the team. We're go for the burn. Apollo 13 now 5039 nautical miles away from the moon, traveling at a speed of 4616 feet per second.

APOLLO 13 MISSION COMMENTARY 4-14-70 CST 8:14P GET 79:01:00 302/2

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Jim, you are GO for the burn. GO for the burn.
SC Roger. I understand. GO for the burn.
PAO This is Apollo Control, Houston. We're a little over 6 minutes now away from time of scheduled ignition. 79 hours 21 minutes. Meanwhile, at Mission Control both the viewing room and the floor of Mission Operations Control Room have filled up with a considerable number of people. Among those here tonight are Dr. Thomas Paine, Nasa Administrator, Mr. George Low, Deputy Administrater of NASA, Frank Borman, who commanded the flight of Apollo 8 and Gemini 7 and had a flying companion named Jim Lovell, Ken Mattingly is here, Al Shepherd, commander of Apollo 14, is on the MOCR floor at this time as is Ed mitchell, the lunar module pilot, along with Stu Roosa who is scheduled to fly in the command module on that flight. We're coming up on 5 minutes until scheduled time of ignition. Gene Kranz has checked with couple of his systems, or members of his flight control team who monitor systems. They indicate they are happy with the data they are looking at now. We're standing by and continuing to monitor, this is Apollo Control, Houston.

END OF TAPE

PAO - Control, Houston, 79 hours, 23 minutes into the flight. We show Apollo 13 at 5263 nautical miles relative to the Moon, and traveling at a velocity of 4578 feet per second. Apollo Control, Houston, less than 3 minutes away now from scheduled time of ignition as we look at one of our displays in the Mission Control Center, we see that Apollo 13's lunar module is now in program 40, that's the descent propulsion system thrusting program

CAPCOM Understand 40 seconds to go on the MARK.

CAPCOM MARK.

CAPCOM Or that was - standby.

SC What was that MARK?

CAPCOM Standby that was incorrect. 3 minutes - counting down to 3 minutes, and I'll give you a MARK, and I'll take into consideration 2 seconds.

CAPCOM MARK.

SC Roger, we got you.

PAO - 79 hours, 25 minutes into the flight, Apollo 13 now at a distance of 5349 nautical miles away from the Moon. Velocity now reading 4564 feet per second relative to the Moon. Less than 2 minutes away now from scheduled time of ignition. Velocity reading 4560 feet per second, distance from the Moon 5383 nautical miles. One minute away now from scheduled time of ignition.

CAPCOM Roger.

PAO Apollo 13 now 5426 nautical miles out from the Moon traveling at a speed of 4552 feet per second. Less than 30 seconds away. The engine is ARMED, standing by. Ground confirms ignition.

SC We're burning 40 percent.

CAPCOM Houston copies.

PAO Attitude looks good at this point.

SC Roger.

CAPCOM Aquarius, Houston, you're looking good.

SC Roger.

PAO 1 minute now into the burn. DPS is looking good, 2 minutes into the burn.

CAPCOM Course you were looking good at 2 minutes. Still looking good.

SC 2 minutes, Roger.

PAO Velocity building up, our DSKY shows we've gained 451 feet per second at this time. Reports to Flight Director Gene Kranz indicate all systems are looking good. Coming up on 3 minutes into the burn.

CAPCOM Aquarius, you're go at 3 minutes.

SC Aquarius, Roger.

PAO The onboard display shows less than a minute to go on the burn now. Coming up on 4 minutes into the burn.

CAPCOM Don't forget descent REG 1, OFF, 10 seconds to go.

SC SHUTDOWN.
CAPCOM Roger, shutdown.
PAO That was Commander Jim Lovell reporting shutdown, the engine is off. We're at 79 hours, 32 minutes into the flight.
SC Are reading 16 40, Houston?
CAPCOM Roger, we're reading it.
SC We'll proceed. Here's our residuals.
CAPCOM Roger, very small.
PAO Apollo Control. 79 hours, 33 minutes, 5707 nautical miles out from the Moon at this time.
CAPCOM I say, that was a good burn.
SC Roger, and now we want to power down as soon as possible.
CAPCOM Roger, understand.

END OF TAPE

PAO We're at 79 hours...
SC Houston.
CAPCOM Go ahead.
SC Suggest maybe you just read off the circuit breakers you want us to power down, like you did yesterday for us.
CAPCOM Okay, we have a procedure ready to send up to you here in about two minutes. Let us know when you're all ready to take it.
SC Okay.
CAPCOM Okay.
SC Is it going to better to write this on a blank page, Vance, or can we use some portion of the power down list there in the contingency book that already...
CAPCOM Stand by one.
CAPCOM Aquarius Houston, over.
SC Go ahead.
CAPCOM Slight delay here Jim. It will be a couple of minutes before we read that up to you and we're looking at the contingency checklist power down and that's on page 5. You might be getting that out while we get all ready to give it to you.
PAO Apollo Control, Houston. 79 hours 37 minutes into the flight...
SC Could you give us that page number again. Page 5 doesn't make sense.
CAPCOM Okay. Make that power 5 in the contingency checklist, Fred. And it's the...
SC That's better.
CAPCOM Middle part of the page, it starts emergency power down and we'll mark that up.
PAO We're at 79 hours 37 minutes into the flight. Guidance has reported that the burn duration was literally right on the money.
SC Power 5 emergency power down.
CAPCOM Okay. But hold off on it because we might have to start PTC up again here, and that's the point that's being resolved right at the moment so stand by.
SC Okay.
PAO Apollo Control Houston. The term PTC passive thermal control is a bar-b-que mode which has been used on previous flights. There's a discussion in the control center as to whether or not we should continue it in that mode during the coast phase in. We're 79 hours 39 minutes into the flight and continuing to monitor this is Apollo Control, Houston.
PAO Apollo Control, Houston, 79 hours 40 minutes into the mission, we show Apollo 13 at 6003 nautical miles out from the moon. At this time traveling at a speed of 4908 feet per second.

CAPCOM Aquarius, Houston, over.
SC Go ahead, Houston.
CAPCOM Okay, we're ready to give you the procedure which will power you down a good bit and after the PTC is going, maybe we can give you further information. Are you ready to copy? Starting at the middle of the page Power 5.
SC Okay, go ahead, Vance.
CAPCOM Okay. After number 1 first line cross out and VHF-A. Second line cross out Simplex operation. Third line cross out prime. That refers to prime power amp off. That, that prime should actually be replaced by off. And that's the second prime that line. Also on the third line, the last word off should be crossed out replaced by PCM. Fourth line is okay. Fifth line which is VHF voice on, off, off, cross out. Lighting floods which is the next line should be off, but add the following, or overhead/forward prefer off. Okay...

END OF TAPE

CAPCOM - prefer off. Okay step 2 remains the same, no change for the moment. Stand by. Skip step 2. Do not do it. Just go to step 3 which is configure circuit breakers per the chart. That takes us to page power 6. Why don't you give me a readback on what you had on power 5.

SC Okay. On power 5, emergency power down Item 1, first line I scratch the amp VHF-A, second line simplex operation, third line I replace the second prime which is the power amp with an off, and the last word on that line is off, replace it with TCM. Fourth line is okay. Fifth line scratch the whole line. Lighting, we haven't needed flood yet so we will just leave them off, exterior lighting off. Scratch line 2 and on by now on power 6 wait for your update on the CB panels

CAPCOM Okay. Power 6. Okay, power 6 refers to panel 11. You should go per the chart with the exception of those breakers that I call out. First line is okay. Or, lets say, first row. Second row quad 4 TCA closed, quad 3 TCA closed, quad 2 TCA closed and quad 1 TCA closed. The rest of that row is okay. Row 3 about half-way over at ATCA PGNCS closed. Okay, the rest of that line is okay. Fourth line heater. Stand by. Okay, that line is all okay with the exception of the last three circuit breakers, Fred. Under PCNGS which is LGC DSKY, IMU stand by and IMU operate. Those three should be closed. At least for the time being. Finally, the fifth line - it's okay as is. And would you give me a readback on that.

SC Okay, I disagree on the fifth line. It appears that we ought to have the ascent ECA control open.

CAPCOM Okay, we'll check into that one while we are listening to the rest of your readout.

SC Okay, top row is correct as is. Second row we want the quad TCA's one through 4 closed. On the third row we want the ATCA PCGNS closed. On the fourth row we want the PGNCS LGC DSKY, IMU stand by and IMU operate all closed, and you stand the bottom row as is.

CAPCOM Okay, we'll go along with what you said on the ascent ECA control. That should be open.

SC Okay, continue, Vance.

CAPCOM Okay. Next page power 7, panel 16. First row, close the four quad TCA circuit breakers, that is, quad 1 TCA, Quad 2, quad 3 and quad 4 TCA. Okay, rows 2, 3, and 4 are okay.

SC Okay, Panel 16, top row, we want to close quad 1 through 4 TCA breakers and you say the other three rows are as is. Again, I have the exception the ascent ECA control on 16 should also be open.

CAPCOM Okay. We concur on that and we have a late arrival in Row 3. Stand by Okay, Fred, one addition third row. The S-band power amp. Request that you pull that circuit breaker

END OF TAPE

CAPCOM - third row; the S-BAND power amp; request that you pull that circuit breaker and leave the switch in PRIMARY.

SC Okay, yes - that's the way we were doing it before. I'll pull the power amp CB and then I'll go back to the first stage and put the power amps to PRIME.

CAPCOM That's correct; that should be changed back to PRIME. And that's - that's it.

PAO Apollo Control, Houston, 79 hours -

SC Thank you.

PAO - 51 minutes into the flight. That was Vance Brand going through a checklist with the Apollo 13 crew for procedures in powering down the systems.

SC And low. Okay lighting bus off; exterior lighting is off. Okay, you want to get your breakers, Jim?

PAO We now show 13 at 6515 nautical miles out.

SC Okay, the BUS tie converters are coming off the line.

SC Yes, go ahead. That's all right, I'll put the switch off that'll kill caution and warning.

SC Okay, let's see. So we're going to lose the ball again.

SC Yes.

SC I'll get 16 NOUN 20 up.

SC What happened?

SC Ah (garble).

SC Do you have me move auto trans for this time? Well, I still have a VHA (garble) receiver off.

SC You don't, do you?

SC Yes.

SC Let's give them a call, pad 11.

SC Okay, Vance, I'm on - Do you read me now, hot mike?

CAPCOM Roger, loud and clear, Fred.

SC Okay, Jim just noticed we got a vhf breaker in on panel 11 still, I think that probably should be opened.

CAPCOM Okay. That's affirmative. Pull the VHF A receiver.

SC Okay. Pull it Jim.

SC I got it already. Okay, now, why are we putting the cabin fan on?

SC (Garble).

SC Oh, oh, oh. Oh, yes, okay.

SC Okay, I'm going to pull inverter 1

CAPCOM Okay. Not very long since they had to switch off on you, anyway.

SC Okay.

SC Roger.

SC But my only question is, I got the cross tie BUS circuit breaker in?

SC (Garble).

SC Could be - Yes - that's what I have.
SC Good line.
SC Cause that line is open.
SC I'll look up what that caution is there.
SC Vance, Aquarius.
CAPCOM Roger, go ahead, Fred.
SC Yes, we've managed the first 30 hours or so here without caution and warning, we don't need to keep it up now, do we?
CAPCOM Okay, Fred. That's one that we're leaving up until the PTC is established. We have a procedure for PTC to try with you, which we're hopeful will work pretty well. And I'll read that up as soon as you get what you're doing now, done.
SC Okay.
SC So, why don't you go ahead and I'll get this PTC procedure. It's about a foot of log and I'll just get that.
SC And one other question, Houston. You really want to pull the ASA breaker, you want to give up the AGS probably for good now, huh?
SC Houston, I'm standing by to copy that PTC procedure.

END OF TAPE

SC Houston, I'm standing by to copy the PTC procedures.

CAPCOM Okay. I'll get back with you on your question in a minute, Fred. Now here comes the PTC procedure. Step 1, guidance control to PGNCS, 2, mode control att hold. VERB 76 enter, maneuver to PTC attitude, and that incidentally is roll 0, pitch 90, and present yaw, we realize you can't monitor that on your FDAI, but you can on a VERB, with a VERB 16, NOUN 20. With me?

SC Rog. Guidance control PGNCS, mode control att hold, VERB 76, enter, maneuver to PTC attitude which is roll 0, pitch 90, and yaw which is the present yaw. Is that correct?

CAPCOM That's correct. Okay, next. Mode - - when you're established at the attitude mote control auto. Key in Verb 16 NOUN 20 to monitor rates, when less that 1 degree a second, rate in all, in each, axis then disable plus X thrusters. Okay, next VERB 25, NOUN 07 enter. 1257 enter. 252 enter 1 enter VERB 77 enter VERB 48 enter put in the DAP 22110 and proceed. VERB 34 enter, then VERB 26 NOUN 20, and monitor rates. On rates less than .01 degrees per second in all axis, VERB 76 enter. Mode control at hold, then 30 clicks of right yaw to start the maneuver. Over.

SC Okay, Vance. PTC procedure, guidance control PGNCS, mode control att hold. VERB 76 enter, maneuver to PTC attitude, roll 0, pitch 90, yaw 0, my ball now of course is inoperative, so I'll have to get that on the DSKY. The 5 is mote control auto, 6 VERB 16, NOUN 20 monitor rates. Rates less that 1 degree per second in each axis disable and I didn't hear that last part. The next one was VERB 25 NOUN 07 enter 1257 enter 252 enter 1 enter. VERB 77 enter VERB 48 enter...

END OF TAPE

SC VERB 48 enter, 22110 proceed VERB 34 enter, Verb 16 NOUN 20 enter, monitor rates. Rates less than .01 degrees per second in all axis. VERB 36 enter, load control att hold, then. 30 clicks of right yaw to stop maneuvers - start maneuvering.

CAPCOM Roger. That's correct, Jim. To answer your questions and correct one point, YAW should be your present YAW whatever it is and that's up with ROLL zero, PITCH 90 present YAW. The other thing is you said disable and you didn't hear the rest. That's disable plus X-thrusters. And, finally, near the end the 22110 refers to DAP loading.

SC Roger. Now maneuver to PTC and ROLL zero, PITCH 90 (garble) YAW whatever YAW is. Okay, Vance, in our initial maneuver to PTC attitude, I am going to have to use the display 1620 and I'll have to use the TTCA to get there.

CAPCOM Jim, Roger, you're still in TTCA and just a reminder that in maneuvering that ROLL is in R3 and the YAW is in R1.

SC That's affirmative and I'm going to take our ROLL first to get it zero and then I'm going to take care of PITCH.

CAPCOM Okay.

SC Okay. Guidance control, stay load control for att hold. Okay, we've got to get that up. There we go.

SC - work out the battery

END OF TAPE

SC We need to work on the battery.
SC (Garble).
SC Do you know where the plus X thrusters are?
SC Yes, okay. I just wanted to make sure you knew. I got them over here.
CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay. A couple of things, Jim. One is that you can use the TTCA's to maneuver, but you're going to save a lot of fuel if you'd try minimum impulse. So, that might be a better recommendation. The other thing is, we'd like to give you a GO before you disable the plus s - X thrusters, and before you do a VERB 76, and mode control 2 at HOLD. Over.
SC Okay, understand. You want a GO before I — I'm - of course, I just hit a 76, and the mode control isn't at HOLD, at this time. But, let's put her on, now.
CAPCOM Yes, all we wanted to do was take a look at things before you disabled the plus X thrusters, and before you go to MIN impulse at the end there. That VERB 76; ENTER, mode control at HOLD.
SC Roger, understand. And I'm maneuvering my roll now 200.
CAPCOM Roger.
SC (Garble).
SC Yes, those are the plus X, right.
SC Yes, those are plus X right.
SC Ahh -
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Ah -
CAPCOM Go ahead.
SC - in what fashion did you want us to disable those plus X thrusters? Just pulling those appropriate PTA breakers, or did you want to actually go in and mask those jets?
CAPCOM Okay, Fred, we didn't explain that. The VERB 25, NOUN 07; ENTER sequence does that.
SC Okay, I didn't read the whole procedure, Jim just mentioned he wanted to disable plus X.
SC (Garble).
SC Okay.
SC And, Vance, are you still trying to get me an answer on that - pulling that ASA breaker?
CAPCOM That's affirm, Fred. This - word here is, pull it.
SC Okay. Sure didn't get much work out of the AGS this time.
SC It's going slightly.
SC A little this way.
SC Yes, you got a ways to go, in pitch.
SC Yes.

END OF TAPE

SC you've got rates in yaw and pitch. Yes. 980.
SC You want to rest a little bit.
SC What time is it? It's 9:30, I got up what at about 10.
SC We're now in the hands of tracking. Yes. It looks different than before.
SC There's a do P-37 to the LM. Tried to do a P-37 in the LM.
SC Well you can see where you're almost to the LM. (garbled).
SC In fact you can barely see Corners there.
CAPCOM Aquarius , Houston.
SC Go ahead, Houston.
CAPCOM Okay, just some info. We're working up a procedure for you to use to use command module LI OH canisters to connect to your hoses, the outlet hoses in the LM so as time passes in the mission, you can continue scrubbing the LM atmosphere. And this whole thing requires that a modifying a kit so that you can attach the hose, you're modifying a LI OH cansiter so you can attach the hose to it. So, some time in the future we will be coming up to you with that procedure. Second point. Second point is we're standing by to watch your maneuver for the PTC procedure.
SC Okay. I'm in process now, Vance, of maneuvering to 0 yaw, 90 degree pitch using the LM mode.
CAPCOM Okay.
SC And Vance, I assume it has also been thought of that we got two extra secondary cartridges. One in each PLSS.
CAPCOM Roger.
SC We better start working on that mod right now.
CAPCOM Yes. We wish we could send you a kit and it would be kind of like putting a model airplane together or something. As it turns out this contraption will look like a mail box when you get it all put together.
SC What are we make it out of Vance.
CAPCOM One canister with a plastic roof.
SC Just for your information, Houston, during, just prior to going around the moon, we saw a lot of debris that was floating by us. Debris of one rather large piece. Sort of looked like the wraping off of a line of some sort. It still is with us.
CAPCOM Roger. Copy Jim.
SC Even after our free return mid course yesterday.

END OF TAPE

SC - free return midcourse, yesterday.
CAPCOM Okay, we copy that.
SC Well, willie-nillie, I can't stop that. To roll either way won't do it.
SC Jim?
SC Well, I don't see any way around it, Jim.
SC It sure doesn't seem to be doing much, does it?
SC It won't go down.
SC Not at all, wonder if they tried that in the simulator, I can't seem to get roll to go up. It goes down on me, no matter how I hit the controllers.
SC Good pitch, Joe.
SC It might be a change in rate.
SC I'd like to move this yaw around, see if it'll couple with roll.
SC No?
SC There we go.
SC That does it.
SC I'm glad for that.
SC I don't know what caused it.
PAO Apollo Control, Houston, 80 hours, 27 minutes. Apollo 13 now 8137 nautical miles out from the Moon. And presently traveling at a speed of -
SC 7 percent (garble) fuel level, I wonder how come they did that all right, Jim.
SC (Garble).
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Jim, we don't have any data on your movements right now. How does it look like this procedure's going to work out so far as getting an attitude set up, the first part of the procedure?
SC Well, Vance, I've been trying to use a bit of (garble) attitude control to get my roll and yaw — the roll and pitch, rather. But with the attitude control rolling in this configuration, I - I can't command these to roll the way I want to, so I had to go to DPCA to get my roll to build up towards zero, it was going - decreasing towards 270. I really don't know what the combination is in the attitude control, that you can get the control to pitch and roll the way you want it to. You've got to use the DPCA.
CAPCOM Roger, copy.
SC (Garble).
SC I now have both pitch and yaw - or pitch and roll going toward the designated amounts, now passing through 23 degrees in pitch, and I'm going up past 321 -

END OF TAPE

SC and I'm going up past 321 degrees in ROLL and I am letting it go that direction and when I get there and when I get there 90 in pitch and zero and zero in ROLL, I'll go to AUTO and damp the rate. Get a little sleep? That's okay.

SC We've got to rig up a method of using those lithium hydroxide cannisters.

SC Okay, Houston, we just got a master alarm in the ECS light, I take it. The partial pressure CO2 is yes - that's what Jim said.

CAPCOM Aquarius, Houston. Say again.

SC Our CO2 value is getting high - We had a (garble) ECS light and a blinking component light.

CAPCOM Okay. Copy.

CAPCOM Stand by on that TP CO2.

SC Say agin, Houston.

SC Houston, haw do you read. Over.

CAPCOM Okay. Read you loud and clear now, Jim.

SC Okay. Did you hear what I just said about the ECS light and the blinking CO2 component lights?

CAPCOM Okay. We got that and stand by one.

SC Okay.

SC Jack, we might have to have you to rig up this CO2 rig they are talking about.

CAPCOM Aquarius, Houston. Over.

SC We've got a long ways to go.

SC Go ahead.

CAPCOM Jim, we're going to have to get back with you in a couple of minutes on that. We switch over at this time to your other cannister. A second point, it might help in setting up this PTC if you concentrate on ROLL first and get that going and then work on PITCH when ROLL is established and sort of take whatever YAW you get.

SC Okay. Vance, I tried that but when I start doing ROLL only I get pitch coupled in with it. (garble) towards the desired amount of 46 and in PITCH and 326 in ROLL.

CAPCOM Okay. Understand you tried it.

SC Once I get ROLL zero I don't think it will be too - be too bad.

END OF TAPE

AQUARIUS (garble) no fuss. (garble)
CAPCOM Aquarius, Houston.
AQUARIUS Go ahead Houston.
CAPCOM Okay, just some info. We are working up a procedure for you to use to use command module LIOH canisters to connect to your hoses, the outlet hoses in the LM so that as time passes in the mission, you can continue scrubbing the LM atmosphere, and this whole thing requires modifying a kit so that you can attach the hose - or modifying the LIOH canisters so you can attach the hose to it, so sometime in the future we will be coming up to you with that procedure. Second point, second point is we are standing by to watch your maneuver for thePTC procedure.
AQUARIUS Okay, I'm in the process now Vance, of maneuvering to zero yaw, 98 pitch, using another mode.
CAPCOM Okay.
AQUARIUS And Vance, I assume that it had also been brought up that we got 2 extra secondary cartridges, one on each PLSS.
CAPCOM Roger.
AQUARIUS We were going to start working on that part right now.
CAPCOM Yeah, we wish we could send you a kit; it would be kinda like putting model airplane together or something; as it turns out this contraption is going to look like a mailbox when you get it all put together.
AQUARIUS What are we picking out of Vance?
CAPCOM One canister with a - how about a plastic roof?
AQUARIUS (garble) procedures -
AQUARIUS Just for infomration, Houston, during - just prior to going around the Moon we saw a lot of debris that was floating by us, including some - one rather large piece, looked like the wrapping of a line of some sort - it still is with us.
CAPCOM Roger; copy Jim.
AQUARIUS Even after our free return midcourse yesterday.
CAPCOM Okay; we copy that.
AQUARIUS What are you doing? Can't stop that; rolling away won't do it.
SC I don't see any way around it chief.
SC Won't come down.
SC I don't know, wonder if they tried that with ventilator; I can't seem to get roll to go up. It keeps going out on me. No matter how I hit the controllers.

END OF TAPE

SC Oh boy. (garbled) He didn't want it. There she goes, okay.

CAPCOM Aquarius, Houston.

SC Go ahead, Vance.

CAPCOM Okay, Jim. Since the first recommendation on how to maneuver PTC didn't work out, we have another one. And you might try this. Put yaw at 0, then start on the roll and the pitch after that.

SC Vance, do you read.

CAPCOM Yes. I do now. Go ahead.

SC Okay. You want to - what sort of material you had in mind to build this mailbox out of and Jack and I will go to work on trying to construct this thing. Assume we will use the space-age baleing wire or the grey tape.

CAPCOM That's afirm. We have a lengthy procedure here, but in short, you use plastic as a covering for the whole thing. You put some kind of a stiffener at the top so the plastic doesn't suck against the LOI LIOH entrance side. You need grey tape to stick the whole thing together and you need something like a sock to put in the bottom so that the outlet side is plugged up. As it turns out the flow is rather U-shaped through this cartridge, Fred. It, if you plug up the bottom it comes in one side of the top and goes out the other.

SC Okay. Hold on a minute. Let us go get a cartridge and when we get it in the hand, I'll speak to you some more.

CAPCOM Aquarius, Houston, over.

SC Okay, Vance, go ahead.

CAPCOM Okay. Really, I think we should give you a more detailed procedure on that and in general, those are the materials that are to be used, but let us get back with detailed procedure on how to make this cartridge arrangement work.

SC Okay. And to answer your question about PTC we have difficulty in yawing zero (garble). We not sure - yaw is working toward zero right now. Pitch is working toward 90 roll is working toward zero. So we're - we did need take some time to get there, that's all.

CAPCOM Roger. There's quite a bit of noise now. I understand you're still having a problem getting there with the PTC.

SC We're getting there slowly.

CAPCOM Okay.

CAPCOM Aquarius, Houston. Let's try a forward OMNI.

END OF TAPE

SC I don't know, it looks that way.
SC Okay. Houston. How do you read, now?
SC Houston, how do you read?
CAPCOM Loud and clear, now. Go ahead.
SC Okay. I switched to forward OMNI, now.
CAPCOM Roger.
SC Okay.
SC I can't stop PITCH.
SC (Garbled) fuel.
SC (Garbled).
SC It's got the wrong (garbled)
SC Oh, yes, that was pretty.
SC It didn't sound very good.
SC (Garbled).
CAPCOM (Garbled).
PAO This is Apollo Control, Houston at 80 hours 49 minutes now into the flight. We show Apollo 13 at 9118 nautical miles away from the Moon, and traveling at a speed of 4718 feet per second. Our revised flight plan shows a rest period of 6 hours for both spacecraft Commander Jim Lovell and Jack Swigrrt, Command Module Pilot, starting at 81 hours 30 minutes.
SC Huh?
CAPCOM (garbled).
SC Yes, I've been trying to get ROLL out. Go to 0 then put it in DATA hold. Then take out YAW, leaving PITCH the way it is with a PITCH down.
PAO Of course the start of the sleep period is dependent on setting up attitude for PTC. We're at 80 hours 51 minutes now into the flight, and this is Apollo Control, Houston.
SC (garbled) try to change to that (garbled).
CAPCOM (Garbled).
SC Huh?
CAPCOM Have to (garbled).
SC What are you doing, now?
SC Nothing.

END OF TAPE

SC (Garbled)
SC What?
SC (Garbled) let's read.
SC Where are you doing now?
SC Nothing. We're not reading anything.
SC Well that's the one they wanted you to leave in.
SC It's in. That's how it trigered the -
SC Okay Jack, I've got to push in on this thing to stop it.
SC Yes.
SC I just turned the (garble) back on.
SC Now that it's on staady I'll leave it on. I can't understand why I got a power - oh, I know. That's right.
SC Their reading is correct.
SC Yaw, we're going the wrong way though aren't we?
SC Okay, what we're going to do Jack, we're going to go over there. (Garbled)
CAPCOM Aquarius, Houston. Over.
SC Go ahead Houston.
CAPCOM Jim. it looks pretty good except that the pitch is going out in the wrong direction now. Over.
SC I concur. What I'm going to do is get roll to zero and try to bring yaw into zero and as soon as I get those two pretty well matched up then I'm going to take a pitch and try to pitch it down.
CAPCOM Okay.
PAO Apollo Control Houston, 80 hours, 56 minutes. Apollo 13 now 9420 nautical miles out from the moon, velocity reading 4701 feet per second. Our real time flight plan has just updated the start of the rest period for Commander Jim Lovell and Jack Swigert. That time now reading 82 hours Ground Elapse Time. Jim Lovell still working with establishing the proper attitudes for passive thermal control. Apparently roll is pretty well nulled out, still moving out a bit in the pitch axis. We're at 80 hours, 57 minutes into the flight, and this Apollo Control Houston.
SC Okay, now I've got pitch going down. I got roll almost zero and yaw is almost zero.
CAPCOM Okay, copy there Jim.

END OF TAPE

SC (garbled)
SC Houston, what's the reciptocal Pitch attitude that you'll take?
CAPCOM Aquarius, Houston. Aquarius, Houston. Over.
SC Roger. What's the reciprocal Pitch attitude that we can have for PTC. I can go into AUTO any time now, I put it on 118 degrees in Pitch. Practically zero and about 40 roll Yaw.
CAPCOM 90 degrees Pitch.
SC I'm looking at 118 degrees of Pitch.
CAPCOM Standby.
SC I'm trying to talk to them.
CAPCOM Standby a minute, Jim. The Pitch is the important thing, but standby one.
SC Okay. It's coming down. Well, I guess I'd better eat something. Hey, this (garble) Hey, we can go a hell of a long time without any sleep. I said we've gone a hell of a long time without any sleep. Fred, I've just been thinking about getting you back to sleep again because — is —
SC Yes, I know. I didn't get hardly any sleep last night at all.

END OF TAPE

SC Hey, Fred, this jettison bag with the real air tight stuff, if you want to use it for wrapping for a lithium hydroxide bag or something like that.
SC Yes, this stuff is pretty tight.
SC Yes
CAPCOM Aquarius, Houston. Over.
SC Go ahead Houston.
CAPCOM Okay, Jim. Would you stable your - stablize your rates here at the attitudes you're at now, and go Att Hold. Over.
SC Okay. Will do. I'll go 150 degrees. 1063 Pitch, and 2.5 degrees Hold.
CAPCOM Roger.
SC (garbled)
SC No.
SC (garbled)
SC Bagets or clean ones?
SC Last ones in the trash bag.
SC Oh, I thought you wanted a clean (garbled) lithium hydroxide.
SC Okay, Houston. You wanted my angles (garbled) might be less than 1 degree per second.
CAPCOM Standby. We'll check them, Jim.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, that's affirm. We're monitoring and you're almost there, but we'd like to let them stablize a little bit longer. Over.
SC Okay. We'll just hold.
CAPCOM If you can now go into your eat period, or do something else while the rates are stablizing, why we recommend you relax somewhere and get some chow.
SC Quite well. We'll do that.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay, Jim. Looks like your rates are damped sufficient. Recommend that you go ahead with the Verb 25, Noun 07 enter bit. On down through the Verb 34 enter, and then wish you'd standby for us to look at it again, before you go beyond that. Over.
SC Okay, Houston. I'll go through Verb 25 07 down through Verb 34 entering and I'll standby.
CAPCOM Right.
PAO Apollo Control, Houston at 81 hours, and 19 minutes now into the flight. We presently show Apollo 13 at 10 431 nautical miles out from the Moon. It's velocity reading 4 649 feet per second. A couple of points of clarification: the master alarm on the CO2 canister was expected to occur at some point in the mission. It is normally set at 7.6 millimeters of CO2. This number chosen as an alert to watch the canisters. However, the medical officials had agreed -
SC It's complete.
PAO - medical officials had agreed that it would be desirable to raise this number on our return to 15 millimeters in order to preserve the lifetime on the canisters. Here at MSC, the level in laboratory testing has -
SC - 15, 20.
PAO Here in the MSC laboratories the levels using test subjects have been as high as 22 millimeters of CO2 with no ill effects. On our passive thermal control we have damped the rates at this point. There has been an effort on the part of the crew and the ground to perform this activity with minimum use of the RCS propellants. We're at 81 hours 21 minutes.
SC Maybe sort of think about rationing some of it. I mean just to make sure we've got enough to last us until we get enough water out. I hate to run out of water on the last day. Take a look and see how much we've got and fill them up and just hold them there. Yes, if something's good to eat now will be the candies, the sandwich spreads. Maybe the (garbled.). The dehydrated stuff if you have to rehydrate it, is going to be difficult. Now, wet packs are good. As a matter of fact, we might use (garbled). How about the (garbled)? Yes, I know but I mean the (garbled) too.

END OF TAPE

SC Yeah, I know, but I mean the PLSS's are bombed too. We're damping rates. Maybe we ought to use the OPS first.

CAPCOM You guys moving around?

SC Okay.

PAO This is Apollo Control, Houston, 81 hours 27 minutes now into the flight of Apollo 13. Apollo 13 now 10 776 nautical miles away from the moon headed towards the earth, and traveling at a speed of 4633 feet per second. To repeat our earlier comments, the master alarm on the Co2 canister was expected to occur at some point in the flight - the return flight. It is normally set for a level of 7.6 mm of Co2 to trigger the alarm.

SC Go ahead, Vance.

CAPCOM Jim, just a reminder. Any waste water dumps at this point would really jiggle up the PTC preparation so request you save that until we're spun up Over.

SC Right. I don't think we're doing any.

CAPCOM No. I don't think so, but I just wanted to make sure you were aware of it - I thought you were.

PAO The 6.7 level was established to be aware and watch. The medics agreed, however, it would be desirable to raise that number to - for the canisters — to 15 mm CO2 in order to perserve the lifetime on these canisters. And at MSC in the laboratories we have run tests with subjects at levels up to 22 mm of CO2 with no ill effects on the subjects. We're at 1 hour - 81 hours 29 minutes into the flight and this Is Apollo Control, Houston.

SC We've just about slowed down.

SC There she is.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Houston. Go ahead.
SC Okay, Vance. A couple of items we uncovered for that cartridge mod. One is the special dust covering bag that we were going to use on the tote bags that is pretty thick and nonporous. Then we went up to the upstairs kitchen and drained water a couple more times and made up a whole bunch of drink bags again. From the pantry we retrieved a fairly large enclosure made of plastic that those drink bags are in that. I think we can gather and also make do for a cover. Taping it on if that's appropriate.
CAPCOM Okay. Jack Lousma here has a refined version of the procedure on how to make these the easy way. I think before too long he ought to be reading that up to you. It -
SC Okay.
CAPCOM It's not time critical to get up to you. It's just that before you get too far in assembling these on your own, we kind of like to give you the benefit of experience down here.
SC Okay. Who built them back there?
CAPCOM Tony did some of it, and Jack's been working on it too. So we've had a big effort on it.
SC Great.
CAPCOM We would encourage you to wait till tomorrow to receive that procedure, but we can send it up sooner if you insist. Over.
SC No, that's alright, Vance. Before we have to worry about that I guess we got another primary and 3 secondaries to go through.
CAPCOM That's right.
SC You know, sometimes those cartridges have -
CAPCOM Aquarius, Houston. Over.
SC Man, that's a wicked low pressure down there. I wish ya'll would hurry.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Okay, Jim. Your rates are once again looking good so we can continue on with the rest of this procedure. We request you go ahead with the VERB 76 enter, and MODE CONTROL to ATT hold, and then the last step 30 clicks YAW right.
SC And, jets are firing again.
SC Okay. I'll go (garble) with mode control ATT hold and dO clicks YAW to maneuver.
CAPCOM VERB 76 enter.
SC Roger.
SC There's your VERB 76 enter. MODE CONTROL to ATT hold. Now you want me to do the 30 clicks of right YAW?
SC Vance, did you say for me to hold on the

SC right YAW or do you want me to start it, now?
CAPCOM No need to hesitate, you can start now.
SC Okay.
CAPCOM After you get that going then we'll think about powering down the PITCH.
SC Okay 30 clicks of right YAW.
CAPCOM Okay. We'd like to look at it for just a little while before we power down the PNGS. So stand by.
SC Understand your planning to power down the PGNS?
CAPCOM Right. We want to get the amps down.
SC Okay.

END OF TAPE

SC That's bad news.
SC (garbled) 26.
SC Why not?
SC - want to bring all the fim back (garbled)
SC I'd like to just go off and shoot it.
SC Every last lousy one of them. Well, that means that I've got to (garbled)
CAPCOM Aquarius, Houston. Request AFT OMNI.
SC You got it, Vance?
CAPCOM Roger. That did it. Thank you.
SC Gad, there's Theophilus and Alphonsus. Sure enough. See them right over the edge.
SC Well, I'm going to shoot a few pictures with the old camera here.
SC Yes. (garlbed) Did you put it back?
SC Yes.
SC (garbled)
SC (garbled)
SC We ought to come up the side.
SC Hey, you got us in the right place, Jim. We're in the right place. We're pointed (garbled) with the Earth and ground in sight. In another respect, it might be easier to give up.
PAO This is Apollo Control, Houston, at 81 hours 45 minutes now into the flight. Apollo 13 presently 115 - 11 587 nautical miles away from the Moon and travelling at a velocity of 4 600 feet per second.
SC Oh, that's right. That blasted Service Command Module is back there. (garbled)
SC That one?
SC It's not much better. (garbled)
CAPCOM Aquarius, Houston. Over.
SC Go ahead.
SC Go ahead.
CAPCOM Jim, we have some status information for you, if you're ready to copy on a piece of scratch paper.
SC Standby, Vance.
CAPCOM Okay.
SC We're ready for you. Let's get away and get this status paper here. Go ahead, Vance.
CAPCOM Okay. The first midcourse correction will probably be at GET 104 hours and all we look for is a 4 to 6 feet per second DELTA V. Okay, that's the first item. Now, I will give you a run down on consumables. Okay, in the LM, you have 1 498 - that is 1 4 9 8 amp-hours remaining. That means over 61 hours you - that would average out to 24.5 amps. We expect that after power down, that you will use 1 4 or 14 amps per hour, and that would leave a reserve of 500 amp-hours at the end of the mission. Are you with me?
SC Roger. We're with you. That's what

SC - my number was yesterday.
CAPCOM Okay. In the LM, you -
SC We're with you.
CAPCOM In the LM, you have 215 that is 2 1 5 pounds of water usable. That would average out over 61 hours to 3.5 pounds per hour available. Okay.

END OF TAPE

CAPCOM Okay. And after you power down, we expect that you will be using water at the rate of 3.2 to 2.7 pounds - that's at 14 amps per hour electrical usage rate. One note, this down not - when we speak here of water avaiable, this does not include CSM water and PLSS water, so that's added on. Okay. Next. LiOH. Using the CSM cans you will have 16 cans at 12 hours per can to give you 192 or 192 hours of LiOH. And in the LM using it's cans you have 44 hours remaining.

SC Vance, is that with the PLSS seconda-ries.

CAPCOM That's affirm. That's affirm. That includes PLSS secondaries. Okay. Oxygen. You have remaining 44 pounds in the LM. At a usage rate of .36 pounds per hour that leaves you 120 or one two zero hours of oxygen. Okay. Next. RCS. RCS A stands at 62 percent and B at 62 percent. We only expect 2 percent to be used for the PTC so you're in good shape for RCS. Next DPS DELTA A. You have 1190 feet per second remaining. And finally CSM EPS. We estimate that you have 99 amp-hours. That's an estimate. And that's it. Over.

SC Okay. I copy.

CAPCOM Okay. and just a question. It would be interesting to hear from Jack to see if he thinks that main B bus is good. - if he has any idea of whether it's good or not, this would influence our steps in the future. For example, we might want to try to test main B to see if it is in fact good so that we'd know how to set switches for entry.

SC Okay. Just a minute. They want to know if you think main bus B is any good for the command module. Now, while Jack's got on the loop, let me pose the question of how we're going to do this midcourse - if we're going to power down the (garbled).

CAPCOM Would you stand by on that, Jim. We'd like to give you a procefure for that later on.

SC Okay. (garbled talk to crewmembers) He's going to give us a procedure on that later on.

CAPCOM In short, Jim, we don't expect any problem, but we'll explain later on.

SC Okay.

CAPCOM Deke says get a night's sleep.

END OF TAPE

SC Okay.
CAPCOM Deke says get a night's sleep. He says you've been working hard and you've got to relax a little bit and be ready for tomorrow.
SC Vance, this is Jack.
CAPCOM Go ahead, Jack.
SC Okay. Let me give you my observations on main bus B. They tabbed us pretty fast there and we first heard the impact or explosion or whatever caused it. I'm not sure. The next - about 1 second later there was a master alarm which was the main bus B undervolt. I looked at the voltage and the voltage was good at this time so I'm suspecting it was right. Fuel cell 3 was also good with good flow. However, Fred, at that point, was coming into the command module and got over into his seat. At that time, we shortly had an ac bus 2 right about the time he got in his seat. He looked at the main bus B and the main bus B was reading zero. However, - and the fuel cell flows were zero. I'm kind of suspecting that perhaps we do have a current main bus B. But that's merely a guess. I never did try to reset it. We were having other problems with the main bus A, having an under volt and a few other things like that. I'd kind of like to hear what your feelings are down there.
CAPCOM Well, Jack, we copy your information. And we'd like to hold off cause we're still working your problem. So we will have to give you information later. Thank you.
CAPCOM Aquarius, request capped OMNI.
SC Vance, are you back with me?
CAPCOM Rog. We're with you.
SC Okay. We lost lock there. We switched OMNI's. Just for my own kind of to get my thoughts together I'd like to hear what kind of entry you're planning. EMS or PNGS or what?
CPACOM Okay. PNGS entry is being planned and people are at work on checklist changes and that sort of thing.
SC Okay. Real fine.
CAPCOM And we'll give you a CSM stuff tomorrow but basically we expect that main bus B is good and we're trying to work up a procedure to test it.
SC Okay. Those are my thoughts too.
CAPCOM Rog.
SC You think main bus B is good, don't you?
CAPCOM That's affirm. We think it is, but we want to check it out anyway. We think you guys are in great shape all the way around. Why don't you quit worrying and go to sleep?

SC Okay, Vance. After all that (garble)
SC Well, I think we just might do that. Or part of us will.
SC I mixed up. How many more of those are we - are (garbled) Mike (garbled) Yes. I'm mixed up. You had 15, I mixed up 7 more. So, we got 22. By the way, there's still some water that's - it's stirring up pressure to mix up another drink, but there is some water out of there, if you want to get some water out of the drink cups.
SC Yes.

END OF TAPE

SC Pressure to fix up another drink, but there is some water out of there, if you want to get some water out of the drinkg cup.
SC That's good.
SC We ought to use that oxygen up, not waste it.
SC You monitoring right now?
SC Yes. Just standby there. Yes.
SC (garbled)
SC I will.
SC You wouldn't believe it, but I'm now in command of the LM. Okay. Vance, I'm probably the only CMP that's ever witnessed DPS burn sitting on the ascent engine head. Did you get that? Is there any coming out still? They didn't answer us. I think we made it. How's this working out?
SC They are, huh?
SC How are we going to get it aligned?
SC (garbled) We've got to watch that one right there.
SC It's decreasing now. (garbled) a clod. And what's that going to do to the Command Module?
SC It'll wobble.
SC Houston, Aquarius.
SC Switch OMNI's transmitters.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Roger. You just want us to set up here very shortly a power down procedure.
CAPCOM That's affirmative, if you'll take out your contingency book and turn to page Power 6. Over.
SC Roger. Standby. Contingency Power 6. Got the book over here. Contingency Power 6.
CAPCOM And while you're doing that, let's put attitude control 3 switches to Mode Control.
SC All three attitude control switches have been in mode control.
CAPCOM Okay, and when you get to power 6, you ought to see a circuit breaker page, Panel 11.
SC Okay. I have Power 6, Panel 11.
CAPCOM Okay. On Power 6, Panel 11. The top 3 rows configure measure (garbled)
SC Okay now, Jack (garbled). We have put the TTA in for the previous procedure. Do you want those out now?
CAPCOM That's affirmative, Jim. Pull them out. DCA's open.

END OF TAPE

CAPCOM (garble) open.
SC Okay. I'm changing those to get back again. First three rows. And you're through the (garbled).
CAPCOM That's affirmative. Pull active PNGS open.
SC Okay. I've done that.
CAPCOM Okay. Are you ready for the fourth row?
SC Affirm.
CAPCOM Okay. Now when we get in the fourth row, we're going to open the IMU operate circuit breaker. And what that means is that we're going to lose the capability to watch your CDU's, so we're not going to be able to see your attitude. Therefore, we will not be able to advise you which antenna to select for communications. The way we want you to handle that is to turn the LM uplink squelch off and when you hear the noise, switch antennas. We'll be able to see you switch antennas and it's going to take us about 3 to 5 minutes to establish a lock-on again after you switch. After each time you switch antennas we will initiate a voice check. And basically when you see the earth out the window you can be on forward antenna and when the moon's in the window use the aft antenna. You copy?
PAO That's Jack Lousma on the capsule communicator position.
SC We're going to pull the IMU operate circuit breaker, so you won't be able to see our attitude. Therefore, you won't tell us how to switch antennas and will enable - turn the squelch off so that when we start getting any static we'll switch antennas and as a thumb rule we could use - with the earth forward we use the forward antenna and when we see the moon we use the aft antenna.
CAPCOM That's affirmative, Jim. In other words, we're leaving the antenna switching up to you and after you switch antennas its going to take 3 to 5 minutes for us to establish a lock-on again and we'll initiate a voice check. And I'm ready to go on panel 11 row 4.
SC Okay.
CAPCOM Okay. On row 4, under heaters RCS system AB SET-1. Open quads 1 through 4. Under ECS the only change is - under glycol pumps close auto trenafer. Under COMM the only change is open vhf A receiver, open COMMANDER AUDIO. Under PNGS the only change is close and leave closed IMU standby circuit breaker so we can have heaters. Read back.
SC Okay. Row 4, we're going to open all four of the heaters. The RCS system (garbled) the first four circuit breakers. We're going to close the auto trans-fer. We're going to open the vhf A receiver and the COMMANDER AUDIO. And we're going to close the IMU standby. The LGC

SC DISKY and the IMU OPERATE will be open.
CAPCOM That's affirmative, Jim. all other breakers in that row are as you see them in the checklist. And in row 5 the only change is that we want you to under EPS open ascent ECA control. Over.
SC Roger. I think we already have that opened (garbled) Okay. So we confirm then one COMM system that will be the LMD system and we'll have to do our own antenna switching therefore we'll have to wait about - -

END OF TAPE

SC antennas, switch E to F4 roll. Have to wait about - okay. Wait till you switch. (garbled)

SC We'll have to wait for you to get a lock on again. Is that correct?

CAPCOM That's affirmative, Jim. You'll be working off of the LMP span over there.

SC Okay. We'll help you up on it.

CAPCOM Okay. Panel 16. That's on page power-7. Top row, the only change is, under RCS system B, open PQGS displays. Over.

SC Okay. Let me go over this with you Jack, because this checklist has been written over 2 or 3 times now at various procedures. Top row, the first two are open, the next three are closed and then we're going to open now the quarined TCA's 1, 2, 3, 4. Crossfeed will be closed and the (GARBLED) displays will be opened and we're going to open up the PQGS, main (garbled) will be closed (garbled) will still be opened.

CAPCOM That's affirmative, Jim. And there's no change to the second row. Over.

SC Okay. Again let me go through this with you. The first four are going to be closed, the next six will be - the next 9 will be opened from logic power B through descent engine override. How about the CWEA? Is that going to be closed?

CAPCOM That's affiraative, Jim. We want the next 5 closed.

SC Okay.

CAPCOM Okay. In the third row, under comm, displays open; SE audio, closed; vhf transmitter open, that's a change, vhf B receiver,open; primary S-band, power amplifier, open; transmitter receiver, closed; S-band antenna, open; PMP, closed: TV, open. Under ECS, displays, open; glycol pump secondary, open; LGC pump, open; cabin fan control, open; cabin repress, closed; and all the next 4 closed also. Readback.

SC Okay. We have displays open, SE audio closed, vhf transmitter open, chf B redeiver, open' power amp, open, transmitter receiver, closed; S-band antenna, open, PMP, closed; TV, open. displays is open next three are open, cabin repress, closed; and all the rest closed.

CAPCOM That's affirmative, Jim. And in row 4. Under heaters, we want them all - correction — we want all the quad heaters open. Correction - we want all the quad heaters closed.

SC All the - -

CAPCOM We want displays open, S-band antenna closed to avoid a master alarm, camera - sequence camera open

CAPCOM And under EPS, we want displays open, dc bus volt closed, inverter 2 open, ascent ECA closed, ascent ECA control open, descent ECA closed, descent ECA control closed, translunar bus tank close, we want the cross tie bus open, the bell loads closed, bat B ties closed. How do you read?

SC Okay. The 4 RCS gears will be closed, displays open, ascent antenna closed, camera sequence will be open, display will be open, dc bus volt will be closed inverter 2 open, ascent ECA - -

END OF TAPE

SC - to be closed. Invertor 2 open. Ascent ECA, will be closed, but the ascent ECA control will be open ECA CLOSED, Descent ECA control CLOSED. (garbled) Bus Tie CLOSED, and cross tie Bus OPEN and (garlbed) is CLOSED and Batt B side is CLOSED. I have one question, Jack. On Panel on the second line there under lighting, why are we keeping the (garbled) CLOSED. Or are they going to be OPEN?

CAPCOM Negative. We have the Lighting Breakers all CLOSED. Control the lighting with the switches and reostats. Over.

SC Okay. We don't need the floodlights, I don't think, but we can do it that way, I guess.

CAPCOM Under row 4, under RCS systems A and B, dash 2, Quad Heaters, you noticed that we've closed those circuit breakers, but what we want you to do is on Panel 3, turn the RCS AB-2 Quad switches 1, 2, 3, and 4 OFF. Over. We're going to watch your Quad temps for you, and when we need to warm them up a little bit, we'll tell you to throw those 4 switches on — on Panel 3.

SC Okay. Now are sure that this ECG mode is good enough so we pon't get cross coupling and get out of configutation.

CAPCOM Standby one on that, Jim. Okay, Jim, as far as we can tell right now the BTC looks as good as any BTC we've ever seen in a CSM so we're going to go with all we've got.

SC Okay.

CAPCOM Okay, and if you turn over the page on Power 8, we have the spacecraft functions remaining to you. We got low-bit rate TM. However, we don't have any VHF. We have CWEA. We have Glycol Pumps. We have Suit Fans. We have cabin repress for you, and standby in attitude control here. Okay in attitude control we'll have hard overs for uses in emergency and for normal usage we want to have a 15 minute delay to get the heaters on. To warm them up before use. How do you read?

SC Okay. For emergency we have hard overs and normal use it requires a 15 minute request to get the heaters on.

CAPCOM That's affirmative. Okay Jim, that concludes our power down procedure, and we're waiting for you to get with it.

SC Okay, Jack, we'll start. I sure hate to lose the tanks. I sure hope that procedure for the midcourse is a good one.

CAPCOM It is.

SC You want me to help you here?

SC Yes, you can.

SC Okay. Start the power down, Panel 11. All of them open. Closed.

SC Yeah.

END OF TAPE

SC Here it comes.
SC Get it. LGC. You just did it.
SC I'll give you this for observation. As we go through this and you go through the (garbled) and double check it.
SC Now, the flood lights are on. Right? I kind of think we need those on. Do you?
SC We'll pull those.
SC Give me the, first of all. We'll get back Go forward, forward (garbled).
SC Watch out.
SC (garbled) switch to AUDIO.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Just to (garbled) on our particular space-craft that on our panel 16 heater I just switched the A & B to QUAD 1 to heater circuit breaker, has been pushed in, and sealed in. Reset it.
CAPCOM Okay, Jim. The four QUAD heater breakers we want you to leave them closed. And we operate the heaters with the switches on panel 3. Over.
SC Okay.
SC Okay. We'll do (garbled)
SC Okay. Now pull the heaters on panel 4 Pull 1 through 4 off.
CAPCOM It's time for you guys to get to bed and get Fred up.
SC I still have one question, Jack. I still think that the light in our panel 6 needs a (garbled) light open. We're not using them.
CAPCOM You have any argument -
SC No problem, Jim. Go ahead and open them TRACK and FLOOD that's alright.

END OF TAPE

SC Ready? (garbled) open.
SC Now why don't you go through that Jack and make sure -
SC Yes.
SC - that I had it right.
SC Okay I'll take this.
SC Okay Jack, my only other concern now is the CO2 lines in the spacecraft. I guess you're keeping a handle on that?
CAPCOM That's affirm Jim. We have you up to 10.6 now and we're willing to go a little higher on that. We have another cartridge and we have a procedure for making the command module cartridges up. We'll pass that on later.
SC I'm not worried about that. I just wanted to make sure that you, that - we just don't want to go to sleep here and forget about the lines to 02.
CAPCOM Roger. We're watching it for you. We have it here. It's now 10.7 and we have a medical go to 15 millimeters.
SC That's a new one.
SC There's a new bird for you.
CAPCOM Okay Jim, we've estimated, we've got 1 more hour on the primary cartridge and 6 or 7 hours on the secondary.
SC Okay. Fine.
SC Say, this is still primary practice back here too isn't it? So this gives us another, how long?
SC (Garbled)
SC Yes. Yes. That's yours though, isn't it?
CAPCOM And your right Jim. We've got another primary cartridge back there behind the ascent engine covers.
SC Right. Yes. We know. Thank you.
SC Yes, yes, I just -
SC Okay. I guess you've got everything right on that panel. Let me check the middle one.
SC Yes. You power down and then you leave me. Tell me, I've got it.
CAPCOM Okay Jack, we just thought it's about time you got a LM checkout.
SC But he's given me INERT. Of course, I'm giving him my command module too which is rather INERT right now too.
CAPCOM Well, you've got to walk before you run, you know.
PAO This Apollo Control at 82 hours, 30 minutes. Here in Mission Control at this time we're in the process of completing a shift change. Flight director Milton Windier and his marooned team of flight controlers replacing flight director Gene Kranz and the white team. On board the spacecraft, the flight plan calls for the, two of the crewmen, Commander Jim Lovell and command module pilot Jack Swigert to begin a 5-hour rest period shortly. All three crewmen are scheduled

PAO to be eating at this time or to have finished by now. The lunar module has been essentially powered down, and at the present time we're showing a total current on the lunar module ranging between 14 and 15 or 16 amps, which is about what was expected.

END OF TAPE

CAPCOM Aquarius, Houston.
CAPCOM Aquarius, Houston. Over.
SC Go ahead, Jack.
CAPCOM Roger. For your information, Jack
SC You're loud and clear.
CAPCOM - all of our analysis is based on power down to 14 amps, but we're reading on you right now, 12.3 and so we're better off than we were in our analysis.
SC It sounds good.
SC Jack, I thought you were going to get the sleep shift where there wasn't any excitement?
CAPCOM Well, I tried, but I didn't make it.
CAPCOM I thought you were supposed to be sleeping now?
SC Well, Fred is getting something to eat and Jim is starting to sack out so I'm taking the con here till Fred gets set.
CAPCOM Okay.
PAO That was Jack Swigert reporting that Jim Lovell, at the present time, is resting, and Fred Haise is getting something to eat and when Fred finishes eating Jack Swigert is scheduled to get a bit of rest.
SC Is that right - are you ready to take over?
SC Why. Did you (garbled) I thought I was supposed to (garbled) I was waiting for you to - okay. You were off the (garbled) We know they can't mark our CDU's any more to tell when to switch antenna so it's just when they can see it switch. It will take a couple of minutes for them to get up. Then I'll just make the morning checklist. It came out here. I caught it. Okay. When you get squared away, I'll give you the con here. Oh. No, no. (garbled) They're showing right now 12.3 amps. Their analysis is based on 14 so they're in better shape. Okay. Hand those here.

END OF TAPE

SC Okay, Jack. How do you read?
CAPCOM Hearing you loud and clear. Great OMNI.
SC Okay.
CAPCOM Okay, I heard -
SC (garbled) You luck out with a good shift.
CAPCOM Yes, I got all the good deals. I heard Jack brief you on the Comm mode so, do you have any questions about that?
SC Okay
CAPCOM And how is your PTC going. I heard Jack tell you that we can't see your CDU's. How's it going?
SC Well, let's see. We may be offsetting slightly, the sun looks like it may be a liggle higher. Now here comes the earth by and it looks about the same perspective. Have to wait to see the moon on the other side there.
CAPCOM Okay, Fred, I can't hear you anymore on account of the background noise. I assume that - I think I heard Jack tell you what we're going to do about Comm. Uplink squelch OFF. You'll take care of the antennas because we can't see your attitude. We'll give you a voice check when come up. It'll take us 3 to 5 minutes to come up, and to make it astronaut proof, when you see the Earth use a forward antenna. When you see the Moon use the aft one.
SC Yes, that's pretty straight forward. Okay, I see the Earth so I've very wisely shifted to forward.
CAPCOM Good boy.
SC Got another battery?
SC (garbled)
SC And Jack, you still with us.
CAPCOM Still here, Fred.
SC Okay, when I was upstairs, just a minute ago, I noticed what appeared to be some new ventings from down the Service Module way. I noticed that out window 1, and also saw one chunk of metal - loose metal about 4 inches square that was tumbling around - silver in color, and it looked like it had come from somewhere down in the Service Module.
CAPCOM Okay. You saw some venting out window 1.
SC Right.
CAPCOM Go ahead.
SC Yes, that's where I happened to be looking. The lighting was such that it showed up out there. What reminded me of it was - I'm looking out the LM window and I see a good part of the star field it's created for us. There are about a thousand little sparklies out here.
CAPCOM Okay, so you're seeing some venting out window 1 and you saw a 4 inch square piece of loose metal which was silver in - are you still seeing the venting? Or has it zeroed out now?

SC I don't know. I left upstairs down in the LM now, Jack. I guess when Jack goes up he can take a look and let me know. Okay, I'll think about switching AFT here directly. I see the Moon, and the Moon looks pretty good Jack so I guess that PTC still doing pretty good.

CAPCOM Okay, and we won't have any Comm delay if the PTC stays good. Yes, sure enough the Moon is getting smaller.

CAPCOM Good, and we want to ask you another question about the venting. Is this - Would you suppose some new venting or is this venting that you just hadn't - that's been going on all the time, but which you hadn't looked at recently?

SC I can't really say, Jack, we've been so tied up down in the LM, I guess we kind of forgot about the other half, but I've been upstairs several times and hadn't continually noticed any flow by the windows before, so my first assumption was that it was new venting. It really wasn't very heavy.

CAPCOM Okay. Copy Thank you.

SC And Jack is going up to take a look now.

CAPCOM Okay. For your information all of our numbers are based on amperage usage of 14 amps. We're using only 12.3, so we're a little bad on our analysis.

SC Very good way to be.

CAPCOM And we're in a -

SC Aquarius has really been a quite a winner.

CAPCOM Well, that's one of several. We want to tell you something that I told Jim earlier, and that concerns control. Right now you have control and hard over if you need it, but when we go to some normal control modes, it's that we have the Quad heaters off. We want to have a 15 minute notice for attitude control request. Over.

SC Okay, Jack. Off hand I can't imagine that since we got the platform powered down why we need to worry about the instantaneous control, but at any rate, we need 15 minutes warm up with the heaters before we can start using thrusters.

CAPCOM Right.

END OF TAPE

SC - but at any rate we need 15 minutes warmup with the heaters before we can start using thrusters.

CAPCOM Right. And another thing we've done is to pull your ECS and EPC display breakers and so we - but we brought your caution warning powered up. So if you get ECS type or EPS caution and warning you're not to power up those meters with the display breakers. And we are watching for you. Your PIPA temperatures, your ASA temp, your propellant temperatures except for the DPS propellant, and we're watching your QUAD temps for you.

SC Okay. That's very good, Jack. You're watching them. That's good enough.

CAPCOM And everybody's fine at home EL LAGO.

SC Great.

CAPCOM And, Fred, your CO2 is building up. It's at 11.3 on our gage, and we've got a medical buildup at 15 millimeters at which time we'll switch over to secondary. Looks like we've got plenty of lithium hydroxide. About 192 hours including the CSM cartridges. And as you know, we've got a way to use those. As soon as we get them written in some good words, we'll pass that along. You might be able to make one.

SC Okay. Yeah, we'll sure give her a try. And I'm showing onboard about 12 and a half millimeters of Mercury

CAPCOM Roger. And I have a flight plan update when you get time to copy sometime, I'll pass it along. There's no hurry on it.

SC Okay. Stand by one. Jack's back now.

SC Okay. Jack just came back and he said it's still coming out and it's only coming out on the commanders' side. So he saw it out the same window I did, window one, and it's between the minus Y and minus Z axis.

CAPCOM Okay. And I -

SC That way the service module which was my impression, too.

CAPCOM Okay. So you're sure it's service module and of course if anyone is interested in knowing is it's something that is residual from before or is it something new. If you have any ideas about that why we'd sure like to have them.

SC (garbled)

SC Yeh, Jack, I'll answer your question in a minute, but make that first impression here is that it's not nearly as intensity it was right after our (garbled) pass and I'll have to agree with that. He said it was a half and I said it was maybe down to a third. And, Houston, I'd like to know if you have any pressures (garbled) residual from that or maybe something new.

SC I don't know why I felt that. Yeah, I felt it was (garbled) venting through.

CAPCOM Okay. Switch to forward option.

CAPCOM Fred, if you think it's practical, we're ready to give you some - we're working on some camera settings for pictures of the venting. And if you have a camera out and ready to go, let us know which one it is so we can get the sightings for that camera. What do you think about that?

SC Okay. Jack got the one with the 250 millimeter lense on it. That's the standard EL. And I have a (garbled) that I've been shooting hundreds of Earth-Moon pictures with, camera one. And we also have the reneau upstairs that's pretty handy. The command module DC camera.

CAPCOM Okay. I copy -

SC - take your choice.

CAPCOM I copy the 250 millimeter, the razo is(garbled), available, but I didn't get what other one is.

SC Okay. I got my Hassalblad service camera down in the LM here handy, too, camera one.

SC And, Jack, if we're going to do any pictures taking out the command module windows, I think we'd better do that pretty quick or hold up till Jim and Jack gets their rest done.

CAPCOM We cuncur with that.

CAPCOM Okay, Fred, we're not going to bother the skipper up there. We won't be taking any pictures out of the command module window until after rest period.

SC Okay.

END OF TAPE

PAO This is Apollo Control at 83 hours 2 minutes. Fred Haise has the watch at the present time in the lunar module, while Jim Lovell and Jack Swigert attempt to get some rest in the command module. The flight plan calls for a five hour rest period for both the commander and the command module pilot. A re-capping briefly - Fred Haise remarks after coming back to the LM from the command module where he had been getting something to eat. Fred reported that he had observed some venting apparently from the service module and had also seen a four inch square piece of metal which he described as silver in color float by the window of the command module. He was looking out the number one window, which is viewed from inside the command module — is the window to the left of the commander's couch, the far left window. Haise was asked if he felt the venting was something new or if it was residual venting from the original event which had caused the loss of power and oxygen to the service module. He did not know and we also have not determined here on the ground whether this was an event associated with the original loss of power from the service module or whether it is something new. That's being evaluated at this time. Haise said he did feel definitely that the event was coming from the service module - that the piece of metal he had seen floating by was from the service module and that the venting was from the service module. Flight director Milton Windler, after reviewing the situation, elected to wait until after the commander, Jim Lovell, and the command module pilot Jack Swigert had completed their rest period before attempting to get back into the command module and photograph the venting and whatever pieces might be visible out the window.

PAO This is Apollo Control at 83 hours 11 minutes. A change of shift press briefing is being planned to being in about 10 minutes at 12:35 am in the main auditorium at the Houston New Center. The participants in the press conference will be flight director Gene Kranz and astronaut Tony England. And repeating the time for that change of shift briefing is tentatively planned for 12:35 am - about ten minutes from now.

CAPCOM Okay. Fred, for your information, your CO2 reading on board is a little higher than what we're reading here on the ground, and so when it gets to 15 on your meter, switch to secondary. And we'd like to get a status about every thirty minutes - we'll give you a call on that. But just to let you know we're still'thinking about you, we'd like you to go bio-med right, please.

SC Okay. Going bio-med right.

SC How do you read me on this COMM mode on base band?

CAPCOM Five square, Fred, (garble).

END OF TAPE

CAPCOM We're still here, Fred. How's it going?
SC Ok. My CO2 reading is now just below 13.
CAPCOM Say again what it is.
SC It's just a trace below 13.
CAPCOM Okay. Just below 13. Just for your information we've got people working on several subjects. We're working on the midcourse coming up, to determine our control system--how to do it with the control system we select, what we should do about the alignment -- we've got the (garble) and several crews cranked up working on that, and we're also working on our entry, how and when we ought to activate the CSM and we're working on the CSM systems status. Tomorrow sometime we're going to have a main bus B checkout, so we've got a lot of people swinging pretty hard here and I've got some F-stop settings for you for the lunar surface camera. At 1/250 we'd like you to take targets of opportunity. Each picture use three F-stops, because we don't know exactly which one is going to work the best, so use 4, 5.6, and 8 and 1/250 for the surface camera. Got it?
SC Okay. Use the surface camera at 1/250 4, 5.6, and 8. And I've been doing quite a bit of shooting at 5.6, and 8. (Garble)
CAPCOM Roger, I didn't catch that last part. Maybe when the COMM gets a little better you can say again.
SC Okay. How do you read now, Jack?
CAPCOM That's a lot better, Fred.
SC Okay, I just said the moon is awfully bright, that I think the higher range of F-stops would be better. F/8 and maybe F/11.
CAPCOM Okay.
SC I can just barely on the left corner of the Moon now make out the foothills of (garble) formation. We never did get to see it when we were in closer.
CAPCOM Okay. I'm reading on my monitor here, Fred, that you're 16 214 miles away from the moon moving at about 4500 feet per second.
SC From the souds of all the work that is going on and is still going on, this flight is probably a lot bigger test for the system on the ground than up here.
CAPCOM Yeah, you've been working it out a little bit.
SC You guys have really got a tough job right now switching OMNIS.
CAPCOM Well, everybody down here is 100 percent optimistic. Looks like we're on the up side of the whole thing now.
SC Yeah, I guess we had better be in good shape, particularly ourselves rested for entry day. I think that is going to be a pretty busy one.

CAPCOM Right and we're working on procedures for that. Ken's been doing quite a bit of work for getting ready for entry.

SC Very good.

END OF TAPE

CAPCOM How's it going Fred?
SC Okay. Just fine.
CAPCOM Okay. We're considering a vent course correction at 104 hours about 20 hours from now, 18 hours from now, and it's only 7 feet per second. The other option is to keep PTC up since we may not be able to get back into it again, and delay it. So, that's the kind of thing we're thinking about would - just wanted to let you know that pretty much right in the middle of the fairway there and a present tracking with no midcourse as you - with a Gamma of 7.11 as opposed to 6.51. So, you're already in the corridor. You're just a half a degree between the center and the outer limit and we're going to tweek that up.
SC Okay. That sounds good.
CAPCOM And we don't - we think there might have been a misunderstanding earlier on the potable water. Don't worry about drinking water. You can drink all you want. There's plenty of it. There's 38 pounds, and the surgeon recommends that you use some of the fruit juices as well. Over.
SC Okay. Yes. We went up and used the procedure pressurize first tank, and Jack and I made up a total of 22 drinking (garbled) of water.
CAPCOM Okay. And I assume Jack is up there sleeping now too. Right?
SC Yes. That's right. They're both up there. I hate to say it Jack, but I think our PTC is about to wobble off a little bit. I noticed that the earth is coming by somewhat lower than the windows and the moon is going by somewhat higher.
CAPCOM Okay. Understand. PTC, earth is coming by lower and moon is coming by higher.
SC Yes.
CAPCOM And Fred on this rigged command module aluminum hydroxide canaster, what we're going to do is we're going to have to make at least two up and use two at a time. One on each set of hoses. What we'll do is we'll connect one of the jury rigged boxes to the red fittings and air will be sucked through the lithium hydroxide and then blown out the blue fitting. And we're also going to, when we do this, remove the LM lithium hydroxide canaster from the suit loop, either the primary or the secondary, and we're getting the works together to make it easy to build one of these things, and it looks like it will probably take two guys so, I think we probably ought to plan to that later. In addition, we have to go up and get a couple of canasters out of the command module so it looks like maybe a smart idea would be to delay a little bit and have you build a couple of these later on. What do you think?

SC Yes. I agree Jack. Jack Swigert and I went up ther earlier and both got a canaster, and we were scratching around some material and think about using them, and that's actually why we're wondering what made up all the water to drink because we needed the plastic container that they were housed in in the pantry, and think that that's ready to use plus some material plus some extra porous bags that were used for the dump control that we may just cut up for (garbled) to.

CAPCOM Did you come up with a design -

SC Did we get what?

SC No. We just thought we'd see what we had in the way of material and stand by for your word. Of course, we also have lots of stiff backed cardboard from flight data.

CAPCOM Yes. We've decided to use a canaster and, you know that the liquid cool garment has a bag around it that we think we can use too, we know we can use. We've tried it. So, what you have is the bag within a bag and inside that is a liquid cool garment. The bag that is closest to the liquid cool garment is the one we mean, and we've got 2 of them, and then of course, we've got to use the, some -

CAPCOM - flight data file timeline book or something like that, and just using those materials we can make this jury rigged canaster. So, the bag that we're looking for is the one that is right next to the liquid cool garment and if we're very careful about where we cut it we can make a very good rig.

SC Okay. It looks like we'll have to use that bag over again though, because we only have 2 of them, and I expect that we'll have to make more than 2 of these canasters up.

CAPCOM Roger.

END OF TAPE

CAPCOM - and expect that we'll have to make more than 2 of these canisters up.
SC Roger.
CAPCOM Fred, in about 4 minutes, we're going to hand you over to a different communications site, and it's going to take us about a minute or so to reestablish uplink, so you can be prepared for that.
SC Okay, Jack.
CAPCOM Fred-o, we've handed over now. How do you read?
SC Loud and clear, Jack.
CAPCOM Same here.
SC Roger. Coming in a little louder.
CAPCOM Fred, you'll have to say again. Can't read you there. There's too much background noise. OK. (garbled)
SC Okay, I'm on the other OMNI now. You're coming in even louder then previously.
CAPCOM Roger. Maybe it's because it's standing up. You're coming in better now too.
SC For your information, Jack, I'm just going to prepare some beef and gravy and other assorted goodies.
CAPCOM I presume that you're doing this with the full permission of the Commander.
SC At the moment, who do you think is the Commander?
CAPCOM If I was him, I'd make you sign out everything you ate so I'd know.
SC (garbled) Incidentally, this PTC must have a wobble mode around our X-axis (garbled) so now the Moon and Earth are back in the right perseective.
CAPCOM Good. Let's see if it goes the other way.
CAPCOM These guys down here are saying they knew it all the time.
SC (garbled)
PAO This is Apollo Control at 84 hours 8 minutes. During the change of shift briefing, CAPCOM Jack Lousma kept up a fairly constant stream of communication with Fred Haise who is on-duty -
PAO - who is on duty in the Command Module in the Lunar Module rather. I would like to recap for you some of the things that were discussed during that period of time. Lousma advised Haise that the mid-course correction being considered at this time is a 7 foot per second maneuver which would occur at 104 hours. The other option which -
CAPCOM Sometime when you're not too busy chewing

CAPCOM - how about telling us what the CO2 is?
SC Okay, I'm reading 13 - 13.
CAPCOM Okay, it looks like I read and it's getting kind of close to yours.
PAO Lousma discussed with Fred Haise the options that we have on that mid-course correction at 104 hours. The other option being to delay the mid-course correction. If that were done, it would not be necessary to stop the passive thermal control mode which the Lunar Module is in at this time. That is being considered but no decision has been made. The carbon dioxide levels in the Lunar Module were also discussed and a procedure was passed up to Haise for keeping tabs on the rising CO2 level, and for changing to the backup lithium hydroxide canister when the level reaches 15 millimeters of mecury - partial pressure. The surgeon also recommended that the onboard reading be used for this indication. It was felt that the onboard reading would be somewhat more accurate although we've been reading about the same thing on the ground as Haise has been reporting from the spacecraft, and at last report the level of CO2 was at about 13. At one point Haise reported that the passive thermal control appeared to be degrading a bit. Said that everytime the spacecraft rotated one complete revolution, the Earth would appear to be a bit lower in the window, and the Moon appeared to be moving higher in the window. I believe you heard Haise report later that there may have been some sort of a wobble in the passive thermal control and that the Earth and Moon were now back in the proper position in the windows. So that's another area that we'll continue to watch, and see how the passive thermal control mode maintains itself. We've also had a communications hand-over. Handing over from the tracking site at Goldstone, California to the tracking site at Honeysuckle Creek, Australia.

END OF TAPE

SC Yes. It appear the wobble on the other way, Jack, because the earth is now rising and the moon is starting to lower in the window.

CAPCOM Roger. Can you give us an LPD number periodically?

SC LPD number? Yes. Okay.

CAPCOM In fact, if you could give it two or three rounds in a row, we could predict where it's going and maybe help us set it up again if we have to.

SC Okay.

SC Okay. The center of the earth has just gone by at an LPD number of 4.

CAPCOM Roger. LPD 4, center of the earth.

SC And the center of the moon is about LPD 21.

CAPCOM Okay. LPD 21. Is that center of the moon you say?

SC That's affirm.

CAPCOM And Fred, you're doing a little better on water than we had anticipated. Our number were designed for 3.5 pounds per hour, we're using about 3.0 and expecting to go a little bit less.

SC Beautiful. When this flight's all over we'll really be able to figure out what a LM can do.

END OF TAPE

SC - figure out what the LM could do.
SC Maybe it'll make tomorrow.
SC Okay the earth went by that time clear above the LTV index (garbled). If it was to be extended. The number would be minus 6.
CAPCOM Okay. Way up there at minus 6.
SC There's actually no such number. I just extended the line beyond zero which for a negative rate is what it would be if there was one.
CAPCOM Right. If minus 6 was there, that's where it would be. Right?
SC That's right.
CAPCOM Do you still have that super dense star field?
SC It's still there. I'm looking at it right now. I can look at (garbled) right behind me then I'll (garbled) and that panel looks like I'm right in the middle the Milky Way. There are several thousand little sparklies at various ranges as far as I can see -
SC (garbled) they're all moving and sparkling. I think I can occasionally give you a real star from the bunch of sparkling that it really does break up the capability to pick out a star pattern.
CAPCOM Okay. So far we haven't identified what the sparklies are and what is venting.
SC I got a feeling that we probably won't get (garbled)

END OF TAPE

CAPCOM How are you feeling Fred?
SC Oh, as soon as I chug down this grape drink and grapefruit, orangedrink, I think I'll be in pretty good shape.
CAPCOM How much sleeping did you get between the burn and the time you got up for this exercise?
SC Oh, I'd estimate about 4 hours Jack. Wait a minute, which burn were you talking about?
CAPCOM That was the burn in we just made. Did you get any sleep between it and the time you got up for this watch?
SC Oh, no. I didn't get to bed since all the action the night before, and I get to go to bed for about 4 hours this morning.
CAPCOM Yes.
CAPCOM Well, we're just trying to figure out who's likely to the most tired up there. You or Jim?
SC I think we'll get caught up pretty good in a couple of days.
CAPCOM Say again.
SC We ought to get caught up pretty good the next couple of days.
SC Okay Jack, the earth is started back down. The angle on the LCG there was 1 degree.
CAPCOM Okay. One degree on the center of the earth.
CAPCOM That was a good TV show you put on tonight Fred during LM entry.
SC Yes. I would have been an even better one about 10 minutes later.
CAPCOM Yes. Things sure turned to worms there in a hurry after that show.
SC Yes. You're right
CAPCOM Okay -

END OF TAPE

SC Okay the center of the Moon now is about minus 2 degrees Delta V.

CAPCOM Minus 2 degrees center of the Moon.

PAO This is Apollo Control at 84 hours 44 minutes. The numbers that Fred Haise just read back down from the spacecraft refer to the position of the Moon, with respect to the landing point designator on the LM window. Haise reported earlier that the passive thermal control mode possibly was degrading a bit. He said that every time the spacecraft rotated, the Earth would appear to be a bit higher in the window and the Moon a bit lower. A short while after that he said that it may have corrected itself. That the Earth and the Moon appeared to be in about the right place. Mission Control asked him to try and give us the degree readings on the landing point designator for a couple of revolutions as the Earth and Moon rotated by and we'd keep a little closer watch on it and see if there was any significant change.

CAPCOM Jeremy said to say Hello.

SC Who's that?

CAPCOM Jeremy.

SC Is he still around there?

SC Unless my watch is wrong, it's almost 2 A.M. back there.

CAPCOM That's the bearded one.

SC Oh, okay.

SC Hey, tell Charlie that I'll be back down there personally to thank him for this (garbled).

CAPCOM Sure will. I did.

PAO This is Apollo Control at 84 hours and 48 minutes. The Charlie who was referred to a few minutes ago in the conversation between Jack Lousma and Fred Haise was not Astronaut Charles Duke, but rather one Charlie Mars who looks after the Lunar Modules at Cape Kennedy prior to launch. At this time the flight plan that we have on one of our display boards here in Mission Control shows that Commander Jim Lovell and Command Module Pilot Jack Swigert have a little bit more than 3 hours remaining in their sleep period. The flight plan is relatively open. Also from 87 hours to 88 hours, which would indicate that there might be a better flexibility in extending that sleep period.

SC Okaay, the Earth went by there Jack, at LPD at about 18 degrees.

CAPCOM Roger. We copy. 1 8 degrees for the center of the Earth.

END OF TAPE

SC Okay. The Moon estimated up around minus somewhere 17 to minus 20 degrees LTV.

CAPCOM Okay. Moon's minus 17 to minus 20.

CAPCOM How would you like to spend a week on a aircraft carrier getting back?

SC If I can get on that aircraft carrier, I don't care how long it takes, Jack.

CAPCOM They're going to take you by Helo Simoa. You'll spend the night in Simoa, get on 141 and be at Ellington shortly thereafter.

SC Okay. Kind of sounds like the original plans for the (garbled).

CAPCOM In case you're worrying about how you're going to spend the night on the ship, Helo to Simoa directly to Ellington.

SC Very good.

SC What (garbled) Jack? (garbled)

CAPCOM I'm not reading you, maybe we'd better wait till we change antennas or unless you can speak up a little louder.

SC How do you read, now?

CAPCOM Better.

SC Okay. (garbled)

CAPCOM I'm sorry, Fred. We're just not reading you right now. Maybe we'll have to wait a little bit.

SC Okay.

CAPCOM Let's try now if you can speak up the background noise is going down a little bit.

SC How do you read now?

CAPCOM A little better.

SC Just commenting, looking here at the thrusters on quads 1 and 4, we've got a slight discoloration in the outside on the outside of the barrel the (garbled) looks like they have never been fired, they look brand new (garbled) in the interior of the upper (garbled)

CAPCOM You say the coloration of the thrsuters appears they haven't been fired on QUADS 1 and 4?

SC I say all (garbled). They've fired so clean that they (garbled) at all (garbled). Okay the Earth's going by and the LPD 42.

CAPCOM Roger. Copy. LPD 42. Is that affirmative?

SC That's affirmative.

CAPCOM Fred, that may be why the COMM's a little bit degraded, more background noise, because we're getting out of attitude a little bit there.

SC Roger.

END OF TAPE

CAPCOM I'm reading you Fred. I've got a lot of background noise. Looks like it might come and go with attitude.

SC Yes. I think that's probably - just looking through this command module (Garble)

SC How do you read, now, Jack?

CAPCOM About the same, Fred.

SC Okay.

SC Okay, and the moon just went by at about minus 14 degrees.

CAPCOM Okay, the moon at minus 14.

CAPCOM Okay, your weather in the landing area, which is about 560 miles south of Samoa, is now predicted to be about 1500 scattered, high broken. Waves are going to be 5 feet, winds are going to be 15 knots, visibility ten miles, showers in less than ten percent of the area, and you will be landing at 0800 local roughly.

SC Okay, that all sounds pretty good.

CAPCOM Say, Fred, did you get the dope on the Saturn V impact?

SC Yes, just as we came around the corner they told us that it hit (Garbled).

CAPCOM Yes, it impacted 74 nautical miles form the ALSEP and the passive seismic detected major seismic activity on all long period samples and this activity was detected for four hours afterwards with decreasing amplitude. And the impact was also detected by the high energy (Garbled).

PAO This Apollo Control at 85 hours, 11 minutes. Capcom, Jack Lousma, has been keeping up a fairly steady stream of conversation with Fred Haise who has the watch aboard the lunar module. Commander Jim Lovell and command module pilot Jack Swigert have been in a scheduled five hour rest period since a little after 82 hours ground elapse time - just about 3 hours now. At the present time Apollo 13 is about 20 400 nautical miles from the moon, traveling at a speed of 4396 feet per second.

SC Okay, the earth LTD number that time was 32.

CAPCOM Roger, 32.

END OF TAPE

SC How do you read now, Jack?
CAPCOM I'm reading you, Fred. I've got a lot of background noise, though.
SC Jack, I can definitely tell we're moving away from the Moon, now. I got it all in the monocular at one time. I was right over the top of (garbled) right now.
CAPCOM You're right over the top of what?
SC Point (garbled).
SC And the point halfway between there and (garbled).
CAPCOM Fred, would say the checkpoint over which you're right now?
SC Okay. Incidently the alternate (garbled) move was zero so it's coming back down. The point looks like we're just about straight over is (garbled) and the point between it and FPA 8.
CAPCOM Okay.
SC Okay. Jack, the Earth LTV angle is 24 degrees.
CAPCOM Roger. I heard that 24. And it looks like you're getting up to about 15 on the CO2 so we want you to select secondary and swap out the primary cartridge. Over.
SC Okay. I'll select secondary and swap out the primary cartridge.
CAPCOM Okay, Fred. And when you select - you swap out the primary cartridge don't reselect primary. Stay on secondary until we use the secondary up. Over.

END OF TAPE

CAPCOM Don't reselect primary. Stay on secondary until we use the secondary up. Over.

SC Okay. Understand (garbled) primary and stay in secondary until we use it up.

PAO This is Apollo Control at 85 hours 26 minutes. In Mission Control our displays were very quick to show the effects of the change over from the primary lithium hydroxide canister to the fresh backup canister. The partial pressure of carbon dioxide which had been reading 14.9 millimeters of Mercury has dropped to 4.6 at the present time and is continuing to go down from there.

SC Hand the tape down here please, Jack.

CAPCOM Okay. Copy the change out complete. We're reading 4.5 on the CO2 here.

SC Okay. (garbled)

SC Okay and the Earth (garbled) was 8 degrees

CAPCOM Did you say 8 degrees, Fred?

SC Affirmative.

CAPCOM Okay.

END OF TAPE

SC Well I just assumed that was Jack's but I guess (Garbled) back a little bit (Garbled)
CAPCOM Fred, I'm having a hard time reading you, but I think you're giving me a LTD.
SC (Garbled) Jack, but the moon is about 42.
CAPCOM You say the moon is at 22.
SC Four two, I said 42.
CAPCOM Okay four two, thank you.

END OF TAPE

CAPCOM How you doing there, Fred?
CAPCOM Okay, Fred. I can just barely hear you saying something in the background and I can't make out what it is.
SC Hello, Houston. Aquarius.
CAPCOM Hello there, Aquarius. Go ahead.
SC Roger. Tell me how do you read now? Fred went back to get some rest. This is Lovell here.
CAPCOM Gee whiz. You got up kind of early didn't you?
SC It's cold back there in the command module.
CAPCOM Well, what we were really thinking about doing is letting you sleep a little bit longer because we figure you're pretty worn out.
SC Well, I'll go back (garbled)
CAPCOM Is Jack up there with you?
SC No Jack's still sacked out.
CAPCOM Okay, Jim. We're kind of watching this PTC a little bit. Fred's been giving us a few LPD angles as we're swinging by the center of the earth - center of the moon. We noticed that the COMM has been degrading just a little bit so you might have to talk up.
SC Roger. Understand.
CAPCOM And we just went on to the secondary CO2 canister. Fred swapped out the primary but we want to stay on the secondary until it is all used up.
SC Okay. Well, if I use (garbled)
CAPCOM We're reading that partial pressure CO2 of 4.2 millimeters. We're cleared to use the secondary until it reaches 15.

END OF TAPE

CAPCOM - pressure CO2 of 4.2 millimeters were cleared to use the secondary until it reads 15.

SC Okay. Copy that.

PAO This is Apollo Control at 85 hours 56 minutes. About 5 minutes - we'll standby for a call from the spacecraft.

PAO This is Apollo Control at about 85 hours 51 minutes we received a call from the spacecraft. Jim Lovell reported that he was now taking the watch duties while Fred Haise attmpted to get some sleep. Jack Swigert apparently still resting in the Command Module. Lovell reported that it had gotten a bit chilly in the Command Module. At the present time Apollo 13 is 197 899 nautical miles from Earth and travelling at a speed of 3 740 feet per second, with respect to Earth.

CAPCOM Aquarius, in comparing initial estimates of water usage and electrical power usage, it appears that we're right on the money. Water usage, we're using a little less amperes that we had originally expected in the first analysis, so we're either right on the money or just a little bit ahead of the game, in that regard.

SC Well, that sounds encouraging, Jack.

CAPCOM There are a few temperatures that we're watching for you. You have the heaters powered down. We're looking at them and those include the PIPA's, the ASA, the QUAD TEMPS, and your propellants except for the DPS propellant.

SC OK. I've got that.

CAPCOM We have, as you probably already know, several groups working on procedures from here on out. We have a group working on mid-course corrections to determine a system, the attitudes, how to do it, alignment techniques and so forth. We have a group working on the entry to prove how and when we're going to activate the CSM. We have a group working on the CSM system status, and in a few hours. Later on tomorrow, when we see it, we're going to build us a face configuration of the CSM and we're going to conduct a Main Bus -

END OF TAPE

CAPCOM - going to go to some pace configuration on the CSM and we're going to conduct a main bus B check. Right now the COMM is kind of degrading and I can't hear what you're about to say very well, but I just want to keep you advised as to how things are going here. And remember you've got duty of the antennas.

CAPCOM Aquarius, are you reading, Houston?

SC (Garbled)

CAPCOM Okay, Jim. I can hear you talking but I can't tell what you're saying because you're way down in the background noise.

SC Okay. Can you hear Aquarius, now. Over.

CAPCOM Oh, yes. That's much better. Did you get my report on the various types of people and what they're doing around here?

SC Roger. Sounds like you had things well organized (garbled)

CAPCOM Okay, Jim. I didn't catch that so - On account of the background noise maybe we can pass it on when it gets more favorable.

SC I'm thinking of (garbled) Aquarius (garbled)

CAPCOM Okay. I heard you say something about using the hycon camera in Aquarius.

SC I'm thinking of (garbled) attitude. We're 40 degrees behind Aquarius (garbled).

CAPCOM Oh, I understand you're thinking about stowage. What'll we leave behind in Aquarius when we fall back into Odyssey. Is that right?

SC That's affirmative.

CAPCOM Okay. We've people working on that, too. And we're presently tracking you at 22 500 miles from the Moon moving out at 4400 feet a second.

SC (garbled)

PAO This is Apollo Control at 86 hours 9 minutes. Communications continue to be rather noisy due in part to the fact that the lunar module has drifted somewhat out of it's passive thermal control attitude and we don't have the best angle on the antennas for reception from the lunar module. During that last series of conversations with Jim Lovell and CAPCOM Jack Lousma, advised him of the status of all consumables on the spacecraft. He reported that the consumables were either ahead of the predicted values or at least right on them. Jim Lovell replied, "That is encouraging". Lovell also asks that here on the ground we look at the stowage in the command module and lunar module, particularly with an eye to what things can be left behind in the lunar module when the crew moves back into the command module for Earth entry.

CAPCOM - Earlier in the evening we thought there was a misunderstanding about the amount of potable water

CAPCOM you can drink. But I want to advise you that you can drink as much water as you want to. There's 38 pounds in the potable tank, and that's about all you need. The doctor's say, yes you drink as much fruit juices as you want, too.

SC Roger, Jack.

CAPCOM Jim, earlier in the evening Fredo reported some draining out of -

END OF TAPE

CAPCOM - reported some venting out of window number 1 in the command module, and he also reported a piece of loose metal about 4 inches square, silver, floating by, and one thing we were trying to establish is whether or not this is a new venting or whether this is part of the residual venting of our original problem. Do you have any more words or comments. And one thing he was doing was taking some photographs, the authorized photographs, targets of opportunity, using the lunar surface camera number one, and use the setting of 1/250 of a second and now knowing precisely what F stop he used, we suggested taking 3 of each using settings of F4, F5.6, and F8. Over.

SC Roger, Jack. (Garbled) I reported earlier I also spotted the large piece go by and (Garbled) burn (Garbled) you could easily distinguish start and didn't have the bright articles and bright objects, and (garbled)

CAPCOM Okay Jim. Once again I hear you talking back there but I can only pick out a few words, maybe we'll have a better time.

CAPCOM Aquarius, we're trying to improve our communications. Could you turn the biomed off and give us a voice check please?

SC Voice check 1,2,3,4,5,4,3,2,1 voice checkout.

CAPCOM Okay Jim. That's seemed to be better.

END OF TAPE

CAPCOM How are you doing there, Aquarius?

SC We're doing good, Jack.

CAPCOM Okay, sometime when you get two guys available there and you could construct one of these lithium hydroxide rigs, I'd like to have you get the materials together and we'll go through the steps together.

SC Okay, sounds good. And how do you read me now?

CAPCOM Well, there is a lot of background noise and sometimes it is worse than others and right now I hear you better than I have in the past.

SC Okay, Jack, I'm kind of curious about the amount of perturbations our PTC attitude is making. I notice that we are getting off attitude - I'm just kind of curious how far we can let this go.

CAPCOM We were checking the attitudes with Fred earlier and it looks like what we were doing was oscillating about some point but coming back - are you detecting some kind of divergence now?

SC Not too much. I notice that it's different than when I went to sleep. They are more at an angle now with the terminator of the earth so when (garbled) you are just about parallel with the terminator and now we are canted off somewhat. I haven't seen any trends, though, of going back and forth.

CAPCOM And Jim, our current plan is to not correct the PTC. We're going to take whatever we get and live with it. And we can kind of keep track what's going on a little better if when you swing past the earth and swing past the center of the moon if you could read off the LPD angles for the center of the earth and the center of the moon. Over.

SC Roger, will do, Jack, and I'm looking into the AOT now to the right - no, the number four detent and we are (garbled)

END OF TAPE

SC We are venting something back there I can see particles moving past the command module what it is I don't know

CAPCOM Okay, Can you identify the quadrant?

SC Well, I'm looking through the right rear window now of AOG, and when I was back in the Command Module I could see it out of the g of one window. The particles are rather small, but they are coming on with some force. That's probably what is disturbing our PTC attitude.

CAPCOM Yes, that sounds quite probable, Jim. That's about the same report we got from Fred, but we haven't beeen able to identify what they might be and probably won't be able to until we crank up the CSM. If there's any change in that status, why, we just want to keep advised of it.

SC Roger. Understand.

PAO This is Apollo Control at 86 hours 35 minutes. That conversation was a bit difficult to copy entirely. Lovell reported that he had noticed some small particles coming out of the Command Module apparently coming out of the Command Module. A service module, to be more specific. He said he did not know what the particles were, but that they were small and coming out with some force, and he suggested that this venting was probably disturbing the PTC attitude of the spacecraft.

CAPCOM Looks like you're a little bit outside of the corridor. We're looking at a 7 foot per second mid-course at 104 hours. We are going to come up with a entry interface minus 8 PAD to use in event of a loss of comm situation.

SC Roger. Understand, and I hope you have that procedure for an attitude.

CAPCOM We are ginning up a procedure for attitude for you, Jim. For the no Comm case, it may be a little different than what the guys working on the procedures come up with for the burn at 104 hours.

SC Roger.

CAPCOM What I'm saying, Jim, is the guys who are working on this attitude situation for the burns haven't made their final conclusions yet, but in the interim period we want to come up with something you can use, in the event that you lose ground.

SC I concur.

SC This is Aquaraius the universe is going through the 10 degree line of the LPD.

CAPCOM Okay. We copied 10 degrees. Is that Earth or Moon, Jim?

SC That is Earth.

CAPCOM Okay. Earth 10 degrees. Thank you.

END OF TAPE

SC (garbled) moved an angle of about 24 degrees on the LPD.

CAPCOM Okay, we read 24, Jim.

SC That's affirm.

PAO Jim Lovell continuing to report the relative positions of the earth and the moon as they rotate by his LM window. He is comparing the position with a grid marked on the lunar module window, the landing point designator, which is a calibrated grid, and by noting the shift in the position of both the earth and the moon as the spacecraft rotates we're able to get at least a rough idea of how much the spacecraft attitude is deviating from the original passive thermal control attitude. Now the combined CSM/LM stack is rotating at a rate of about one revolution every 11 minutes at this time. Repeating again, both Lovell and Fred Haise have reported seeing particles coming from the area of the service module, apparently venting. Fred Haise was asked at the time he reported it if he felt it was continued venting from the original event which lost the power and oxygen from the service module or a new event, and he did not know. A short while ago Jim Lovell reported seeing a similar phenomena. He described it as small particles coming out of the spacecraft from what appeared to be the service module. He said that they were coming out with some force and mentioned that this was probably disturbing the passive thermal control attitude. We're watching this with some interest in Mission Control, but with no concern at this point. The primary concern, as I mentioned, is with what effect it would have on the passive thermal control attitude. However, this is not a significant problem. The effect on the passive thermal control attitude is relatively small. The flight dynamics officer has also reported that there is relatively little effect on the position of the vehicle as reflected in the ground tracking of the spacecraft, which would lead us to believe that the venting is relatively small.

END OF TAPE

SC Jack, the LTV on the Moon now is 22 degrees.

CAPCOM Okay. I'm reading you better, Jim. Say again, please.

SC Roger The LTV now on the Moon is 22 degrees. I missed the Earth last time. I'll get it this time.

CAPCOM Okay. 22 degrees, and it looks like we've come up with a procedure for the attitude control on the upcoming burns. Probably the ones that we'll use from here on out.

SC Okay, Jack. Standby one.

CAPCOM It's going to be a few minutes before I'm ready to read it up to you.

SC Okay.

SC Jack, on the first of the LTV angles (garbled)

CAPCOM Okay. Just went by minus 2 degrees. Is that on the Earth?

SC That's the Earth I don't know whehter we're oscillating back and forth or not yet or whether it's is in a continual motion. We'll have to see here.

CAPCOM Roger.

SC Okay, Jack. The Moon now has a LTV angle of 10 degrees.

CAPCOM Roger. The Moon in 10 degrees.

END OF TAPE

CAPCOM Okay, Jim. Just as kind of a lead in to this procedure that we're going to use for the midcourse burn, I'd like to say that we're going to use AGS and it's going to be a manual burn. The attitude will be controlled manually and start-stop on the engine will be controlled manually. So we have a pretty good vector on you now and it turn out you're coming in a little bit too shallow. So what that means is that we're going to make our burn to come a little more steeply and we're going to be coming in around the dark side of the earth. Therefore, to come in more steep, our thrust should be in the direction with the sun. Does that all make sense to you?

SC (garbled) we're going to use AGS for a burn monitor. The burns are going to be manual and they're going to be started manually and stopped manually.

CAPCOM Okay. And your reentry is around the dark side of the earth and sense we're coming in shallow we're going to have to burn toward the sun to make it steeper. Do you follow that?

SC That's affirm. Especially these burns perpendiculr to our flight path and to the sun giving a deeper entry angle.

CAPCOM Okay, Jim. I heard you say perpendi- cular to the flight path, which is affirmative and I didn't get the rest of your statement.

SC I understand the technique, Jack. We're going to give it time to steepen our entry angle and it will be perpendicular to our flight path for a corridor control.

CAPCOM Okay. That's affirmative. So, in general terms, what we're going to have to do is to power up the AGS and bring up the AG rate ball and then to set up your attitude, put the COAS in the front window and guidance control will be in AGS, of course, to manually orient the spacecraft, to place the center of the earth directly out the Z-axis. Then rotate about the Z-axis to place the point of the crescent on the Y-axis of the COAS. And this will have your plus X-axis in the direction of the sun as we discussed before. So the crescent will be up with the point down. Copy that?

SC Okay, Jack. We'll have to go over that again. The COAS will be out front window, rotate the earth to the center of the COAS and, let's see the (garbled) of the earth is parallel to the LPD which is about parallel to our X-axis. And we'll have to rotate about 90 degrees to get our X-axis pointing toward the sun.

CAPCOM Okay, Jim, so we want to get the Y-axis of the spacecraft parallel to the terminator by putting the points of the crescent on the Y-axis.

SC Roger. Write it down. Seriously, Jack, I got the phase that I put you (garbled) the earth, I'm going to have to roll in LM time, roll the spacecraft 90 degrees to get the (garbled) of the earth ball on the Y-axis.

CAPCOM That's affirmative, Jim. You're going to have to roll 90 degrees to point your plus X-axis at the sun and put the crescent - the point of the crescent on the Y-axis. The points of the crescent on the Y-axis with the COAS pointed at the center of the earth will take care of your yaw and your pitch.

SC Roger.

CAPCOM Okay, Jim. After you get that orientation to come in a little more steeply, we perform AGS body axis aline which is 400 plus 5 on the vida. If the AGS ball is up at this time, the AGS ball will go to 000. We can talk more about control modes later, but we recommend doing this, of course, in AGS attitude hold. Attitude hold. Put your yaw to mode control and leave pitch and roll in pulse. Therefore, controlling your attitude with the PTCA. We don't want to use the gimbal so have engine gimbal off. We'll make the burns at 10 percent thrust. We'll use a manaual start and stop. For ullage, we'll use the plus X translational button and ullage will be for 10 seconds. Over.

SC Okay. Understand what you're saying, but you'll have to repeat it here.

END OF TAPE

CAPCOM - control to AGS and MODE CONTROL to attitude hold. Your attitude control switches will be ROLL to pulse PITCH to pulse and YAW to mode control. So the AGS will control your YAW and you will use the TTCA to control PITCH and ROLL. Engine gimbal off, 10 percent thrust, start and stop manual, for ullage use the plus X translational button 10 seconds ullage. Over.

SC Okay. For the burn there will be full control AGS, full control ATT hold, attitude switches will be ROLL pull to PITCH pull fuel mode control. For your TTCA control for PITCH and ROLL engine gimbal will be off will be in 10 percent thrust, start and stop manually, ullage will be a plus X translation (garbled).

CAPCOM That's affirmative, Jim. After you get oriented the attitude you want to burn in do an AGS and lines which is 400 plus 5. When you hit air this will bring ball up to 000 and I want to confirm with you that you said gimbal engine off. O-F-F. Over.

SC Roger. That engine gimbal will be off. And Jack, how long do you estimate the length of the burns will be?

CAPCOM Okay, the length of the burns are going to be probably less than a minute.

CAPCOM And we want you to have cutoff based on time. So we will give you a burn time. And I have a P30 maneuver pad for midcourse 7, in the event we lose comm if you are ready to copy.

AQUARIUS Okay, Jack, ready to copy.

CAPCOM Okay, Jim. P30 LM maneuver pad; the purpose is midcourse 7. Noun 33 is 134 59 42 98. Noun 81 is NA. HA is NA. HB is plus 00 205. Delta VR is 00193. Burn time; 039 008 000; the rest is NA; thrust will be at 10 percent. Read back.

AQUARIUS This is midcourse 7 corridor control, and its in case we lose comm; 134 59 42 98. Noun 81 is NA, 42 NA, plus 00 205 00193. Burn time; 039 008 000. All the rest is NA, thrust 10 percent.

CAPCOM Okay, Jim, that is a good readback, and in the event of lost comm, use the procedures that I gave you. It may be that between now and tomorrow these procedures will change a little bit, so we'll go with what we've got now, and stand by for something better if it comes; over.

AQUARIUS Okay, Jack, I'm looking at your burn pad and I agree that (garble)

CAPCOM Okay, Jim, we verify 19.3 feet per second for 39 seconds.

AQUARIUS The midcourse techniques sounds like something that we came up with on Apollo 8.

CAPCOM Yeah, everyone wondered if you would remember that; by golly you did.

APOLLO 13 MISSION COMMENTARY, 4/15/70 CST 4:28A GET 87:14 355/2

CAPCOM Hey Jim, I got a little bit more information; maneuver pad, I got Lap long range to go, VERB 10 and GET; if you got a place to copy that down I'll give it to you for EMS.

AQUARIUS Okay Jim I -

AQUARIUS Go ahead.

CAPCOM Okay, Jim, I just have the last 3 blocks. NOUN 61, latitude minus 021 62 longitude minus 16537 range to go 11629, VERB 10 36291, GET of 05G is 142:41:30; read back.

AQUARIUS I didn't get the last here, but the longitude is minus 16567, range to go, 11629, (garble) 36291, 142:41:30.

CAPCOM Okay, Jim, the lattitude is minus 02162; I have a correction on the longitude - minus 16537; go ahead.

AQUARIUS Roger Jack; the (static) 62, longitude is minus 16537, and this goes with your midcuorse (garble)

CAPCOM That's affirmative. That means no maneuvers between now and 6 or 7. And this is a -

END OF TAPE

SC - - plus 6537 and this goes in conjunction with that 647 (garbled)

CAPCOM That's affirmative. That means no maneuvers between now and midcourse 7. And this is a horizontal in plane burn, plus X, toward the sun, 19.3 feet per second.

SC (garbled) go ahead.

CAPCOM And, Jim, on the - setting up the AGS, right after we do the 400 plus 5, you should do a 400 plus all balls. And one other point we want to clarify is that we know that you're sure that this burn will be made with the plus X axis pointing at the sun to make the entry angle steeper. You got it?

SC That's right, Jack. But right now we're at - we're stopped up here in the commander's window the COAS down and I'm going to maneuver the spacecraft until I have the right portion of the earth at the top of the window. Now if the course will be along the plus Y of the spacecraft and the top of the window of the rendezvous window I should be looking into the sun. That means I'll be burning it towards the sun and figure the angles (garbled).

CAPCOM That's right, Jim. You got the attitude right and did you copy about doing a 400 plus all balls after - after you do the 400 plus 5. That is a 400 plus 5 and 400 plus all zeros back to back.

SC Roger. I have copied that.

PAO This is Apollo Control at 87 hours 29 minutes. The conversaiton which we just had with Jim Lovell related to a - what is called a pad data for entry interface minus 8 hours. This is a more or less routine bit of information which is passed to the spacecraft at various portions of the mission the purpose of which is to give them the information they would need to perform a critical maneuver were they out of communications with Mission Control for any reason. In this particular case, this would be the burn that would put them in the proper position for reentry, if at some point, prior to entry they had lost communications with Mission Control. Normally, of course, the final midcourse corrections will be made with the information passed from the ground including the spacecraft attitudes. Without communications to the spacecraft, it would be necessary for them to determine their own attitude.

SC This is Aquarius. I'm not too sure how long or with what force the venting is going to do our trajectory Although, you might keep it turned on that. Indeed it's been going on for some time.

CAPCOM Roger, Jim. We are taking a look at it. We haven't been able to detect an on Doppler however.

SC Roger.

PAO Lovell's question there pertained to the -

SC - pretty small

PAO Lovell's question pertained to the venting, which he reported a short while ago. He was asking if the vent was having effect on the trajectory and suggesting that we monitor it to determine how significant effect the venting from the service module might have on the spacecraft trajectory. As we mentioned before, we've been tracking and Flight Dynamics Officer reported that he could detect no change in the trajectory which could be attributed to a venting to that reason we would suspect that the effect of the particles coming out of the service module is minimal and from that we would also conclude that the vent is quite small.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead Aquarius.
SC Jack could you give me time hack of an even GET so I can start my watch.
CAPCOM Okay, coming up on 87 hours and 35 minutes, we'll be there in 30 seconds. Set it for 87:35.
SC Roger. Just give me a hack at 88 hours.
CAPCOM Okay, I'll give you a hack at 88 hours. That will be another 25 minutes.
SC All right. Thanks.
PAO This is Apollo Control at 87 hours, 36 minutes. The series of numbers passed up to the spacecraft several minutes ago, as we were saying, related to the pad information which the crew would use in the event they were out of communications with Mission Control because of some unforeseen failure, and were not able to receive from the ground the information needed to do a final midcourse correction prior to entry. In this case, Lovell would be required to get the spacecraft in the proper attitude and perform final midcourse correction with numbers supplied previously, and those numbers were just passed up to him. The procedure for putting the spacecraft in the proper attitude would be to use the sun and the earth as reference points, and then once the spacecraft was in the proper attitude he would perform the maneuver as indicated on the entry interface minus 8-hour pad, which we just read up to him. This of course, would be a back-up procedure. The normal procedure would be to use the onboard guidance equipment and numbers supplied prior to the burn from the ground, and only in the event of some unforeseen communications failure would this backup procedure be used. At the present time Apollo 13 is 194 269 nautical miles from the earth and traveling at a velocity of 3771 feet per second. Coming up at 90 hours, 24 minutes, and 40 seconds, the spacecraft will cross into what is known as the earth's sphere of influence. At this point in Mission Control we'll begin calculating the spacecraft altitudes and velocities for trajectory purposes with respect to the earth rather than with respect to the moon, and we'll also at that point begin to see the velocity climb as a result of the ever increasing of Earth gravity. On the spacecraft, up until that point, the trajectory displays would indicate the spacecraft slowing down under the dominant affect of the lunar gravity. The height from the earth at the point of sphere crossing would be 188 067 nautical miles, and the distance from the moon at that time would be 33 821 nautical miles. One other bit of information from the Flight Dynamics Officer is that the mid point in terms of distance will occur at 119 hours, 44 minutes, 33 seconds; at that point the space-craft will be 110 730 nautical miles from Earth, and from the Moon. At 87 hours, 39 minutes, this is Mission Control Houston.

SC Houston, Aquarius.
CAPCOM Go ahead Aquarius.
AQUARIUS (garble) going to go - I'm going to check for over all the attitude and then do the burn; is, the control technique. The way it looks now I'll try to stop the spacecraft in yaw with the Earth out my window.
AQUARIUS Then we'll be in guidance or will be AGS control (garble) control in yaw control use PPA's to control the pitch and then control the roll. I don't believe we can control the combination that we have here without using the PPA's. Then we will also use the PPA during ignition burn. Can you give me the (garble)?
CAPCOM Jim, that sounds like the one that is best to use, to me, let me talk it over with the rest of the guys here and we'll advise you.
AQUARIUS Okay.

END OF TAPE

CAPCOM Jim, in that control mode, that sounds like the best way to go. The only thing you'll have to do is to get attitude hold in the AGS, so before you start to maneuver you'll have to bring the AGS up and get a 400 plus all zeros in there and then AGS will respond in yaw when you go to mode control. That is, AGS will control your yaw in mode control and your pitch and roll can be taken care of in pulse with a PTCA. After you get in attitude, then, you'll have to re-do an AGS body axis align which is 400 plus 5, then go back to 400 plus all zeros again.

SC Right, Jack. That was my next question. I don't want to align the AGS ball 000 until I am in position, so we use that as a primary attitude rate monitor device.

CAPCOM And Jim, you can do a 400 plus all zeros any time you want to; that just tells the AGS that you want it to control your attitude should you go to attitude hold in mode control.

SC I understand, but after we get to the attitude we'll do a 400 plus five to get the AGS align ball and then we'll do a 400 plus zero.

CAPCOM Affirmative.

CAPCOM Another thing, Jim, is while you're maneuvering to that attitude using AGS to control your yaw, should you find out in route to that attitude that you didn't quite have the yaw where you wanted it to be, you can use your ACA and tweek up the yaw and your AGS needles go right back to zero because you zero the attitude errors.

SC Roger, sounds good.

CAPCOM Jim, you'll be splashing down about 560 miles southeast of Samoa at about 0800 local time. The weather forecast for the area is good. 1500 scattered, high broken, 10 miles visibility. The seas will be five foot waves, 15 knots, and you'll be going to Samoa by boat and/or aircraft. Spend either the night on the boat or in Samoa. And return to Ellington by 1:41 on Saturday, the following day.

SC Roger. Would you tell the people of the LRL to turn it off.

CAPCOM Oh no, we're going to do the whole bit.

SC And don't forget my (GARBLE) at 88 hours, Jack.

CAPCOM Say again, pleas. Aquarius.

SC I want to get my time (GARBLE) I get 88 hours.

CAPCOM Roger, that will be —

END OF TAPE

CAPCOM Say again please Aquarius
AQUARIUS (garble)
CAPCOM Roger, That will be about 6 and a half more minutes.
Aquarius (garble)
CAPCOM Jim, we got a couple of news type items. President Nixon has chosen the Judge from Minnesota to the position of Associate Justice in the Supreme Court; still giving federal employees a 6 percent pay raise passed the House and went to the President; includes the military. And the air traffic controllers returned to work.
AQUARIUS Well that's great. You think they'll consider this for flight pay?
CAPCOM We might be able to work out some arrangement.
AQUARIUS Standing by for 88 hour contact.
CAPCOM Say again Jim.
AQUARIUS Standing by for 88 hour contact.
CAPCOM Okay, we got a minute to go.
CAPCOM Okay, coming up on the 88 power mark, I'll give you a 2 second delay; stand by to mark. MARK.
AQUARIUS I got it.

END OF TAPE

CAPCOM How are you doing Jim?
SC Very good Jack. Say, you might take a look at our DPS burn card to see what changes have to be made on the burn.
CAPCOM You say look at the DPS burn - you'll have to say what about it again, please.
SC Roger, Jack. You might take a look at our DPS burn card, our checklist card we have in the LM and see what changes might have to be put in our checklist.
CAPCOM Okay, DPS burn card.

END OF TAPE

PAO Here's some words on that vent that the crew report -

END OF TAPE

CAPCOM How're you doing there, Jim?
SC Okay Jack. It appears that we're feeling a funny vibration and here the PTC attitude is pitch. I'm going to do a LPD check now, but the last time the moon went around it was above - away above the LPD angle and see the Earth coming around now which is going to be pretty low. The (garble) is forward, but each time we're getting a little farther away from the centerline. You might think of some procedure to re-establish the PTC, if necessary.
CAPCOM Okay.
CAPCOM Jim, the only way we know of getting the good or better PTC than you've got right now is to crank up the P and N and we don't want to do that. So our plan is to just take whatever we get out of this, and either one may turn out by the time you get to burn attitude. You will be right here on abse.
SC Okay, whatever you say is go.
SC Houston, Aquarius.
CAPCOM Go ahead.
SC What's our course of action to set up PTC after this midcourse at 107?
CAPCOM We thought you'd ask that. The only thing we can try to do Jim, is to set the thing up manually and see what happens there must be a better answer to that.
SC Okay.
CAPCOM One course of action is to omit the midcourse and take this other midcourse, say, about 8 hours before entry. We haven't decided yet.
CAPCOM Right now we're talking about a 7 foot per second midcourse at 104 hours. The extrapolate that down to about 8 hours before entry. We gave you a pad for that just about (garble) per second, so if it doesn't change too much we can get all kinds of DPS.
SC Understand. Sure like to keep that (garble) though.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70 CST 5:48A GET 88:35:00 363/1

ALL DEAD AIR

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70 CST 5:58A GET 88:44:00 364/1

ALL DEAD AIR

AQUARIUS Houston, Aquarius.
CAPCOM Go ahead Aquarius.
AQUARIUS Can you think of any normal phenomena that might occur like maybe - a hydrogen tank that over-pressurized relieving (garble)
CAPCOM Yeah, we thought of that Jim.
CAPCOM That is one possibility that we thought of Jim because we heated up that tank and we never used any hydrogen and therefore it could be venting in the overboard release.
AQUARIUS Right - the only other thing I can think of when I look at it through the AOG is it disappeared and its coimg to one spot; that's the only difference although I can't see where it is coming from because its beyond the curvature of the command module. It seems like it might be coming from more than just one spot.
CAPCOM Okay, thank you. We hope that when we crank up the command module tomorrow it will - or later on today - that we will be able to identify it, a little closer, what kind of problem, but the guidance guys say that they haven't been able to see the results of any venting in your data and it would take a very, very small amount to disturb their data.
AQUARIUS Well thats a note of encouragement.
CAPCOM You got a Chinese band going up there?
AQUARIUS Oh sorry, I forgot I was on on mike.
CAPCOM Sounds pretty good.
PAO This is Apollo Control at 89 hours. A short while ago, just moments ago, you heard a bit of music on the air to ground line coming in over the noise. Jack Swigert, the Capsule Communicator, or rather, Jack Lousma, the Capsule Communicator checked with Jim Lovell and Jim confirmed that the music was coming down from the spacecraft. At the present time the status aboard the spacecraft is - as best we can tell, is that Lovell is the only one of the 3 crewmen who is up and about. Jack Swigert has been resting since about 82 hours elapsed time, and Fred Haise began his rest period at 86 hours ground elapsed time. Lovell rested from about 82 hours until about 86 hours, now when he changed positions with Fred Haise taking over the watch. At the present time Apollo 13 is 191 187 nautical miles from Earth, and traveling at a speed with respect to Earth of 3804 feet per second. We expect to continue having quite a bit of noise on the communication line communication circuit with the spacecraft - partially due to the fact that the spacecraft, in its passive thermal control attitude, is deviating somewhat from this attitude and we do not have the optimum positions on our antennas on the spacecraft on the antennas for strongest reception. This situation corrects

PAO itself somewhat as the spacecraft continues to rotate at the rate of 1 revolution every 11 minutes and periodically we get a combination of antenna positions on the spacecraft with respect to the antennas on ground that improves our communications situation. We do not intend to attempt to modify the spacecraft attitude with the primary guidance system powered down at this time, the feeling is that the attitude we would get by trying to reestablish the passive thermal control mode manually would probably not be as good as the one that weve got right now. So the plan is to live with the communications problem and to expect that we will have periods during which it will not be possible to get usable communications because of the background noise. At Mission Control at this time, we are beginning the shift change, the handover, a number of flight controllers have come in from the - for the succeeding shift; flight director Glynn Lunney and his black team of flight controllers will be replacing flight direction Milton Windier and the maroon team. And that shift handover is scheduled to occur at about 7 AM Central Standard Time, or about 45 minutes from -

END OF TAPE

PAO time or about 45 minutes from now. At 89 hours three minutes this is Mission Control, Houston.

CAPCOM Jim, we've got you scheduled for an (garble) period about an hour ago, I suppose you've taken care of that (GARBLE) Did you have to stick there, or did you go back to bed or what?

SC Okay Jack we're going to set up a regular watch and sleep period Fred was up for a long time and I got up a little earlier to relieve him (garble) Jack got about an hours sleep - better let him sleep as long as he can (garble) and then I will I will go back and rest for a bit.

CAPCOM Okay, we're now, we're (GARBLE)

CAPCOM Jack had the xuty while Fred went to sleep so according to the plan we got you got up about 3 or 4 hours early. Next time that we have that is a rest period for you is at 96 hours, which is 7 hours from now, and an hour before that, say at 95 hours all three of you would eat and then Jack would hit the sack and Fred would have the duty to until one or two hours. We'd be glad to take care of this (garble)

SC Okay, that's good. Let me wait til they get up at least Jack is up - he should get up before Fred. We'll try to get back on the schedule. I hate to wake everybody up right now though, they're sleeping.

CAPCOM Okay, your choice on that. As soon as Jack gets up I'd suggest that we go ahead and break up these lithium hydroxide cannisters a couple of them. Jack could work on that. (garble)

SC Okay. We'll make that project getting the lithium hydroxide and cannisters squired away.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/15/70,CST 6:28A,GET 89:14:00,367/1

NO VOICE COMMUNICATION ON THIS TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70 CST 6:38A GET 89:20:00 368/1

ALL DEAD AIR

APOLLO 13 MISSION COMMENTARY,4/15/70,CST 6:48A,369/1

NO VOICE COMMUNICATION ON THIS TAPE

APOLLO 13 MISSION COMMENTARY,4/15/70,CST 6:58A,GET 89:00:00,370/1

NO VOICE COMMUNICATION ON THIS TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Hi, Jim. We've got a flight handover in about 2 minutes and we'll have a temporary lapse of time and you don't need to switch antennas. Over.
SC Okay, fine.

END OF TAPE

CAPCOM Aquarius, Houston. Through Madrid for a COMM check. How do you read?

SC Loud and clear, Joe. How me?

CAPCOM Okay, Jim.

SC Apollo, Houston. Aquarius.

CAPCOM Aquarius, Houston. Go ahead.

SC Okay, Jack's up with me now. (GARBLE) general procedure for making these lithium hydroxide measures and soon as he gets done helping he'll be ready to copy, and tehn he'll (garble)

CAPCOM Roger, that Jim. Are you going (garble) Go ahead.

SC (GARBLE)

CAPCOM Okay, Jim, I didn't copy your second thought. Over.

SC I just knocked the headset over here trying to get set.

CAPCOM Okay, Jim, the way I thought it might be best to do it would be to have you gather the equipment and let us talk you through the procedure while you do it. Maybe you could give Jack the headset and uh - and uh - get the equipment together and we'll talk you through the procedure. I think it'll be a little easier to do that way than if you tried to copy it all down - and then go do it.

SC Okay, do you have any equipment listed on this (GARBLE).

CAPCOM Okay, I think the equipment you'll need will be two Command Module lithium hydroxide canisters, a roll of the gray tape, the two LCG's because we're going to use the bags from the LCG's and one - one LM cue card - one of the cardboard cue cards which you will cut off about an inch and a half out from the wrench. I think that's all we'll need. Over.

SC Okay. (GARBLE) Okay, Houston.

SC Apollo, Houston.

CAPCOM Go ahead, Jim.

SC Okay, that's two lithium hydroxide canisters, one roll of that special gray tape, two LCG's which were going to use the bags from one LM cue card and (GARBLE)

END OF TAPE

CAPCOM Okay. That's affirmative, Jim. If you'll just cut the cue card which is a handy piece of paper the right size about an inch and a half from the rings. Cut off the ring holes in other words so you'll have a card about 11 inches long and probably 6 inches wide.

SC Okay, pardner, I'll have it ready to go.

CAPCOM Okay.

SC (inaudible)

SC Okay, Houston, Aquarius.

CAPCOM Aquarius, Houston. Go ahead.

SC We have gathered the material, and I can put Jack on the headphone and you can copy (garble)

CAPCOM Why don't you put him on the headsets, Jim, and I'll read it out to him.

SC Okay.

SC Okay, Joe.

CAPCOM Okay, Jack, did anybody ever tell you that they got a 60 day extension on your income tax. Over.

CAPCOM Yes. I think somebody did tell me that I could get a 60 day extension.

CAPCOM Okay, right. Okay, I'm ready to start in on the procedure. When you answer me back, speak up into the microphone because our downlink is pretty noisy. The first thing we want you to do, and we'll do this on one canister and then let you go ahead and repeat it on the second. So take one of the LCG's and cut off the outer bag. By cutting

END OF TAPE

CAPCOM - and cut off the outer bag by cutting along one the heat seals; do it carefully and close to the heat seal because we may have to use the outer bag if we damage the inner bag. So go ahead and do that, and we'll do the next step.

AQUARIUS Okay, take an LPG, cut the outer bag by the heat seal, be careful not to damage the inner bag. Right?

CAPCOM Right. Just cut along one side.

AQUARIUS Hey Houston, Odessey, Aquarius has done that.

CAPCOM Okay, Jack. Now remove the inner bag from the outer bag, and cut the inner bag also along one of the heat seals down one side.

ODESSEY Remove the inner bag from the outer bag, cut the inner bag also along one heat seal on one side.

CAPCOM Okay, that's correct. Do that, and report.

ODESSEY Okay, Joe, we've got that done.

CAPCOM Okay, Jack, now you can put the LCG itself, that is take it out of the inner bag, put it in the outer bag, and stow it some place; we recommend U1, but you can stow it wherever its convenient.

ODESSEY (garble)

ODESSEY Okay, Joe, we've done that.

CAPCOM Okay, now pick up one of the lithium hydroxide canisters and let me describe which end is which. Its approximately square on one of the vented flat ends, has the strap, and that end we call the top, the end opposite we call the bottom. Is that clear?

ODESSEY Right. Okay, I've got it Joe.

CAPCOM Okay. Now then, we want you to take the tape and cut out 2 pieces about 3 feet long, or a good arms length, and what we want you to do with them is to make two belts around the sides of the canister, one belt near the top and one belt near the bottom, with the sticky side out; wrap it around, sticky side out, as tight as possible. It'll probably take both of you to get it nice and snug. Over.

ODESSEY (garble) Okay, now we've got to make the belt real taut.

END OF TAPE

SC Okay, Joe.
CAPCOM Okay, Jack (garble)
SC (garble)
CAPCOM Jack -
SC (garble) the one around the bottom all done.
CAPCOM Okay, fine. The next step now is to anchor that tape and the way we want you to do that is to cut about a 2-foot line from the roll and then tear it lengthwise so that you have two strips about 2 feet long and about a half an inch wide. And you'll wrap those around the canister at right angles, more or less, to the tape that you've got so that it goes across the top and across the bottom and when it goes across the top and the bottom, put it so that it's outboard of the center hole and try to get it over one of the ridges between the screens so that it won't block the flow. Is that clear? Over.
SC Yeah, Joe. Very good.
CAPCOM Okay, press on.
SC Okay, I've got a (garble) and we tear it lengthwise (garble) all the way around at right angles and anchor it (garble)
SC Joe, should we fire (garble) PTS down, right?
SC (garble)
CAPCOM I didn't quite copy that, Jack. Say again.
SC Okay, that will be the sticky end down on the container right?
CAPCOM That's correct. I forgot to say that. That's right.
SC (garble)
SC Okay, Joe, Qauarius we've got that set.
CAPCOM Okay, Jack, the next step is to get the EVA Q-card and use it to form an arch over the top of the canister, just tuck one short end under one ridge on the top the other one against the ridge on the other side so that it forms a rounded up arch over the top of the canister. You see, Jack, what we're going to do is slip the bag over this whole assembly and the Q-card will serve to keep the bag from being sucked down against the screen. Over.
SC Okay, I got that, Joe.
CAPCOM Okay, and when you've done that, to hold the arch in place, just run a strip of tape across the side of the - that is across the top of the arch and anchor it down to the sticky strips along each side.
SC Okay, I got that set. Okay, let me just repeat it here. EVA Q-card form an arch over the top

SC bringing it under the side here, when we're through anchor the tape from the sides across the top of that anchor to the other side.
CAPCOM That's correct.
SC Okay, it worked.
SC The top.
SC Across the top.
SC (garble)
SC Look, you're going to have to cut the Q-card.
SC (garble) the only thing we're (garble) here (garble)
SC (garble)

END OF TAPE

AQUARIUS Okay, Joe, we've done that belt, and its all fixed in securely.

CAPCOM Okay, Jack, the next step is to stop up the bypass hole which is the hole in the center of the bottom of the canister; we want to stop that up because we don't want to bypass the flow, and I forgot to tell you to get something to stick in that hole. We recommend that you either use a wetwipe or cut off a piece of sock and stuff it in there or you could probably even crumble up some tape and use that; over.

AQUARIUS Okay, we'll start plugging up the bypass hole.

CAPCOM Okay.

AQUARIUS Plug that hole. How about a piece of your towel?

CAPCOM Sounds good.

AQUARIUS Okay, Houston, Aquarius; we have the bypass all plugged up.

CAPCOM Okay, Aquarius. The next step is take the inner LCG bag that you cut open, and slip it over the top of the canister, when you do that, orient it so that the ears of the bag, the corners that stick out on the closed - are oriented along the open ends of the arch, cause we're going to snip one of those corners to stick the hose in. Pull it down until it fits snugly over the arch. Over.

AQUARIUS Okay, Joe; slip the bag over the canister so that the arch is at the bottom of the bag and the ears are along - I guess it would be at the side of the arch.

CAPCOM Depends on what you mean by sides - the open end of the arch.

AQUARIUS Right - the open ends of the arch. Okay.

AQUARIUS Okay, Joe, we've got that done.

CAPCOM Okay, now press the bag against the sticky belts that we put on the sides of the canister; if there is any excess material, just kinda pleat it, so that it makes a fairly tight seal, and then take another 3 foot strip of sticky tape and wrap it around the outside of the bag opposite the bottom - the bottom sticky belt - to make a nice tight seal.

AQUARIUS Okay. You want 2 strips down here, to make a tight seal. Okay.

END OF TAPE

SC Okay, Joe we've got the canister inside the bag, two strips are around the side of the bag, real tight, and both sealed.

CAPCOM Okay, real fine. Now there's probably a couple of inches of excess bag sticking out around the bottom of the canister; to prevent this from sucking in against the bottom screen we'd like you to trim it off with the scissors and when you've done that we'd like you to cut 2 more strips of tape about twelve inches long or so, cut the - tear them lengthwise to get four pieces 12 inches long and 1/2-inch wide and then use those four strips to secure the bag by passing the strips from the sides of the canister outside the bag around the bottom of the canister and back up the other side and when you do this, just as you did on the top, make them go outward of the hole and in between the screens. Over.

SC Okay. You want me to trim the excess material that's sticking out, trim it at the edge of that canister or do you want any excess left over?

CAPCOM No, you don't need to have any excess. Just trim it approximately level.

SC Okay, let's do that first.

CAPCOM Okay.

SC Okay, now, Joe, you want to cut 4 strips, 12 inches long each, 1/2-inch in diameter tape that along the outside of the bag across the ribs.

CAPCOM That's correct, Jim. That's just for additional security on the bag. When you get those done you'll have - you'll have 2 strips going one way and the other 2 will be perpendicular to them.

SC Okay, Houston, Aquarius we've got four strips in place.

CAPCOM Okay, we're in business now with the bag and the next step to perform is to get ready to put the red suit hose, either the commander's or the LMP's because we're going to want you to have both of these made up eventually, into the top of the bag and to do that you, first of all, have to assure that the - that the red hose is separated from the blue hose. I don't know whether this has been done already but if it hasn't what you have to do is cut the outer Beta cloth sheath down the full length of the - of the hoses and then also cut the rubber ties that secure the two hoses together and the hoses should come apart and the COMM cable should come on. Over.

SC Okay. Take the - I'm going to separate the red hose from the blue hose by cutting your Beta cloth sheath. Okay, that should work.

CAPCOM Okay.

END OF TAPE

SC Okay, Houston, Aquarius. I have the LOP's separated from the others.

CAPCOM Okay, real fine. Now the next step is to cut a diagonal hole is one ear of the plastic bag near the arch. You can pick either one and cut about a 1-1/2 or 2 inch diagonal hole, big enough to slip the red hose through and you've done that you'll just slip the red hose through so that it goes about to the center of the canister. It's not critical except that the opening should be down and then tape the bag to the hose where it goes in so that it's nice and snug. Over.

SC Okay, copy that. We want a 1-1/2 inch hole right here at this ear, put the hose in here head down and toward the canister and tape the seal right here.

SC Let's try it if we have to, we can always make it bigger if we have to (garble)

SC Say, Houston, Aquarius.

CAPCOM Aquarius, Houston, go ahead.

SC Okay, our do-it-yourself (garbled) lithum hydroxide unit is complete. Joe, the only thing different is that our arch on this piece of cardboard is -

END OF TAPE

SC The only thing different is that our arch on this piece of cardboard is not big enough to position the red hose with the inlet down, and the inlet - the inlet to the red hose is lying on its side, but I think it'll still work

CAPCOM Okay, Jack, I concur. I think it'll work too. There's one step that I omitted, which you can do now quite conveniently, and it's this. Where you stuff the towel in the bipass hole on the bottom, we recommend that you cut a few short pieces of tape and just tape that over so it doesn't fall out. Over.

SC Okay. Will do. (garble)

SC Okay, Joe. That's finished.

CAPCOM Okay, Jack. Now the remaining steps are simply suit loop configuration steps to get this thing into full operation, and our ECS people want to hold off on that until the canister you're working on gets to 7.6 millimeters mercury, which will probably be another 45 minutes or an hour yet. We're reading 4.7 now. So what we'd like for you to do in the interim is to set up the second command module canister the same way you just did the first one using the commanders hose, and get that all set and probably about that time it'll be time to switch over. For your information when you've got that done and you've had your breakfast and so on, the next thing I've got for you is a switch configuration list for the command module, which will represent the power down, square 1 starting configuration for all our preentry checks. Over.

SC Okay. We'll start setting up the Commanders (garble)

CAPCOM That's affirmative, Jack. What we have done is marked up the liftoff configuration check list, and we'll run through it whenever you get around to it.

SC (inaudible)

SC (garble)

SC Okay, Houston, Aquarius.

CAPCOM Aquarius, Houston. Go.

SC Okay, Joe. Should this canister be operation now because it's already mounted on the hose.

CAPCOM Well, yes. We haven't completely configured the suit loop to get full flow through there and it's okay the way it is, what I recommend you do with the commanders hose is get the bag all ready, but not slip the hose in until we call you on that. Okay.

SC Okay, will do.

END OF TAPE

AQUARIUS (garble)
CAPCOM Hello Aquarius, Houston.
AQUARIUS Go ahead.
CAPCOM Roger Jack. Tom here. Just thought I would pass on to you and Jim that got a little data priority going today and going to convene to CB CB and we'll have you all kinds of good procedures for later on; over.
AQUARIUS Okay, thank you Tom. You guys are really working overtime.
CAPCOM We're getting a little coordination down here.
CAPCOM Aquarius, Houston. You might pass on to Jim he had such a long day yesterday, we though we were going to have to play him some guitar music to get him to sleep last night. Over.
AQUARIUS That's exactly what he did.
AQUARIUS (talking within the spacecraft-garbled)

END OF TAPE

AQUARIUS (garble)
AQUARIUS Let me check - (garble)
PAO This is Apollo Control 91 hours, 31 minutes GET. In the last hour or so, Spacecraft communicator Joe Kerwin has passed up to the crew some items of shade tree engineering on how to build the lithium hydroxide canister container which uses the suit system - suit circuit return hoses in the lunar module, and these two canisters will scrub the atmosphere, removing carbon dioxide. This is primarily a backup to look forward to the time when the time has run out on the canisters in the lunar module. Present position now as shown by the space digital display which at this moment are on a Moon reference frame, showing 36 688 nautical miles from the moon, this computes out in Earth distance to about 184 830 nautical miles out from Earth. Velocity relative to the Moon 4284 feet per second. Current usage electrical current still hovering around 12 to 14 amps. At this time, Haise apparently is still sleeping. All consumable usage is at either on or below the predicted levels and at 91 hours, 33 minutes, ground elapsed time, this is Apollo Control, standing by.
AQUARIUS That looks good.
AQUARIUS Part of that - you see, Jim, I have the same problem that you had, I can't control pitch very well. With my REC - I have to use (garble) I don't know why (garble)

END OF TAPE

SC (garble)
CAPCOM Roger, Jim, (garble)
SC (garble)
SC (garble)
SC (garble)
SC (garble)
SC (laughter)
SC Okay, why don't you put the - your special (garble) under the cable there.
SC (garble)
SC (garble)
SC (garble)
SC Yeah, I'm going to use the launch check —
SC Yeah, we're going to go over on this side, too.
SC (garble)
SC (garble)
SC I couldn't help it, I did. (garble)
SC (garble)
SC (garble)
SC (garble)
SC (garble)

END OF TAPE

AQUARIUS Houston, Aquarius.

CAPCOM Aquarius, Houston. Go ahead.

AQUARIUS Okay Joe, I'm ready to start on that command module switch configuration checklist.

CAPCOM Okay, Jack, understand. You are ready for the switch configuration checklist. And I have in front of me the liftoff configuration, page L1-1; are you with me; over.

AQUARIUS I'm right with you.

CAPCOM Okay, I'll read these in bunches of 3 to 4 at a time, some of them are the same, some of them are changed, and you can read them back every few steps. EMS function to OFF, EMS mode to standby; no change. GTA off, down, no change. And GTA cover secure, no change; over.

AQUARIUS Okay. EMS function OFF, mode standby, GTA off, GTA cover secuer. Over.

CAPCOM Roger. CMC attitude to IMU no change. FADI stay 055, no change. FDAI select number 1, and FDAI source GDC over.

AQUARIUS Okay, CMC attitude IMU, FDAI 055 and FDAI select 1 and FDAI is GDC. Hey, what you do is just read the ones that have the changes Joe, and I'll read back to you, everything, where you stop.

CAPCOM Okay, fine. The next one that change is 3 down, where we go man attitude pitch to rate command. Over.

AQUARIUS Go ahead.

CAPCOM Okay, the next one 2 - 3 - 4 are unchanged. And then we want translation controller power to OFF, rotation power NORMAL 2 to OFF and rotation control power DIRECT 2 to OFF. Over.

AQUARIUS Okay.

CAPCOM Okay, the next 2 are unchanged. And we want the 3 B mag switches in rate 2; over.

AQUARIUS Okay.

CAPCOM Okay, the next 1, 2, 3, 4, 5, 6, 7, 8 are unchanged, and we get down to the ELS auto swtich which we want in MANUAL; over.

AQUARIUS Okay.

CAPCOM Okay, and we want CMRCS logic DOWN, and the rest of the page is unchanged. Over.

AQUARIUS Okay, let me read back the whole page.

CAPCOM Okay, go.

AQUARIUS EMS, CMS mode OFF, mode standby, GTA down, GTA cover secure. IMU A 055, GDC, GDC radio attitude roll, pitch, yaw rate command. (garble) cycle on, (garble) rate high. S band rate high. G&C Power OFF. Rotation control power normal 2 off, rotation control power S2 off, (garble) mode 3 roll 2, (garble)

CAPCOM Jack, Houston. You are not coming through. Unless you talk a little more directly into the mike. I've got the B mags at rate 2 - start from there; over.

AQUARIUS (garble) SPS (garble) to NORMAL, (garble) OFF, CDC pitch and yaw to AUTO, SCS gimbla motor pitch and yaw OFF, LVC descent, ELS logic OFF, ELS auto to Manual, RCS logic off down, propellant up, propellant surge off, IMU gage off, EMS roll and roll (garble) off.

CAPCOM Okay, - that's 100 percent Jack. Lets go to page 2. We start with Alpha PC to PC and launch vehicle SPS indicators to GPI; over.

AQUARIUS Okay, keep going.

CAPCOM Okay, the next 3 are unchanged. And have the event timer start to STOP. Over

AQUARIUS Okay.

CAPCOM Okay - the next ones on handle one are unchanged and one handle two, go all the way down to MRCS propellant talk backs and in parenthesis scratch out 8'4 to gray and then pencil in a line SM RCS propellant talkbacks or barber pole. Over.

AQUARIUS SM RCS propellant talkbacks or barber poles to manual (garble)

CAPCOM I guess that's the config - stamp I want to know - I'll check that one. Okay, Jack, the switches all remain in their present position, which is center, but because we have no power on the bus, the bottom row of talkbacks will be spring loaded to the barber pole position and thats for your information; over

AQIAROIS Oh I'm sorry; I knew that, but I'm not thinking too well.

END OF TAPE

CAPCOM Okay, now the next 1, 2, 3, 4, 5 are the same and we want EDS auto to OFF. Over.

SC Okay.

CAPCOM Okay, the next 3 are the same and then we want propellant dump to RCS COMMAND, 2 engine out to OFF and launch vehicle rates to OFF. Over.

SC Okay, let me read back the whole page.

CAPCOM Go.

SC Alpha PT to PC, launch vehicle RCS indicator to DPI, GDC gimbal drives (garbled) in AUTO, max timer reset UP, max timer (garbled) vent valve PUSH, probes are then released to OFF, (garbled), retract primary and secondary OFF, then running lights, EVA lights OFF, rendezvous light OFF, I've got to get a (garbled) tunnel light OFF, bus power light OFF, service module RCS helium 4 centered, helium 1 (garbled) back 4J, telemetry command module IU deployed, command module RCS conductor OFF, service module RCS indicator propellant quantity service module RCS heater 4 OFF, (garbled) service module RCS propellant (garbled), service module RCS propellant contact 4J (garbled)

CAPCOM Okay -

SC Joe, are you with me?

CAPCOM Jack, Houston, the comm kind of gets better and worse and the last one I copied was RCS transfer to center. Start from there.

SC Okay, and that's exactly where I was. Command module RCS propellant to center on UP, propellant contact 2J, service module RCS secondary fuel pressure 4 center and CLOSED, ECS auto OFF, command module LM final step 2 OFF, command module and service module step 2 down (garbled), propellant dump to RCS COMMAND, 2 engine OUT, and the LV rates OFF.

CAPCOM Okay, that's correct. Let's go to page 3 and the first one on page 3, tower jet 2 to OFF. Over.

SC Okay.

CAPCOM Okay, the next 1, 2, 3, 4, 5, 6, 7 are the same, and then we get CAUTION WARNING normal to ACQ, CAUTION WARNING to CM and CAUTION WARNING power to OFF. Over.

SC Okay, got it.

CAPCOM Okay, the next 1, 2, 3, 4 are the same and then we get to the H2 heaters 2 OFF and the 02 heaters 2 OFF, got that?

SC (garbled) and the H2 (garbled) Okay.

CAPCOM Okay, Jack. Those are the only changes on page 1-3.

SC Okay, power jet 2 OFF (garbled) CAUTION and WARNING normal, (garbled) CAUTION and WARNING CSM and CM (garbled) power off. H2 02 heaters OFF.

CAPCOM That's correct, Jack. Those are the only changes on 1-3. Not let's go to 1-4. No changes on the remaining 3 panel 2 switches. On panel 3, the first

CAPCOM 1, 2, 3, 4 are unchanged and then we want fuel cell heaters 3 to OFF. Over.

SC Okay.

CAPCOM Okay, the next 1, 2, 3, 4, 5, 6, 7, 8 are the same and then we want fuel cell 1 main bus A to OFF and skipping one we want fuel cell 2 main bus A to OFF. Over.

SC Okay.

CAPCOM Okay, skip 2 and then we want fuel cell 3 main bus A talkback to gray. Over.

SC Okay. The next one we want main bus A reset to OFF, skip one, and we want fuel cell 1 main bus B talkback to gray. Over.

SC Okay.

CAPCOM Okay. Skip one, and we want fuel cell 2 main bus B talkback gray and the next one we want fuel cell 3 main bus B to OFF. Over.

SC Okay, copied that.

CAPCOM Okay, skip one, and we want main bus B reset to OFF. Over.

SC Okay.

CAPCOM All right, then the next 1, 2, 3, 4, 5,6 are the same and then we want S-band transponder to CENTER OFF, skip one, and we want S-band power amplifier HIGH TO CENTER OFF and the power amplifier talkback to barber pole. Over.

SC Okay, reading back the changes of the page, (garbled)

CAPCOM Jack, Houston. Start it again. I wasn't copying that.

SC Okay reading the changes, Joe, on pages 1-4, fuel cell heater 3 OFF, coming down to fuel cell 1 main bus A center or main bus A to OFF, main bus fuel cell 2 to main bus A OFF, fuel cell 3 to main bus A talkback gray, main bus A reset OFF, fuel cell 1 to main bus B talkback gray, fuel cell 2 to main bus B talkback gray, fuel cell 3 to main bus A to OFF, main bus B reset OFF, S-band transponder OFF, S-band power amplifier HIGH to OFF, power amplifier talkback barber pole.

CAPCOM Okay, Jack, that's completely correct on 1-4. Let's go to 1-5 and on that page the first 1, 2, 3, 4, 5, 6 are the same and we want up telemetry command to OFF. Over.

SC Okay.

CAPCOM Okay, the next 1, 2, 3 are the same and we want VHF AMB to CENTER. Over.

SC Got it.

CAPCOM The next 1, 2, 3, 4 are the same and we want S-band squelch to OFF and fuel cell reactants valve to NORMAL. Over.

SC Okay.

CAPCOM Okay, the next 1, 2, 3 are the same and

CAPCOM then we want tape recorder forward to CENTER, tape motion talkback barber pole, SCE power to CENTER and PMT power to CENTER. Over.

SC Okay.

CAPCOM Okay, skip the next one and we want ac inverter 1 to OFF and ac inverter 2 to OFF. Over.

SC Okay.

CAPCOM Okay, skip the next one and we want inverter 1 ac 1 to OFF and skip 2 and we want c 01 reset to Off. Over.

END OF TAPE

CAPCOM Skip 2 and we want AC1 reset to OFF. Over.
SC Okay.
CAPCOM Okay skip 1 and we want inverter AC2 to OFF and skip 1 and we AC2 BUS reset. AC2 BUS reset to OFF.
SC Okay. That was AC2 BUS reset wasn't it.
CAPCOM Okay you skip the next one and on panel 4 we want SPS gaging to OFF, TELECOMM group 1 to OFF, TELECOMM group 2 to OFF and glycol pumps to OFF. Over.
SC Okay reading back. (GARBLE) S-band (GARBLE) off. (GARBLE) Tape recorder forward (GARBLE) (GARBLE) AC1 inverter to OFF, AC inverter 2 off. Burner 1 - AC 1 off, AC1 reset to OFF. Burner 2 to AC2 to OFF. AC Bos 2 to reset OFF. And coming to panel 4 (garble) gaging, TELECOMM group 1, TELECOMM group 2, glycol pumps all off.
CAPCOM Okay, that's correct on 1-5. Check. Let's go to the 1-6. The first line we want suit compressors bulk to OFF. Over.
CAPCOM Okay, Jack, Houston. is noisy again, I didn't copy you Roger on this.
SC Okay, how do you read this, Joe?
CAPCOM You're loud and clear now and let's go to panel 5. We want fuel cell pumps AC1 OFF, AC2 OFF and that's the fuel cell one pumps AC1 OFF, fuel cell 2 pumps AC2 OFF, fuel cell 3 pumps AC2 OFF. G&N power OFF and both the main BUS ties OFF. Over.
SC - Okay.
CAPCOM Okay. Skip 2, and we want interior integral lighting OFF and interior floodlight OFF. Scratch out full dim or full bright. Over.
SC Okay.
CAPCOM Okay and circuit breakers on panel 5 we want all OPEN. Over.
SC Okay.
CAPCOM Okay on panel 6 skip the first one. We want power to OFF and skip down then to suit power to OFF. Over.
SC All right.
CAPCOM Okay, on panel 7 we want EDS power OFF. PVC servo power 1 and 2 OFF, FDAI G&I power OFF and logic 2/3 power off. Over.
SC Okay, I read back. Compressor 1 and 2 OFF. Fuel cells up 1, 2, 3 OFF. Back power OFF (GARBLE) Interior integral lighting OFF, interior floodlighting OFF. Then coming down all circuit greakers on panel 5 OPEN. Panel 6 the power should be off. (garble) be off. Panel 7 all 5 those circuits should be off.
CAPCOM Okay, Jack, that's correct. Let's go to page 1-7. SCS electronics power OFF. SCS signal conditioner

CAPCOM driver BIAS 1 and 2 OFF and BMAG power both OFF and DIRECTO 2 valve to CLOSE. Over.

SC Okay, SCS electronics power OFF, full signal conditioner driver BIAS power OFF. BMAG power, 2 of them OFF. DIRECTO 2 CLOSE.

CAPCOM Okay, now on panel 8 I'm going to have to read you a number of circuit breakers that we want open and so start with CV panel 8 all closed except leave the 2 that we have there CM/RCS heaters OPEN and smoke bag OPEN. Add the following. I'll read them up one at a time and you can roger. SCS logic BUS 4 to OPEN. Over.

SC SCS logic BUS 4 OPEN.

CAPCOM Roger. SPS pitch and yaw 4 OPEN.

SC SPS pitch and yaw 4 OPEN.

CAPCOM Roger. SPS gaging 4 to OPEN.

SC SPS gaging 4 open.

CAPCOM Okay, and sets are 2 to OPEN.

SC Okay, with me (GARBLE) 2 of them OPEN.

CAPCOM Roger. The next is EDS 3 to OPEN.

SC EDS 3 OPEN.

CAPCOM Roger. The next ELS BAT a, BAT B to OPEN.

SC GLR BAT A and BAT B two the Open.

CAPCOM Roger. Post-landing vent flight slash post landing OPEN.

SC Okay, post-landing and post-landing vent OPEN.

CAPCOM Okay that was, yeah, the post-landing vent FLT/PL to OPEN. The next are SCS direct ullage 2 to OPEN.

SC SCS direct ullage 2 to OPEN.

CAPCOM That's correct and the next ones are SM/RCS heater A, MAIN B, and heater C, MAIN B, OPEN.

SC Okay service module RCS heater MAIN B OPEN and heater C MAIN B to OPEN.

CAPCOM That's correct and SM/RCS heater B, MAIN A, OPEN and heater D, MAIN A OPEN. Over.

END OF TAPE

SC Okay. Got those too.
CAPCOM Okay, Jack. That's the last of the additions to this page. Go back to the regular check list, and go to the AUTO RCS select switches. We want all 16 of them open. Over.
CAPCOM That is off.
SC Okay. They're sitting at OFF right now. All 16 of RCS switches off.
CAPCOM Okay. Then we go down to interior numerics lighting lighting OFF, interior integral lighting, OFF and interior flood lighting OFF. Over.
SC Okay.
CAPCOM Okay. Skip 3. We want SEC's logic 2 OFF DOWN, and SEC's pyro ARM 2 OFF DOWN. Over.
SC Okay.
CAPCOM Okay and on panel 9. Power to OFF. Over.
SC Okay
CAPCOM Okay, Jack. I don't think you have to read back all the circuit breakers. We copied them as you went. You just want to read back the panel 8, panel 9 changes.
SC All right let's do it (garble) all 16 RCS switches OFF, lighting OFF, interior integral, OFF, interior flood lighting OFF (garble) down and OFF (garble)
CAPCOM Okay, that's correct Jack. Let's go to page 1-8. In the second line suit powers OFF. Over.
SC Okay.
CAPCOM Okay, Jack. COMM sounds a little - COMM sounds a little better now then when -
SC (garble)
CAPCOM Good. Suit power was OFF, and then go to panel 10, and power OFF and suit power OFF. Over.
SC Okay. I got it.
CAPCOM Okay, and that's the only changes on pages 1-8. Over.
SC Okay. suit power OFF, panel 10 power OFF and suit power OFF.
CAPCOM That's correct. Go to page 1-9 and on panel 100, skip the first 4. We want IMU power OFF. Over.
SC Okay.
CAPCOM Okay. Skip the next one and we numerics lighting OFF, flood lights, OFF, and integral lights OFF. Over.
SC All right.
CAPCOM Okay. On panel 101. Skip the first 3. We want urine dump to OFF, and waste water dump to OFF. Over.
SC Okay.
CAPCOM Okay. On panel 122. The only change is condition lamps to OFF. Over.
SC all right.
CAPCOM Okay. Panel 162. No change, panel 163

CAPCOM no change. Now add in, panel 201 food warmer to OFF. Over.
SC Okay. Got it.
CAPCOM Okay. On panel 225. It will read the same except I have 3 additional circuit breakers that we want open and I'll read them up one at a time. The first one is FM transmitter DSC, group 1 OPEN. Over.
SC S-band transmitter DSC group 1 OPEN.
CAPCOM Roger, that. The next one is flight BUS, main A and main B and that's 2 breakers, both OPEN.
SC Flight BUS main A and flight BUS main B OPEN
CAPCOM Okay. That's correct. The last change is CTE both OPEN. Over.
SC Could you say that again.
CAPCOM Affirmative. Central timing equipment CTE both OPEN. Over.
SC Okay CTE 2 OPEN.
CAPCOM Affirmative. And that's all the changes on page 1-9.
SC Okay garble Let me read back (garble) numeric lighting flood lighting intergal lighting 00FF panel 101 (grable) urine dump to OFF (garble) to OFF panel 122 condition lamps OFF panel 201 (garble) panel 225 add additions that are S-Band transmitter DSE Group one (garble)
CAPCOM Okay. That's correct Jim. Go to page 1-10. And on panel 226.
SC Allright.
CAPCOM Okay.
SC Okay. How you read?
CAPCOM Okay. Satisfactory, Jack. You ready for panel 226.
SC Let's go.
CAPCOM Okay. On panel 226, we want all OPEN ACCEPT so change word closed to OPEN and then scratch out the next 3 lines cause we want them open too. Over.
SC Okay. All open ACCEPT and you going to give the
CAPCOM Right. I'll give you the opens now. We want lighting, flood main A main B and Flight/Post Landing CLOSED.
SC Okay. Lighting, Flood main A, lighting FLOOD MAIN B, CLOSED, and Flight/Post Landing CLOSED.
CAPCOM Roger. Jack. ECOM tells me that it's all 1 circuit breaker and the next one is lighting numerics/ integral LEB AC2 LNDC AC 1 and RM DC and AC 1 to closed and that's 1 circuit breaker also.
SC Okay. I'll read that all back. Okay lighting numerics/integral and I didn't get the rest of it.
CAPCOM Okay. Stand by for 1 second while I make sure of one thing.

END OF TAPE

SC (garble)
PAO This is Apollo Control. We're anticipating a change of shift press conference with the Maroon Team Flight Director Milton Windier and Maroon Team Retrofire Officer, Tom Weichel within the next 10 or 15 minutes in the main auditorium. Apollo 13 now 183 306 nautical miles out from Earth; velocity 3907. Medical status now: Lovell had about 3 hours plus sleep during the night; Swigert had 8 hours; Raise has been asleep 6 hours and still asleep at this time.
SC Go ahead.
CAPCOM Okay, on the 226 circuit breakers that I read up they are - there are 6 circuit breakers involved and they're all - they're the first six from the left on the bottom row of the panel. They're under lighting. We want the three flood circuit breakers out and the three numeric slashed integral circuit breakers out. I don't mean out, I mean closed. Those six closed and the rest open. Over.
SC Okay, there are three flood circuit breakers and three numeric circuit breakers and you want all six closed
CAPCOM That's affirmative, Jack, and all the rest open. Okay. Panel 227, no change. Panel 229 one addition to the circuit breakers we want open, and those are the timers Main A and Main B 2 to open. Over.
SC Okay. You want the timing circuit breakers, two of them open.
CAPCOM That's affirmative. Okay. On Panel 250 we want all closed, except, and then scratch out all the ones that are there.
SC Okay. All closed, except Okay, I'm going to get out now.
CAPCOM Wait a minute. Yeah, ECOM caught me. I said that wrong. We want you to change the word closed to open, and then scratch out the ones that are there.
SC Okay, all open.
CAPCOM Okay, the two that we want closed are Sequencer A and Sequencer B. Over.
SC Okay, back with me.
CAPCOM Say again, Jack. EECOM is just improving (garble)
SC Okay. Switch on these here. You want all open but panel 250 except Sequencer A and Sequencer B.
CAPCOM That's correct. Panel 251, no change. Panel 252, waste storage vent valve closed. Over.
SC Waste storage vent valve closed.
CAPCOM Roger, and on Panel 275 we want all the circuit breakers open, no exceptions. Over.
SC Panel 275 all open, no exceptions.
CAPCOM Okay, and that's all for Page 1-10 You want to read any of that back, or have you got it all.
SC No, I think I've got it all.

CAPCOM Okay, let's go to Page 1-11. On Panel 276, no change. On Panel 278, we want all circuit breakers open, no exceptions. Over.

SC Panel 278, all open.

CAPCOM Roger. Now we'll skip all the way down to Panel 306 where we want the Mission Timer to stopped and the Event Timer to stopped. Over.

SC Okay, Panel 306, Mission Timer stopped and Event Timer stopped.

CAPCOM Okay, and those are all the changes on 1-11, Jack.

SC Okay, ready for 1-12.

CAPCOM Okay, on Page 1-12, Panel 325 we want both cabin pressure relief valves to normal. Over.

SC Okay, both to normal.

CAPCOM Okay, on Panel 326 we want the rethrust package valves to off; the SM-02 supply valves to off, the search tank 02 valve to off. Over.

SC Okay Request service module O_2 supply search tank O_2, the three of them to off.

CAPCOM Roger. You did include the request tankage there. Okay, glycol resovior invalve closed. By-passed open, and out-vale to closed. Over.

SC Okay. Glycol reservoir invalve closed, by passed valve open, and reservoir out valve closed.

CAPCOM That's affirmative and on 350, no change. Panel 351, main regulator valves 2, to closed and the H2O slash glycol tank pressure regulator valve off and relief valve off. Over.

SC Okay. Main regulator valve 2 closed water glycol tank pressure reg and relief valves both off.

CAPCOM Okay, that's affirmed, now those are the last changes on 1-12. Let's go to 1-13.

SC Okay, ready to copy.

CAPCOM Okay, go down to Panel 380. 02 demand reg valves off and suit circuit return valve pulled to open. Over.

SC 02 demand reg valves off and suit circuit return valve pulled open.

CAPCOM That's correct. Go to Panel 382. First 1, 2, 3, 4 are unchanged. We want sep EVAP H2O control valve off and prime EVAP H2O control valve off. Those are both counterclockwise. Over.

SC Okay. Sep EVAP Panel 382 H2O control valve off and prime EVAP H2O control valve off.

CAPCOM That's correct, and those are the only changes on 1-13, and there are no changes on 1-14, and you've got it all, Jack. Over.

SC Okay, real good, Joe. (garbled)
CAPCOM Okay, you can get those configures when you can and the next order of business I've got for you is a procedure to verify that main buss B is good and a little after that, we'll want to read up to you for your future information a procedure for transferring LM power to the command module. Over.
SC Okay, that sounds good. You want to get this (garble) configuration, first before we get those other procedures.
CAPCOM Yes, I think so. Stand by one second and I'll see if Flight has any words for us before we start that.

END OF TAPE

CAPCOM Jack, Houston, over.
AQUARIUS Go ahead.
CAPCOM Okay, we don't have anything for you, our only concern is that you'll wake up somebody; is there anybody sleeping right now?
AQUARIUS No - we're all sitting here eating; I'm just gonna get a bite to eat, then I'll write down that switch configuration, or I'll copyt he procedure now if you want.
CAPCOM Yeah, okay. Understand they are all up. Did you say you wanted to copy the other procedure now? Over.
AQUARIUS I can if you want. Its your choice.
CAPCOM I'd rather you went ahead with the switch configuration Jack.
AQUARIUS Okay, let's do that, then I'll be back with you.
CAPCOM Okay, see you later. And tell Jim that Deke wants to go to bed.
AQUARIUS Okay, I'll tell him that right now.
CAPCOM Okay.
AQUARIUS I'll tell you, I'll get my switches all set before I eat, so I won't disturb J m any.
CAPCOM Aquarius, Houston, over.
CAPCOM Go ahead.
CAPCOM Stand by one minute Jack, before you go into there, flight has got one other item for you.
AQUARIUS Deke wants you to go to bed.
SC (talking within the spacecraft)
SC You know what I thought - I think what we saw venting was the result of our Delta V's stirring up. Popping the relief valve.
SC Yeah.
SC I don't see anything venting now.
AQUARIUS Okay, Houston, we are standing by.
CAPCOM Aquarius, Houston, Over.
AQUARIUS Okay Joe.
CAPCOM Okay, Jack, you can go ahead and set up that switch configuration - what we are discussing is having you activate your main bus tie motor switches later on simply to verify that they will be okay, because the batteries are probably getting a little bit cool. But we'll be back to you with a procedure and discussion about that after you get the switch configuration set up; over.
AQUARIUS Okay, I'm going to get the switch configuration done now before Jim goes to bed so I don't disturb him.
CAPCOM Okay, real fine.
AQUARIUS Jim thinks he sounds like Frank Borman on Apollo 8.
CAPCOM (laughter) Okay. Sorry about that.
AQUARIUS I'm going to give the comm to Fred-o now.
AQUARIUS Houston, Aquarius.
CAPCOM Aquarius, Houston, go ahead.

AQUARIUS Okay, before I hit the sack Joe, I just want to make sure you're still plotting on MCC at 107 and whats the latest find?

CAPCOM Okay, Jim, we are still gathering our thoughts on the MCC, but some of the considerations go like this; FIDO tells us that we can do that correction probably as late as 118 hours, with no significant Delta V penalty, and with plenty of tracking thereafter to make sure that we've gotten the right thing, and to set you up for a late MCC if we need it, which we probably wouldn't. We are happy with the PTC mode that you are in now, and although we are working up a ags PTC mode to use after the midcourse correction, we kinda like you to stay in this PTC for awhile because it is doing good. We are looking at the weather in the landing area - we don't think we'll have a problem, but we are checking it real close, and if there is any changing that we want to do, we want to get it into this midcourse correction. For reasons like that, we are considering possibly delaying the midcourse correction from 104 hours to sometime between there and 118; we'd like to know what you think about it; over.

LOVELL We have no druthers. As long as we do the midcourse, and there is plenty of tracking thereafter to correct the midcourse; that's my only concern.

CAPCOM Okay, Jim, roger that. And based on FIDO's input that he'd like to do it not later than 24 hours before EI, we will be doing it prior to 118 hours.

LOVELL Okay.

AQUARIUS Hello Houston, Aquarius, Go ahead.

CAPCOM Aquarius, Houston, go.

AQUARIUS Question; Joe. Jim has been talking to me about how we are going to do this midcourse, and awhile back when we went through this power up, we had pulled the stab control ASA breaker; I was wondering if the lost the heaters in the ASA; I was wondering how it looked; what kind of shape it's gonna be in.

CAPCOM Okay, stand by there Fred.

RAISE Okay.

CAPCOM Fred, Houston.

HAISE Go ahead.

END OF TAPE

SC Go ahead, Houston.

CAPCOM Rog (GARBLE) for this package. It'll be okayed for the burn. We're massaging the detail procedures for this burn at this time and we expect to have a real clean setup (GARBLE) time.

SC Okay, very good.

SC Ed, I don't know if Jack gone to you but Jack and I just finished logging about 6 hours sleep, each.

CAPCOM Roger, Fred. Copy that. Is it a little chilly up there?

SC Yeah. We made the mistake of putting up the window shades which we won't do again and we just powered our mode, we're not generating much internally and it really did get chilly.

CAPCOM Yeah, I guess you'll have to generate your own heat in there for a while.

CAPCOM Deke says unstow the exer-G.

SC Okay.

PAO This is Apollo Control. We are anticipating the start of the change of shift press conference within the next few moments in the Building 1 auditorium (main auditorium). The participants will be the Maroon team Flight Director Milt Windier and retrofire officer from that team Tom Weichel Changes in procedure - the spacecraft power up and checklist being passed up by Joe Kerwin went to the crew. We've had no bio-medical telemetry in the last several hours from the crew and there's been no report of any medication having been taken by the crew of Apollo 13. Distance now from Earth, 182 390 nautical miles, velocity 3920 feet per second. Total spacecraft weight 87 942 pounds at 92 hours 54 minutes Ground Elapsed Time and standing by this is Apollo Control.

CAPCOM Aquarius, Houston. Over.

SC Go ahead, Houston.

CAPCOM Fred, just wanted to let you know in advance that we're coming up on the red line CO2 value for the secondary canister and we expect to get there something like a half hour at which time we'll be asking you to switch over to the Command Module canisters. I have the rest of that procedure ready and I just wanted to warn you a little bit in advance.

SC Okay. And I've got a question for you, Joe.

CAPCOM Go ahead.

SC Okay. The - I need to find out if the condensing container that we were going to use to strain some water in on the lunar surface now is this container also completely air tight? Okay to use it to (GARBLE)

CAPCOM Fred, I didn't copy what you wanted to use it for. Over.
SC (GARBLE)
SC Okay, how do you read now, Joe.
CAPCOM Oh, that's much better. Go ahead.
SC Okay, I was just going to say we say we haven't had an overboard waste water duct since clear back around the other side of the moon - about this time we're running out of the bags we've got onboard here.

END OF TAPE

CAPCOM Okay - I'm - I'm stupid; I'm not quite quite sure what you are getting at.

AQUARIUS Okay, Joe, we need some place to put the urine.

CAPCOM Okay, it sounds to me as if the suggested receptacle is perfectly satisfactory; do you think you can use it in its present configuration?

AQUARIUS Oh yeah, we got all the innerconnects mocked up we need, but I wasn't sure if that gadget was devised soley with the 1-6th g environment in mind, and whether it might leak, now in zero g.

CAPCOM I'll have them verify that, but off the top of my head, I'm sure its going to be alright. We'll check it Fred.

AQUARIUS Okay.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC Okay, Joe. One thing I noticed. There are a couple of circuits here now, the pulse star is taking a number of them, is marginally decreased, and what I thought rather bad and apparently that added venting we had out of the service module was some overboard relief valve maybe letting go. It appears to have stopped now.
CAPCOM Okay, Fred. Copy that. Thank you.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC What do you read down there for partial pressure, CO.2?
CAPCOM Oh, let's see. We're reading 6.6 right now Fred. What do you read?
SC I'm reading about 12.5. I guess (garble) you get a master alarm and no caution light we kind of figure. That's what it was with CO2 approaching its limit (garble)
CAPCOM Okay. Let me get a GO and I think it's time for us to put the other canisters on. Stand by.
SC Okay. We went to 15 on DEI primary last night before I changed it.
CAPCOM Roger, that Fred. W want to -
SC I don't have a steady ECS light on at this time, Joe, so it's just for a moment.
CAPCOM Okay. We know when you went to 15 last night on the primary. We want to switch out today at 7.6. Let me check and see if we're ready.
SC Okay.
SC (Garble) ECS light
CAPCOM Fred, Houston. (Garble)
CAPCOM Okay, Aquarius. Houston.
SC Houston, Aquarius. How do you read?
CAPCOM You're loud and clear now, Fred.
SC Okay. I was just - I'm getting mass alarms every few seconds and I (garble)
CAPCOM Okay. Copy. Ready to go ahead and get you on the command module canisters. As the first step, I'd like to know whether you've inserted the commander's red hose to the second canister bag. Over.
SC Okay, yeah, sure enough commander's red hose is inserted into the canister bag.
CAPCOM Okay, Fred. The next thing I'd like you to do is to take some more grey tape and tape over half the outlet area of each of the blue nozzles of commander's in the LMP. The reason we're doing this is we're going to be running this loop through the secondary LiOH canister hole with the canister removed and we don't have the flow restriction we need to keep the separator from over speeding. Over.
SC Okay. Yes, that's right. So we want to tape over half of both the blue and the red commander hoses. Is that right?
CAPCOM Negative, Fred. That's half of the commander's blue hose and half of the LMP's blue hose - outlet hoses.
SC Oh, okay. I'll tape over half of each of the outlets. Stand by.
CAPCOM Okay.

END OF TAPE

ALL DEAD AIR

SC Okay, I'm going to turn off the 1 (garble) flow valve at a time (garble).
CAPCOM Say, again, please Fred.
SC Okay, what I'm doing the taping. I'll have that particular (garble) flow valve in disconnect position momentarily.
CAPCOM Okay. Fine.

END OF TAPE

AQUARIUS Okay, how do you read now Joe?
CAPCOM Okay, Fred, reasonable comm; are you ready for the next step; over.
AQUARIUS Okay, at what correction - the red hose that's connected up right now to the lithium cartridge in the LSD (garble)
CAPCOM Okay, Fred (garble) the LMP red hose is (garble) In that case, we would like you to follow the procedure for inserting the other red hose in the other cannister bas (garbel) as follows: cut a diaganal hole in one corner of the bag stick the hose in about 6 inches and try to get the outlet nozzle down if you can, or else sideways, and just tape up the hose to the bag making a nice tight seal. Over.
AQUARIUS Okay - Jack's back in here; I guess he can do that - stand by
CAPCOM Okay.
AQUARIUS How do you read Joe?
CAPCOM Okay Fred - is that done; over?
AQUARIUS Nope; thats still in works; I just wanted to comment you might pass on to Steve Grega we thank you for lots - for those rendezvous procedures - being able to make up these little boxes.
CAPCOM Okay, we appreciate your appreciating it. We're just having a ball down here working on all kinds of new procedures Fred, the CP CB (garble) but we expect to have your entry procedures out here by Saturday or Sunday at the very latest.
AQUARIUS Saturday or Sunday?
CAPCOM At the very latest.
AQUARIUS Take your time Jack.
AQUARIUS Why don't you run that other hose back up in the tunnel so Jim can get some air.
AQUARIUS Yeah, I got it.
PAO This is Apollo Control. For the benefit of newsmen at the Houston news center, there will be a briefing in the main auditorium momentarily regarding the Apollo pressure suit; the briefer will be Mr. Bruce Ferguson of ILC Industries, in the main auditorium to start within the next few moments. AT 93 hours, 49 minutes, ground elapsed time, and standing by, this is Apollo Control.

END OF TAPE

SC and Joe how do you read now.
CAPCOM Satisfactory, Fred. Go ahead.
SC Okay, back to the condensate container I guess the only question I really need answered is will it leak
CAPCOM - Is will it leak only.
SC And we've checked all the fittings and I know I can hook everything up to UCD's - if it doesn't leak we can transfer.
CAPCOM Okay, Fred, we still don't have a final answer on whether or not it'll leak. If you need it, I'd go ahead and use it, and standing by for your completion of the hose insertion procedure.
SC Okay. The hose insertion procedures (GARBLE) complete.
CAPCOM Okay. Let's complete the next step is to switch to the primary CO2 canister and remove the secondary canister and stow it. Over.
SC Okay. I'm going to have to get on COMM here, I'll let Jack get the head set.
CAPCOM Okay.
SC Hey, Joe, (GARBLE) set down.
SC Start secondary.
SC Both cartridges are out.
SC Okay, Joe, Fred has the secondary cartridge out. We're back on primary now.
CAPCOM Okay, Jack. The next step is to place the Command Module canisters with the hoses attached in a suitable location to permit the bottom of the canister to be exposed to free air flow and tape them in place. Ideally, well, it doesn't matter. Just - just pick out your own spot.
SC Okay, I'm going to tell you where they are. They're both situated (GARBLE) canister exposed to free air and one of these are right by (GARBLE)
CAPCOM Jack, Houston. The COMM got real noisy there and I didn't copy that.
SC Okay, Joe, how do you read now?
CAPCOM Okay, that's real good Jack, go ahead.
SC Okay, the canisters are situated as you would like with the bottom of the canister exposed to free air.
CAPCOM Okay.
SC The position of the LP's canister - the LP's canister is staying on the ECS panel now and the CDR's canister is positioned up in the tunnel.
CAPCOM Okay, real fine, Jack. The next step is to physically separate both blue hoses a good distance away from the canister so that we don't short circuit the flow and tape them in place and the ideal location for them would be up in the tunnel so as to get some flow into the Command Module. Over.

SC Both hoses in the - up in to the Command Module.
CAPCOM Well, you can use your judgment on that Jack We'd like at least one and the recommendation that I got was to put them both up in the tunnel.
SC Okay, we have the LP's blue hose up by the LP's window and the, of course, the red hose is separated by itself about 4 feet. The other hose, the has the extension on it. The CDR's blue hose, of course, has the extension on it and it's blowing way up in the Command Module and the red hose is about oh, it's right at the docking ring where the blue latches are so there's about 4 or 5 feet difference from there to. Is this satisfactory?
CAPCOM Okay, Jack, that sounds satisfactory. The next steps are - are suit loop configuration steps and the first one is to place the suit diverter valve to the full Egress position.
SC Okay suit diverter valves to full Egress.
CAPCOM That's affirmative.
SC That done.
CAPCOM Okay, the next step is cabin gas return to egress. Over.
SC (GARBLE)
PAO This is Apollo Control. The briefing on the Apollo suit should begin momentarily in the main auditorium in the Houston News Center. Bruce Ferguson of ILC C industries.
CAPCOM Yes, we did turn the egress. Over.
SC No I didn't get that Joe. Cabin gas returned to egress.
CAPCOM That's correct.
SC Okay that's done.
CAPCOM Okay, next, suit circuit relief to CLOSE. Over.
SC Suit circuit relief to CLOSE.
CAPCOM Roger.
SC Okay, I got that done.
CAPCOM Okay, and the last step is select secondary CO2 canister, let it flow through the empty hole and let's see how we do.
SC Select secondary CO2 canister.
CAPCOM Roger, Jack. That completes that procedure and the next thing I've got for you is a procedure for going back into the Command Module and powering up the main BUSES temporarily using the BUS tie switches. We want to do this for two reasons: first of all, we want it absolutely verified that there are no loads on the main BUSES, that we've got everything off and that the BUSES look good, and the second thing we want to do is to power the BUS, the main BUSES with the BUS tie motor switches and then depower them by pulling the circuit breakers, leaving the main BUS tie switches in the

CAPCOM ON position just to assure that they'll be there when we need them whether the batteries get cold or not. Over.

SC (Garbel)

END OF TAPE

SC Okay, Joe. How you read?
CAPCOM Better now, Jack. Satisfactory. Did you copy my rational for the main bus power up.
SC Yes, I did. Do you want a power up both buss's with buss type motor switches first of all to see that there are no loads on the buss's and second depower the Buss's by pulling the circuit breaker to insure that the motor switches don't - so the Buss's stay on so they're there when we need them.
CAPCOM That's correct, Jack. Are you ready to copy the procedure?
SC Okay. Go ahead.
CAPCOM Okay. As the first step, I have one change to the basic configuration that we gave you. It's 2 more circuit breakers that we want open. On panel 225. Are you ready to write that down? Over.
SC Yes. I'm all ready Joe.
SC Joe, I'm all ready. Go ahead.
CAPCOM Okay. On panel 225, we want the rendezvous transponder flight buss circuit breaker OPEN, and the S-band FM transmitter/DSE flight bus circuit breaker OPEN. Over.
SC Okay. TV rendezvous transponder flight bus OPEN, TV S-band FM transmitter/DSE flight bus OPEN on panel 225.
CAPCOM Okay. That's correct, Jack. Now we'll go into the main bus power up procedure. And the first step there is on panel 5. We want the bat charger, bat A charged circuit breaker closed, and the BAT B charge circuit breaker closed. Over.
SC Okay. B AT chargers, BAT A charged BAT B charged, both closed on panel 5.
CAPCOM That's affirmative. We need them closed to power the switches. Next on panel 5 we want the EPS sensor signal MAIN A and MAIN B circuit breaker CLOSED. Over.
SC Okay. Panel 5 (garble) and EPS sensor's signals MAIN A AND MAIN B CLOSED.
CAPCOM Okay. That's affirmative. We need them closed so you can read out your volts and AMPS. Next step on panel 250, we want circuit breaker BAT A, power, entry and post landing and BAT B power, entry and post landing CLOSED. Over.
SC Okay on panel 250 (garble) BAT A, power and post landing CLOSED, BAT B power, entry and post landing CLOSED..
CAPCOM That's affirmative. And at that point we'd like you to check the BAT plus voltages on both BAT plus's to make sure we don't have any shorts. Over.
SC Okay (garble) Bat plus A and Bat plus B.
CAPCOM That's affirmative. The next step on

CAPCOM On panel 275 circuit breaker MAIN A Bat plus A closed and circuit breaker MAIN B Bat plus B closed. Over.

SC Okay. Panel 275 circuit breaker MAIN BAT A plus A CLOSED, BAT Circuit Breaker MAIN B CLOSED.

CAPCOM That's affirmative. Next step on panel 5. We want the main BUS tie AC Switch to the BAT AC position, and verify proper voltage on MAIN BUS A, and read the AMPS on BAT A to make sure we don't have a short. Over.

SC (garble)

CAPCOM (garble)

SC Okay how do you read that?

CAPCOM That's better, Jack. Go ahead with your readback.

SC Okay. MAIN BUS tie AC ON, MAIN BUS A current and voltage.

CAPCOM Okay, that's affirmative. The next step will be the main bus tie B C switch to the ON position and read MAIN B voltage and battery B amp as above. Over.

SC Okay, main bus BC ON, main B voltage is ON.

CAPCOM Okay. That is correct. Then to reconfigure from this configuration, Jack. We want you to leave the main bus tie switches in the ON position and pull the circuit breakers out in reverse order that we had you close them. Over and do you want me to read them up individually?

SC Let me see if I've got it here. I go down to panel 275, (garble) open Main bus A and B and go down to 250 and (garble) go up on panel 5 pull ECS Main A and Main B and battery charger BAT B charged, Battery charge BAT A charged. I don't know whether you want me to close rendezvous radar transponder flight BUS and S-band transponder. (Garble)

CAPCOM Okay, Jack. We don't want you to close those last 2. Those are changes to your basic configuration and we want to leave them open now. Over.

SC Okay, I'll do that. Was the readback okay.

CAPCOM That's correct. Everything was 100 percent, and we'll wait to hear from you.

SC Okay, Joe. And just for confirmation, I went through (garble) you gave me. We are in exactly that configuration with 1 exception, and that is over on panel 382, these 2 acumulators are in the OFF position so that if we need any more water we can get it.

CAPCOM Okay, Roger, Jack. Copy that. On panel 382. You've left the H2O accumulator valves in the OFF position and we concur.

END OF TAPE

CAPCOM And we think that -
SC Okay, and there's one other thing that I don't know whether you're aware of. We have no lithium hydroxide canisters in Panel 26 the canisters panel. So when we get ready to power up, you'll have to remind us when you want us to amp.
CAPCOM Okay, Jack. We copy that. That's correct and I'll add that to our basic checklist so that we won't forget it.
SC Okay. Real fine, Joe, and I'm on my way back into the command module.
CAPCOM Good deal.
SC How do you read, Joe.
SC Joe, how do you read, Aquarius.
CAPCOM Aquarius, Houston. Pretty good. Go ahead.
SC Okay, I'm back on the line now, and Jack, really (garble) ack to the upstairs bedroom.
CAPCOM Okay, Roger that Fred.
CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay, Fred, we recommend that you push your master line circuit breaker in so you'll have audio and visual on that, and also we medical types are getting to feel left out down here and we'd like you to give us biomed (garble) position if you're plugged in for it, and we'll see whether it affects your voice or not.
SC Okay, Aquarius, going downvoice backup S-band. How do you read us?
CAPCOM Aquarius, Houston. Read you now satisfactory.
SC Okay, and that's my project.
CAPCOM Okay, thank you very much.
SC Actually, a good deal that little power tank's used up (garble)
SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC Okay, Jack, the (garble) is going back down. We're actually still on the vent 250 BAT A- BAT B breakers. We read BAT BUS volts as 32.3 on A, 37.0 on B. And then back to the 275 breakers, thistime we find the BAT BUS volts 32.0 on A, ZERO amps and 37.0 on B, zero amps.
CAPCOM Aquarius, Houston. We have (garble) there and I want to be sure that we get these numbers right.
SC Okay, How do you read now, Joe?
CAPCOM Okay, probably okay, Fred, read it nice and slow so we'll be sure to get it. Over.
SC Okay, Jack -

END OF TAPE

SC Okay, Jack puts in the 250 bat A bat B entry breaker. The dead battery bus volt is 32.3 on A, 37.0 on B. Then he puts in the P75 breaker tieing the bat to the main bus. This configuration main A is at 32.0 volts, zero amps. Main B is at 37.0 volts, zero amps. It looks like the basses are okay.

CAPCOM Okay, Fred, copied those numbers and I assume you got them off all right.

SC That's affirm Got all the breakers pulled together. Over.

CAPCOM Okay, real fine.

END OF TAPE

SC Houston, Aquarius, how do you read?
CAPCOM Aquarius, Houston. Go ahead.
SC Okay, how did our (garbled) configurations appear to be working down there?
CAPCOM I'm sorry, Fred, but we got noisey again.
SC Okay, let me know when you want me to try.
CAPCOM Okay, that sounded better already. Go ahead.
SC Okay, I'd just like to know how our little (garbled) set up (garbled) appears to be working down there.
CAPCOM We are reading 0.2 on our CO2 sets here and we're all delighted, it seems to be working fine.
SC Boy, that is great.
CAPCOM And Fred, Houston. In a little while here I'm going to have a procedure that I want to read up to you and have you copy down for future use. It's a procedure for powering the command module main bus off the LM and it's something that we feel that's going to come in real handy later on for such things as topping off the command module entry batteries and also possibly for doing some preheating and preliminary powering up of the command module before we get rid of the LM. We'll have that for you in probably 10 or 15 minutes. Over.
SC Okay, okay, Joe. That's good. (garbled)
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, Fred, our procedure generating mill has generated another very short one for you here. It's a procedure for getting an onboard readout -
SC Stand by one, Joe.
CAPCOM Okay.
SC Okay, Joe, go ahead.
CAPCOM Okay, Fred, this is a procedure for getting the readout of the descent propellant tank temps. It's no big problem, but our LM people say that the bottom of the descent stage is probably cooling off and we just want to verify that the descent water tank will be okay. Right now it looks as though it won't freeze until several hours after it's empty, but we want to have you read these temperatures out to us so we can see how good our predictions are. The procedure is on panel 16, close the propellant display/engine override logic circuit breaker. Over.
SC Okay, the propellant displays override circuit breakers are closed. (garbled) the propellant.
CAPCOM Right, Fred, the next step is simply to turn the propellant temp press monitor switch to descent 1, read the fuel and ox temps, turn it to descent 2, read the fuel and ox temps and tell us what they are.

SC Okay, descent 1 I get a fuel temp of 66.5 degrees, ox (garbled)
CAPCOM Okay, Fred, we're (garbled)
SC Okay, how do you read now?
CAPCOM That's better. Go ahead.
SC Okay, you got 66.5 on descent 1 fuel temp, oxidizer temp is 66 degrees.
CAPCOM Okay, and I'll -
SC Tank 2 fuel is reading - okay, descent 2 fuel is reading 68 degrees, oxidizer 65 degrees.
CAPCOM Okay, copy that Fred. Thank you. We'd like you to pull the circuit breaker and we'll probably come to you again in 5 or 6 hours for another check.
SC Okay, the panel 16 (garbled)
CAPCOM Roger.

END OF TAPE

PAO This is Apollo Control at 94 hours 41 minutes ground elapsed time. Position and velocity now showing 178 274 nautical miles out from Earth. Velocity 3982 feet per second. Spacecraft weight still hovering around 87 942 pounds. 94 hours 42 minutes ground elapsed time and standing by this is Apollo Control.

CAPCOM Aquarius, Houston, Over.

SC Go ahead.

CAPCOM Okay, we're chasing a small glitch that we saw a while ago in the 02 flow rate which is not normally that but we'd like you to do is, first of all tell us during that canister procedure you moved 02 DEMAND REG A to any position other than cabin and then we'd like you to move it to OFF momentarily and back to cabin for us.

SC Okay, to answer your question, Joe, it's no. I checked the cabin all the time. I saw repeatedly in the (GARBLE) configurations that it just seemed like the frequency or (GARBLE) Reg A out of HOLD (GARBLE) cabin (GARBLE)

CAPCOM That's correct, Fred

SC (GARBLE)

CAPCOM Okay.

SC NOw, I'm back to cabin.

CAPCOM Okay, thank you very much, Fred. I'll get back to your proceedings.

SC Woman singing: Dawnning of the age of Aquarius, the age of Aquarius.

SC (GARBLE).

CAPCOM Hey, have you guys got a women on board?

END OF TAPE

SC And, Joe, we have the (garble)
CAPCOM I'm not sure I copied that, Fred. Did you ask me whether I had that power up procedure, I don't have it for you yet. Over.
SC I know that. The question was do you have the systems (garble)
CAPCOM Still didn't understand, Fred. I'm sorry.
SC Okay, we'll be able to get better comm.
SC Okay
CAPCOM Fred, you said you want to try it now?
SC How do you read, Houston?
CAPCOM That's pretty good, Fred.
SC Okay. A few things. First of all, we noticed a cable (garble)
CAPCOM Well, darn it, just as you started talking (garble)
SC Okay.
CAPCOM Try it now, nice and slow.
SC Okay, Jack got a (garble) how far out (garble).
CAPCOM On how far out what?
SC Where we are now.
CAPCOM Oh, our little plot shows you just touching the 180 thousand mile mark. So you're about 40 k out (garble)
SC Okay. And the other thing is we've noticed some fresh new particles floating around outside, so possibly the service module is beginning to vent a little bit again.
CAPCOM Okay. Copy that, Fred. On the 02 float thing, we are thoroughly sorry that the main regulator go to off inside the cabin. some here thinks that it's no big thing, but we've seen a little change in flow due to the different positions we've got to (garble)
SC Right.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, Fred. Recommend you go to OFF on biomed switch. We never did get any biomed and (garble)
SC Okay, how you read now?
CAPCOM Okay, Fred, that might be a little better.
SC Houston, we're going to 180 feet. Are you ready now? Over.
SC (garble) about 20 down.
SC (garble)
SC (garble)
SC - this could be interesting. Let us know when you're doing it.
SC Manual AGS (garble) burn, we're controlling TPCA attitude.

SC (garble) we can't tell too much.
CAPCOM (garble)
SC (garble)
CAPCOM (garble)
SC (garble)
SC (garble)
CAPCOM (garble)
CAPCOM (garble)
CAPCOM (garble)
SC (garble)
CAPCOM (garble)
SC (garble)
CAPCOM Aquarius, Houston. This is your 02 vector attitude to roll and pitch (garble) backup -
SC Really, you can almost (garble) with your eyes are (garble) I didn't realize that was (garble) and we (garble) if you'd like that, Jack. Apollo 8 used it on (garble) command module heaters and left them on.

END OF TAPE

SC (garble) we activated and it shoots both (garble) on the console and watched it and (garble) but not much, and man, was it a long pop. (garble)

AQUARIUS Okay Houston, Aquarius; how do you read?

CAPCOM Aquarius, Houston, Okay go ahead.

AQUARIUS Okay, Joe our water bowl at PTC is (garble) the moon pretty high in the window and the earth pretty low so I expect on the side where the moon's present we are having a little bit of trouble - break out there in a couple of places.

CAPCOM Roger that Fred.

AQUARIUS Houston, Aquarius.

CAPCOM Aquarius, Houston, go.

AQUARIUS Okay Joe - I'm all set to copy that procedure for powering up the command module from the LM, whenever you want to give it to me. I guess you want to put battery A on our charge, huh?

CAPCOM Jack - we're not certain when the best time is to implement this procedure and what we want to do at this time, is read it up to you so you'll have it, and understand it, and we'll be able to do it quickly when the time comes, and I don't have it for you quite yet

AQUARIUS Okay - all right. I'll be standing by to copy it whenever you get it.

CAPCOM Okay Jack.

END OF TAPE

CAPCOM Aquarius, Houston; over.
AQUARIUS I have a bad antenna here. Okay, Joe, I hear you.
CAPCOM Okay, Jack, I have the procedure now to read up to you; before I do, I want to mention something that will be of interest to Fred. We are looking at the she tank pressure rise and we expect it to blow; we don't know exactly what time it will go, somewhere around 105 hours or perhaps later than that; we've got plenty of blow down capability; we just thought you ought to be informed.
AQUARIUS Okay, standby I'll call it down.
CAPCOM Okay.
AQUARIUS Fred (garble)
CAPCOM Okay, real fine. Are you ready for the pocedure now Jim?
AQUARIUS Yeah - how long is it? Is it a big long one, a short one, or medium sized about how many pages?
CAPCOM It's about I'd say 15 to 20 steps Jack.
CAPCOM Some of it is LM stuff, and the rest of it is in GSN.
AQUARIUS Okay, I got a fresh page here and I'm ready to copy.
CAPCOM Okay, I'll give you the LM steps first they have to be done first. The first step is on panel 11N16, circuit breakers ascent BCA ASE ECA 2 to CLOSE.
AQUARIUS Panel 11N16 ascent BCA CLOSED.
CAPCOM Okay. Next step. 11 and 16 CB ascent BCA control to CLOSED. Over.
AQUARIUS Okay, panel 16 ascent BCA HOLD to CLOSED.
CAPCOM Okay, that's correct. The next step is BAT 5 and 6 NORMAL B to HIGH on your switches.
AQUARIUS Okay, BAT 5 and 6 NORMAL gage ON.
CAPCOM That's correct. Next step BAT 1 and 3 to OFF SPLASH RESET: over.
AQUARIUS BAT 1 and 3 OFF SPLASH RESET.
CAPCOM That's correct. Next step; wait 30 minutes for 3 positions.
AQUARIUS Okay - that's 30 minutes for 3 positions.
CAPCOM That's correct, and the last step for now is BAT 2 and 4 to OFF/RESET.
AQUARIUS BAT 2 and 4 to OFF/RESET.
CAPCOM That's correct, now we'll go to the CSM and the first step there is connect LM CSM umbilical. Over.
AQUARIUS LM CSM umbilical.
CAPCOM Okay, next step on panel 5 CB LM power 1 MAIN B and LM power MAIN B volt CLOSED. Over.

SC Okay, on panel 5, CP LM power 1 main B and 2 main B both closed.

CAPCOM That's correct. On panel 5, CB BPS sensor signal, main B to close. Over.

SC BPS sensor signal, main B close, on panel 5.

CAPCOM That's correct. Next step, panel 250 CB BAT B power entry full slanted, over.

SC Okay, panel 250, CB BAT B power full slanted, closed.

CAPCOM That's Charley, verify main BUS voltage then LM power switch on panel 2, CSM.

SC Okay, that's verify the panel, main BUS voltage and turn off power in the CSM.

CAPCOM Okay, that's correct. Then go back to 275, CB main B BAT BUS B, open. Hey, Jack that's step by step for you, before verifying main BUS voltage, you have to account 275 closed, main B BAT BUS B.

SC Okay, Joe, how you read on the aft OMNI?

CAPCOM You're okay now. Go ahead.

SC Okay, after battery B power entry full slant on, then I want to push the panel 275 DC BAT BUS B.

CAPCOM That's right, then you go to verify main BUS voltage LM power to CSM and then on panel 275 circuit breaker main B BAT BUS B, open. Over.

SC Okay, after verifying the main BUS voltage then I change the LM power to CSM for main B BAT BUS B, open.

CAPCOM That's correct and then on panel 250 circuit breaker BAT B power entry post landing, open and verify main BUS B voltage.

SC Okay, panel 250 main BUS B power post landing open then verify the main BUS voltage.

CAPCOM Okay, that's correct. The last steps are to get the LM back on descent batteries. The first step is BAT 1, 2, 3 and 4 high voltage on. Over

SC Okay, then the next step is the last step, that's BAT 1,2,3,4 high voltage on.

CAPCOM That's correct and the last step in the LM, BATS 5 and 6 to off. Over.

SC Could you say again, you cut out there Joe.

CAPCOM Okay, Jack. The last step in the LM batteries 5 and 6 to off. Over.

SC Okay. BATs 5 and 6 go off.

CAPCOM That's correct. That should configure you. Note that circuit breaker protection on that circuit limits the available current to 15 amps. We think we can do quite a bit with it though. The LM CSM umbilical is will be hot and main BUS voltage is monitored by selecting main B. Over.

SC Okay, real fine.
CAPCOM Good deal, Jack.
SC Okay, and I'll be ready to implement this whenever you call it up.
CAPCOM Roger that.
SC And roger, hey Joe.
CAPCOM Pretty good, Fred.
SC Okay, while Jack was copying those I was looking out the Jacks window here and I could see another good shower...

END OF TAPE

SC docking window here and I can see another good shower of particles coming out of the service module and position this time appears to be on the other side, before we'd always seen them out of window 1 and we're up looking at it from here, it looks like it would be down below window 6 in the service module. Jack's going upstairs to see what it looks like up there.

CAPCOM Okay, good deal. We copied that, Fred, and to show you how relaxed we are about the entry, Ken is looking at - giving you guys a chance to - prior to going into entry prep to send a few pictures of the service module.

SC Ken is -

CAPCOM Yeah, he's got all that film up there and he doesn't want to waste it.

SC Oh, I thought maybe you'd want me to do a PLSS EVA shoot your pictures or something.

CAPCOM Okay, okay.

SC Right, we got a lot of pictures.

SC I guess I agree with Joe, I'd like to document some way (garble)

CAPCOM Yeah, we think it'd be a lot of help.

SC Joe, how you read me (garble)

CAPCOM Stand by a minute Fred we're having (GARBLE)

SC (Garble)

SC Okay, how's that.

CAPCOM That's better.

SC Okay, the waste transferred into the condensate works real well, Bill.

CAPCOM Okay, forget.

SC So, I guess we can keep Fido happy with no overboard dump.

CAPCOM Roger, that.

SC That brings about one more possibility, Joe.

CAPCOM Say again, Fred.

SC Brings up another possibly, now we've got all that stowed and the bags and the condensate can and it's probably blow through the (garble) sublimator and work on waste water.

CAPCOM It might work if we had to do it, Fred. Right now we're looking at a comfortable excess of water through the sublimator. We were talking among ourselves this morning about having you try out the PLSS to assent tank water transfer situation and we decided not to do it, not to recommend it because we figure it'd take us 30 hours to empty one of the assent tanks, which you have to do in order to get PLSS water to it and we'd rather use the descent water and we don't think we've gotten any sweat.

SC Okay, Joe. I don't think there's any question about it (GARBLE) that might be indicated.

CAPCOM Okay, copy that.

PAO This is Apollo Control. 95 hours 30 minutes ground elapsed time. Present thinking on the midcourse correction which would bring Apollo 13 back into the Earth's intercepting corridor, would be a Lm maneuver, propulsion maneuver of about 7 feet per second at 104 hours ground elapsed time and would return the spacecraft to entry corridor shooting for a flight path angle of about minus 6-1/2 degrees on all lunar missions to date, with a few exceptions, during the trans-earth coast phase some sort of midcourse correction has been necessary to get back on to the corridor depending on the accuracy of the transearth injection. This particular mission is certainly no different. Spacecraft communicator Joe Kerwin is away from the console at the moment, after having read up some additional checklist changes. We are continuing to monitor the air-to-ground. Kerwin returning to the console. If the midcoure correction in this trans earth phase is delayed beyond 104 hours to the second one, it's in contention of second time of 118 hours, it would be somewhat greater magnitude more in the neighborhood of 40 feet per second. With the 7 foot per second midcourse correction at 104 hours, the vacuum perigee would be around 20 nautical miles. Flight path angle of minus 6.51 degrees. AT 95 hours 32 minutes, ground elapsed time and standing by this is Apollo Control.

END OF TAPE

SC Houston, Aquarius. How do you read, Joe?
CAPCOM Read you pretty good, Fred. Go ahead.
SC I think our PTC wobble is growing worse. The earth now is really up to the top of the window. I have to get way down almost to the floor boards to see much, and conversely the moon is way down at the bottom.
CAPCOM Loud and clear.
SC A lot more water.
SC Far more than I noticed on my previous watch.
CAPCOM Okay. Copied that Fred. And our thermal people will be looking at it. One of the things you were talking about relative to the midcourse correction is we'd like not to do it before the (garble) goes. If it's going to go just so it won't give us a problem reestablish PTC and right now our people think that the burst disc will pop around 106 hours.
SC Okay.
SC (Garble)

END OF TAPE

CAPCOM Aquarius, Houston, over.
SC Go ahead, Houston.
CAPCOM Okay, Fred since you went ahead and used the PLSS condensate container we got the procedure in for review. We're not going to read it up to you except that it cautions a little bit about shaking it too much or about filling it too full, because they feel that if you do that the vent valve might unseat and the bag might leak a little bit. Over.
SC Okay. We haven't removed it from the storage spot, we just left it right in it's place and just (garble) the end of the cable and hooked right into that and hope that is correct.
CAPCOM Understand, that's satisfactory and recommended that you leave it in the storage spot, that should help the situation.
SC Roger.
SC We're getting a - we're getting another (garble)
SC Jack thinks it may be an H2 vent.
CAPCOM Okay, copy what window are you looking out of?
SC Out of the LM docking window.
CAPCOM The docking window, Rodger that -
CAPCOM Somebody just handed me your latest consumables status report and you're using 11 or 12 amps per hour real steady and it looks real good.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70 CST 1:08P GET 95:55:05 408/1

PAO This is Apollo Control at 96 hours. At the present time the discussions here in the Mission Control Room about the midcourse correction, are beginning to firm up toward a definite time, heretofore, the times under discussion were 10 - 104 hours and 113 hours. Right now it's shaping up to look like we'll do the midcourse correction to bend the trajectory back to the entry corridor with a vacuum perigee of around 20 nautical miles. The burn would be at 105:30 ground elapsed time; descent propulsion system burn 7.6 feet per second; 14.8 seconds duration. this burn would be - is being timed to coincide with the estimated time that the burst disk in the supercritical helium in the lunar module will give way, so that the effects on the trajectory would be lessened in having both the burn and any perturbations (garble) in the trajectory come at the same time. The vent from the supercritical helium now is non-propulsive, that is, there's a T in the line and it should cancel out any DELTA-V added by the venting, however, there's somewhat - a certain amount of uncertainty in this regard. At any rate, having the burn and the burst disk event near the same time frame gets both of these events out of the way and it gives a good long bit of tracking to pin down what the new trajectory will be. We're now showing 0.1 millimeters in mercury partial pressure carbon dioxide in the lunar module. So, apparently the shade tree engineering using the command module lithium hydroxide cannisters in the plastic bag and the suit hoses, is working out all right. And at 96 hours, 3 minutes ground elapsed time, this is Apollo Control.

END OF TAPE

PAO This is Apollo Control at 96 hours 15 minutes ground elapsed time. There's some white sacks with sandwiches being brought into the room by a young lady. Getting back to midcourse correction in the transearth coast phase here in Apollo 13, the current thinking is to do a descent propulsion system maneuver at about 105 hours 30 minutes ground elapsed time. 7.6 feet per second. The burn time of 14.8 seconds. Apollo 8, back in December 1968, did a similar burn in about a similar time. However, it was a command module or service module RCS burn of 4.8 seconds - 4.8 feet per second at 10358. The burn is intentionally timed to the estimated time frame in which the lunar module super critical helium burst disc is suppose to let go. It's not anticipated that this burst disc, the venting of the super critical helium will cause any perturbations to the trajectory and that vent outlet has a T on it and thereby cancels out any propulsion. It's called an non-propulsive vent. Having the burn and the burst disc take place in the same time frame will allow the tracking after these events to provide a good handle on spacecraft trajectory for refining the - into the recorder and calculations towards entry. There's quite a bit propulsion available out of the spacecraft up to some 28 feet per second still available with the vehicle that weighs in the neighborhood of 87,000 pounds. For the small RCS thrusters on the lunar module, 28 feet per second available out of that system. Still a great deal of propulsion available in the descent propulsion system and one as yet untapped system. That's the ascent propulsion engine in the upper stage of the lunar module which likely won't even be used at all. Rather quiet now in the air to ground circuit. Taking a lunch break here in Mission Control. Sandwiches were brought in as mentioned earlier and most of the people are taking this opportunity to have a mid-afternoon snack. At 96 hours 18 minutes and standing by, this is Apollo Control.

SC Joe, what are you showing for GET time?

CAPCOM I think he wanted the GET, Jack. The first GET is 96 hours, 21 minutes. Over.

SC Okay, thank you.

CAPCOM Okay.

CAPCOM And Jack, Houston. For your information FIDO tells me that we are earth's sphere of influence and there's certain accelerations.

SC I thought it was about time we crossed, thank you.

SC We are on our way back home.

SC There's something that puzzles me Joe. Vance mentioned yesterday that the planned entry is C of C guided entry so I'm kind of curious how are we going to get alignment on it.

CAPCOM Did you say, how we're going to get guidance? Over.

SC No. How are we going to get a platform alignment?

CAPCOM Okay. We got a number of interesting ideas on that and the last one I heard is to power up the LM platform - align it - align the CM platform to it.

SC Okay. That sounds good.

CAPCOM Okay, and we're working out detailed procedures on it Fred.

SC Okay.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Aquarius, Joe.
CAPCOM Okay. We are taking our final look at the midcourse procedures and we have a question as to the present position of one of the switches. The switch is the AGS status switch on N-6. We just like to know where it's at.
SC Okay, Joe, the AGS status switch is Off.
CAPCOM Okay. Off. Thank you.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4/15/70 CST 1:58 PM GET 95:56:15 411/1

PAO This is Apollo Control 96 hours 53 minutes ground elapsed time. Spacecraft communicator Vance Brand has releived Joe Kerwin at that post, the spacecraft communicators on a different shift schedule than the rest of the Flight Controllers. To go back again, once over lightly with the midcourse correction upcoming.. Repeat the current thinking is to do a midcourse correction burn at 105 hours 30 minutes ground elapsed time, the descent propulsion system of the Lunar Module would do the burn - the velocity change would be 7.6 feet per second. This burn would place the Apollo 13 spacecraft back on the entry corridor for entry into the South Central Pacific. Another aspect of timing the maneuver at 105:30 instead of the earlier discussed 104 hours, is that it is expected that super-critical helium burst disk in the lunar module descent stage is likely to let go at about - about this time frame 105:30 and by doing the maneuver and the - and having the burst disk rupture at this time would put both of these events close together so it wouldn't be expecting the burst disk to go which in turn may or may not effect the trajectory as far as tracking concerns, so this would get them both behind and an accurate tracking state vector of the spacecraft could be measured. It's expected that the new thinking on the midcourse correction will be passed up to the crew before too long.

PAO The midcourse correction burn made earlier at 79 hours and 28 minutes transferred Apollo 13 from a hybrid nonfree return trajectory to a free return trajectory. The next maneuver at Pericynthion plus two hours transferred back from one free return to another with a change in the landing point and landing time. We're continuing to stand by. The velocity now showing 4068 feet per second as Apollo 13 continues to accelerate, now that it is back into the Earths sphere of influence. Some 172 937 miles out from Earth. At 96 hours 57 minutes ground elapsed time and standing by, this is Apollo Control.

END OF TAPE

SC (All garble)

END OF TAPE

SC Houston, Aquarius.
CAPCOM Aquarius, Houston, Go ahead.
SC Okay, Vance. I just heard a little thump, sounded like down in the descent stage, and I saw too a shower of snow flakes come up that looked like they were emitted from down that way. We've already decided though - I wonder what the descent pressure looks like now
CAPCOM Okay, understand you saw a thump in the descent stage and a few snow flakes. We'll take a look down here, see if we see anything.
CAPCOM Aquarius, Houston.
CAPCOM Aquarius, Houston.
AQUARIUS Go ahead.
CAPCOM Fred, we don't see anything wrong percent but your SHe appears to be okay. As far as we can see. The thing we don't have data on, is the start tank down there.
AQUARIUS Okay and I doubt if it would have been that anyway.
CAPCOM Okay. While we have you on the horn.
AQUARIUS It's still good.
CAPCOM Roger, still good.
AQUARIUS Go ahead.
CAPCOM While you're on the horn, our calculations show you might be running out of portable water in the CSM pretty soon. Also, that you might start to have hydrogen tank venting in the CSM and a question. Next time Jack looks through the sextant and telescope, we'd like him to see how it looks. Do you have anything on the optics, any specs or anything.
AQUARIUS Houston, Aquarius, how do you read.
CAPCOM Aquarius, we read you 4 by 4. Go ahead.
AQUARIUS Okay, it looks like the PTC is deteriorated enough that (garbled)
CAPCOM Aquarius, Houston. We got part of your transmission. Understand the PTC has deteriorated quite a bit and you'd like to know what to do about it. Is that afirm?
AQUARIUS Negative. How do you read now Vance?
CAPCOM Okay, a little better.
AQUARIUS Okay, the only comment was it deteriorated to where the moon is now coming through the overhead docking window now, and of course (garbled) and about that time I just loose COMM on either antenna, so there's going to be a short period of time on each revolution where we're not going to have COMM.
CAPCOM Okay, Fred. We understand that and one more item for clarification on the water. We don't really know what your usage of portable is. That was purely an estimate assuming a fairly healthy usage.
SC Okay.
SC Hey, Houston, Aquarius.

CAPCOM Aquarius, Houston, Go ahead.
SC Okay, Jack just took a look through the optics through one rev and he said they look good, loud and clear. He doesn't have any current condensate on either sextant and telescope.
CAPCOM Okay, Fred. Thanks for the info.

END OF TAPE

CAPCOM Okay, Fred, thanks for the info.

END OF TAPE

SC How do you read, Vance?
CAPCOM Okay, I'm reading you weakly, Fred. Go ahead.
SC With all this other procedures you've been working on there; I thought I was going to have a new one for you. How to get 4 gingerbread cubes apart, I think they were stuck together with epoxy.
CAPCOM This is in the food bag?
SC Yes.
CAPCOM That's to stand loads of launch and boost.
SC Roger, tool V did the trick.
SC Yes.
CAPCOM Hey, Fred. John says you can use the Dikes on it to get them apart.
SC Yes, that probably wouldn't have crumbled them as badly.
SC I generally don't (garble).
SC You can tell we're feeling pretty good, Vance. When we start complaining about the food.
CAPCOM Yes, that's good to hear.
CAPCOM I think everybody's feeling better down here, too.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Fred, we have you on the Goldstone big dish now, and our COMM is much better, if you'd like would you turn the BIOMED switch ON to either crewman there.
SC Okay, standby. I'll have to plug in first.
CAPCOM Okay.
SC Okay, Vance. How do you read on (garble)?
CAPCOM We read you - just - just standby.
CAPCOM Okay, Fred, we're receiving your mid data, it was a little slow in coming in.
SC Okay.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70, CST 2:59 PM GET 97:34:30 416/1

ALL DEAD AIR

END OF TAPE

CAPCOM Houston, Aquarius, are you calling?
SC Negative, no call from here.
CAPCOM Okay.

END OF TAPE

SC And Vance is ready.
CAPCOM Go ahead, Fred.
SC Okay Vance. Coming back on the line is - I'm unhooking the biomeds and you want me to go back to the SPA downvoice backup?
CAPCOM Stand by.
SC Okay. Jim doesn't have this biomed rig working right now so (garble).
CAPCOM Okay.
CAPCOM Okay, Fred. You're too weak on that last. I understand you're disconnecting (garble).
SC Okay. How do you read now?
CAPCOM Okay.
SC Okay. All I said was Jim doesn't have his biomed rigged right now so I'll go back to downvoice backup SPA and Jim's coming on the line.
CAPCOM Okay. We copy you're in downvoice backup.
SC Roger.
SC Well, thinking about the last 10 hours. We've lost our suit compressors.
SC Because we don't want to use the power.
SC GARBLE
SC (Garble) now we can use these fans right here and circulate air in through using those fans.
SC Are we on mike now?
SC Hello Houston, Aquarius.
CAPCOM Roger Jim. Good morning.
SC Good morning Vance. How's things going down there?
CAPCOM Oh quiet and smooth.
SC Oh, it's afternoon down there.
CAPCOM Right. We thought maybe it was morning for you.
SC We sort of lost track.
SC Yeah, but I had a good sleep.
CAPCOM Glad to hear it. Doctor just said he wondered how many hours?
SC Oh, let's say whenever I left Jack and Fred came by and we ate for about an hour and then I went to bed so whatever that time was. It must be about 5 hours, something like that. 4 or 5 hours.
CAPCOM Good. Glad to see you catching up.
CAPCOM Aquarius, Houston.
SC Go ahead Vance.

CAPCOM Jim, the next time that it's convenient, could you get the readout of the repress package in the command module for us? Over.
SC Will do.
CAPCOM Okay.
SC When you go back there Fred they want the repress package readout.
CAPCOM We don't want you to wake anyone up to get it.
SC No. No ones asleep now.
SC Pass.
SC Hey, that's a funny thing about this (garble) you can forward tilt it and get a pretty good view of the venting.
SC And Houston, Acquarius. It looks like the service module venting has ceased. At least, momentarily.
CAPCOM Roger. Understand service module venting has ceased momentarily. How about the descent stage? Does Fred reported venting down there? Do you still see that?
SC Stand by.
SC What is your report on descent stage venting — was it venting?
SC Anything else going on.
SC Anymore venting?
SC No.
SC No. Fred hasn't seen anything else from the descent stage. And I understand that we can expect the SCH tank pressure to build up to relieve our about 105 hours.
CAPCOM Roger. A little later than that. Like 106 - 107.
SC Okay.

END OF TAPE

SC Did you get some interior photos?
SC Yea.
SC Good.
SC I would like to show the arrangement of these hydroxide cannisters. You have.
CAPCOM Aquarius, Houston.
SC Did you give Jack any more procedures on the Command Module power up?
SC (garbled)
SC (garbled)
SC The main thing that we have got to think about (garble) is the procedures for LM jettison. Transfer of the LM to CSM mode. LM jettison.
SC (garbled)
SC All you have to do is turn the (garbled) we'll be in that.

END OF TAPE

SC All we have to do is turn the light off in the entrance tunnel we'll be in there.

CSC Houston, Aquarius.

CAPCOM Roger, go ahead, Aquarius.

AQUARIUS We would like permission to turn the bio-med on to get off the hot-mike mode. I don't think we have to be on it now if you have the big dish on do you? Yaw's coming or rolls coming up. We were going to burn.

CAPCOM Rog. Jim. We concur. Go ahead and turn it on.

AQUARIUS Okay, fine, thank you.

CAPCOM One other point, the philosophy on timing this mid course is based a little bit on just before the SHe tank is susposed to vent, in that way, we hope that we have, you would be powered up and you would have control when the venting occurs, in case you were tossed around a little bit. Over.

AQUARIUS Okay, understand. Philosophy on the mid course is doing it prior to venting of the SHe tank which means we'll be doing this around 105 hours, I suppose or 105 30 and so I'll have control of the spacecraft if it should give us some perturbation.

CAPCOM Rog. Then, after that we would establish PTC again.

AQUARIUS Roger.

AQUARIUS Houston, Aquarius.

CAPCOM Go ahead Aquarius.

AQUARIUS Our repress pressure is 820.

CAPCOM Okay, repress pressure is 820, thank you.

PAO This is Apollo Control at 98 hours 49 minutes. ECOM says that repress package pressure is good, it's about where he would expect to see it. He was pleased with that 820 pounds per square inch reading. The repress package consists of three one pound oxygen bottles, in the command module. It's used to quickly repressurize the command module after it has been depressurized. The name repress comes from repressurization. In addition to these three one pound bottles of oxygen in the command module, the surge tank contains an additional three pounds of oxygen for the command module. Flight Director, Jerry Griffin, and his gold team have releived Glenn Lunney and his black team. He has no estimate yet on the time for the change of shift briefing. We'll continue to stand by for live air-ground transmission.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, could you switch your BIOMED switch to the position opposite to where it is now? We are getting a subcarrier, but no data. Over.
SC Now you know, Houston, that I don't have BIOMED on.
CAPCOM Okay. And we have a small addition to the procedure that was read up to you earlier, which involves power transfer from the LM to the CSM.
SC Standby one.
CAPCOM Okay.
SC Okay, Houston, go ahead.
CAPCOM Okay, at the end of the procedure, after the step BATT 5 and 6, OFF add the following: circuit breakers, panels 11 and 16, ascent ECA control both OPEN. Over.
SC Okay, after the step BATT 5 and 6, OFF, step 3 will be circuit breakers panels 11 and 16 ascent ECA control both OPEN.
CAPCOM That's correct, Jim. And this is to guard against a single point failure that - remote possibility that would preclude you from getting the batteries back on.
SC Roger.
CAPCOM Go ahead.
PAO This is Apollo Control at 99 hours, 1 minute. Apollo 13 now is 167 992 nautical miles from Earth. Velocity 4154 feet per second. As you heard on air-ground, we do intend to - play the ignition time for the midcourse correction rather loosely. Basing it on the predicted supercritical helium tank burst disk going as the pressure in that tank rises to the point where it will burst the disk and vent the helium overboard. However, we burned the descent propulsion engine which is pressurized by this helium enough times now that - we have enough helium entrapped in the propellant tanks - known as blowdown capability or ullage capability, for 800 feet per second DELTA-V so there will be no problem in - in loosing the - the remainder of the helium from the helium tank. Based on a prediction of 106 hours at the present time for the helium tank relieving, we would expect to do the burn somewhere around 105-1/2 hours. If the helium tank relieves earlier than predicted, we would do the burn as quickly after that as operationally possible. We'd like to keep - to do the burn within a half an hour of the tank pressure relieving, if possible. This is a non-propulsive venting, but it will probably cause some attitude excursions, and they would like to have the spacecraft powered up with the crew in control of the - Aquarius when the venting occurs. The midcourse correction itself will be a straight forward maneuver, estimated right now that it will be on the order of 7 to 8 feet per second. About a 15 second burn, using

PAO - the descent propulsion system. We'll use the AGS or the secondary guidance system, back up guidance -

END OF TAPE

PAO - For the secondary guidance system — backup guidance system of the Lunar Module for this burn. The AGS takes less power than PGNCS and we would like to hold the power usage down. And this burn is well within the capability of the AGS as far as accuracy. We will probably burn on time rather than velocity acheived. It will be done with the throttle in the minimum position. The Flight Director Jerry Griffin has been taking a status report from his Flight Controllers. The CO2 lithium hydroxide procedure worked out with the hoses and the - the makeshift method to run the cabin air pass the Command Module, lithium hydroxide cannisters appears to be working very well. The CO2 in the cabin is now up to only 2/10 of a - of millimeters of mercury. Based on present usage rates we have enough water to last until an elapsed time of 165 hours 14 minutes. The water rate will go up slightly during - during burns. We expect to use about 7 pounds of water for midcourse. We have enough oxygen to last until an elapsed time of 273 hours 27 minutes, under the present usage rates. And enough electrical power for 209 hours 8 minutes. We calculate we have enough lithium hydroxide for 100 - for 164 hours from now, that is not a GET time, we have enough remaining for 164 hours. All of these consumables are well above what is required for a 142 hours elapsed time landing.

END OF TAPE

PAO This is Apollo Control at 99 hours 17 minutes, Flight Director Glynn Lunney has left the Control Center for the Building 1 Auditorium and the News Conference. I repeat, Flight Director Glynn Lunney is on his way to the MSC Auditorium for the Change of Shift News Conference.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC Okay. We just (garble)
CAPCOM Stand by, Jim. The COMM's no good here right now.
SC Houston. Aquarius how do you read now?
CAPCOM Go ahead. Loud and clear.
SC Okay. We just had a battery warning master alarm. It looks like it's battery 2.
CAPCOM Roger.
CAPCOM Roger, Houston. This is Houston. Would you close the power amp circuit breaker and we'll get some high bit rate?
SC Roger.
SC It's closed.
CAPCOM And we need high bit rate.
SC Garble
CAPCOM Roger. And want to open the valve (garble) panel 16. Over.
SC Say again.
CAPCOM Open the val load cross tie breaker on panel 16. Over.
SC Open balance load cross tie breaker on 16. Roger.
CAPCOM That's affirmed.
SC It's open.
SC If you're getting high bit data we could do an off reset and get back on on battery 2. We're standing by for that.

END OF TAPE

SC (Garble).
SC Longer.
CAPCOM Okay, could you turn off battery 2 and leave it off and let us look at it?
SC Say again. You want us to turn off battery 2, leave it off until you look at it?
CAPCOM That's affirmative.
SC Okay, battery 2 coming off the line.
CAPCOM Okay, Aquarius, so you want to stay in this configuration for awhile and let us look at the battery.
SC Roger, we'll stay in this configuration.
CAPCOM Want to close the bal loads circuit breaker back now.
CAPCOM 13, Houston, we want to close the bal loads circuit breaker on panel 16 now, again.
SC We have it closed; the balance loads circuit breaker is closed.
CAPCOM Roger.
CAPCOM Aquarius, Houston. Request range function switch to range split.
SC All right. Range function switch going to RANGE.
CAPCOM Righto.
CAPCOM Aquarius, Houston.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, on the battery problem, we have determined that it is not overcurrent or reverse current; we suspect it's over TEMP; but don't know for sure, so we're going to watch it for awhile.
SC Okay.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, Charlie has some procedures to read up for you here; I think you'll need your activiation checklist, if it's handy.
CAPCOM Aquarius, that's the contingency checklist.
SC Okay, got it.
SC Okay, standby Charlie.
SC Okay, Charlie, I've got the contingency check-list, and standing by.
CAPCOM Okay, Jim, we'd like you to turn to page — page 24 which is the 30 minute activation, and this is going to be a procedure for the midcourse burn that we got coming up at 105 with the AGS up. Over.
SC Roger, on the midcourse at 105, got them on page 24.
CAPCOM Okay, 30 minute activation; omit steps 1, 2, and 3; perform step 4; RCS system AB/2. Over.
SC Roger, omit steps 1, 2, and 3; perform step 4.

CAPCOM Roger, and on the EPS activation, same page; perform step 1, and in step 2 perform line number - line number 6; EPS display close. Over.

SC Okay, on EPS activation perform step 1, and perform step 2, line 6 only, is that correct?

CAPCOM That's affirmative, Jim. The rest of the stuff is already closed at this time, so that's all we'll have to do is close the EPS display breaker.

SC Okay.

CAPCOM All right. Turn to page 25; on page 25 omit step 3, perform step 4; on step 4, last line, scratch CB16 EPS inverter 2, closed. Over.

SC Roger, omit step 3, perform step 4, except for the last line. Circuit breaker 16 EPS inverter 2 closed.

CAPCOM Roger. That's correct. On step 5 perform step 5; under primary glycol loop activation, step 1, line 1, CB16 ECS display, closed. That's a crew option, you can have it if you want to; omit the rest of step 1 and step 2. Perform step 3. Over.

SC Okay, on primary glycol loop activation; crew option on step 1, first line; the rest of it we'll omit. Step 2 we'll omit, and we'll do step 3.

CAPCOM That's affirmative, Jim, with -

END OF TAPE

SC - step 2 little bit and we'll do step 3.

CAPCOM That's affirmative, Jim, with the following DELTA's on step 3 and if you will turn to page 26, I'll give your the DELTA's on the activation circuit breaker list. Over.

SC Okay. I'm there.

CAPCOM Rodg. On line 1, correction row 1 under AC Bus A tape recorder should be open, decker gimbal open. All the other ones as shown on the page. Over.

SC Okay. On row 1 AC Bus A tape recorder and decker gimbal will be open. All the rest as shown.

CAPCOM Roger. We don't know the status of your windows. If you - during this burn we are going to have to look out the forward window to get the alignment with the COAS so you might need the commander window heater and you can, of course, use that breaker if needed, since we do have the AC power. On row 2 go ahead. Over.

SC I don't think we will need it, Charlie.

CAPCOM Okay. Fine, Jim. On row 2 under RCS system A ascent feeds 2 and ascent feed 1 should be open. Under flight displays, mission timer should be open. Gasta open, ordeal open. Under AC Bus A gasta open. The rest are as shown on the page. Over.

SC Okay. On row 2 we are going to open up ascent feed 2 and ascent feed 1 under RCS system A. We're going to open up the mission timer and flight displays the gasta and the ordeal and the AC Bus A the gasta.

CAPCOM That's affirmative. Okay. Row 3 under propellant descent helium reg vent should be open under heaters rendezvous radar stand by open, landing radar open. Under staff control ACCA PGNCS open, under ED and lighting all four open. Over.

SC Okay. Row 3 under propellant propulsion the descent helium reg vent will be open, the stand by rendezvous heater will be open and the landing radar heater circuit breaker will be open. I just changed antennas and keep it on down the line, ACCA PGNCS will be open and the last four circuit breakers, two under ED and two under lighting will be open.

CAPCOM That's affirmative. Okay row 4 under ECS, glycol pump auto transfer closed. Under COMM updata link open. VHF B and VHF A should be open. Under PGNCS LGC DSKY open, Imu operate open. Over.

SC Okay. Under row 4 the auto transfer will be closed. Updata link open. VHF A and B open. DSKY open and IMU operate open.

CAPCOM That's affirm. On the last row the only DELTA is under the cross tie bus and it should be open. Over.

SC Say it again, Charlie.

CAPCOM Okay. Under the last row, under EPS is the only DELTA and that is under the cross tie bus and it go open. Over.

SC Under the cross tie bus, we should go open.

CAPCOM That's affirm. Going on to page 27, Activation, panel 16. Under RCS system BRAVO, ascent feed 1, ascent feed 2 should be open. Under propulsion PUGS should be open

END OF TAPE

CAPCOM - under propulsion, PUGS should be OPEN. Ascent helium reg, OPEN. Over.

SC Okay, line 1. On panel 16, ascent feed 1 and 2 will be open. And the PUG will be OPEN and ascent helium reg. will be OPEN.

CAPCOM That's affirmative. On the next three rows we've only got the nine deltas so I'll go through the next three rows completely and then you can read those back. Under lighting,

SC Okay.

CAPCOM Under lighting, flood open. Track open. Under ED logic, correction on the ED, logic open. Under staff control, decent engine override, open. Under ECS, suit flow control open. Under row three, COMM display open. VHF A transmitter open. VHF B receiver open. Under ECS, display that's crew option. Last row, under EPS inverter 2, open. Over.

SC Okay. On the last three rows we have flood and track circuit breakers row 2 open. Logic power B open. Descent engine override, open. Suit flow control, open. On the third row, COMM display open. VHF A — VHF A transmitter open. VHF B receiver open. And under ECS we have display open at crw's option. And the last one, inverter 2, under EPS, will be open.

CAPCOM Roger. That's a good read back. Under that ECS display, it shows it closed. If with it closed you can have some readout of onboard readout of your ECS system - draws a lot less and a half amp so it's up to you whether you want it or not. Okay on page 28.

SC Rog.

CAPCOM On page 28, step perform step 4 with the following changes in the warning lights status. Under the warning lights you will probably - you will have ascent pressure and an LGC light. Scratch RCS A and RCS B reg. Under caution lights, you'll have a preamps light. Over.

SC Rog. Under warning, we'll have ascent pressure and LGC and the caution will have a preamp.

CAPCOM Affirmative. Under VHF/S band activation in checkout scratch step 1. Under step 2, change downvoice backup to voice. Scratch step 3 under PGNS turnon, scratch the entire procedure. Under DAP set gimbal drive, scratch the entire procedure. Over.

SC Okay. Under VHF S band activation in checkout scratch step 1. Do step 2 with the following change, downvoice backup to voice. Scratch step 3. Scratch the entire remaining events of that page. Over.

CAPCOM That's affirmative Jim. Go on to

CAPCOM - page 29. We've got at this point there's a write in required. It's about a six or seven liner and I'll try to go fairly slowly and let you write it down if you're ready to copy. Over.

SC Ready to copy.

CAPCOM Okay. At this point, we'd like you to verify RCS heaters in AUTO for 15 minutes.

SC Is that the first step Charlie?

CAPCOM That's affirmative. What we're trying - -

END OF TAPE

CAPCOM - (garble) minutes.
CAPCOM I want -
SC Is that the first step, Charlie?
CAPCOM That's affirmative. What we're trying to do here, is we're getting you setup in an attitude, so you can damp your rates and come out of PTC; and this is the configuration I'm reading you now, the next - and the next 6 lines, the procedure for getting you into a configuration to damp the rates, and stop PTC. Over.
SC Okay, for the first, the thing will be to - get her to AUTO on the RCS system A and B?
CAPCOM It's the varify that the heaters have been in AUTO for 15 minutes. Back on the first page of this procedure you put the heaters in AUTO, and you pushed the breakers in, and we'd like for them to warm up the quads for 15 minutes before we start to stop at - stopping PTC. Over.
SC Roger, varify heaters RCS, ON for 15 minutes.
CAPCOM Okay, step 2. Balance couple, OFF; DEADBAND, MINIMUM; attitude control; pitch and roll to PULSE; yaw to DIRECT; mode control AGS at HOLD; guidance control to AGS; damp rates pitch and roll with the TTCA; yaw with the ACA with the Earth in the front window. Over.
SC Okay, let's see if I got it. Step 2 is balance couples, OFF; DEADBAND, MIN; attitude control pitch and yaw at PULSE; yaw, DIRECT. Mode control will be in AGS at HOLD; guidance control will be in AGS; we'll damp the rates pitch and roll with the TTCA; and the yaw with the ACA; and we'll probably have to have some reference point, so I have to try and stop on the Earth. Over.
CAPCOM Roger, Jim. We were hoping that in your PTC that you occasionally see the Earth coming through the window, and if that's true, then we'd like you to have to - just damp the rates with the Earth in the forward window. And then we'll give you the burn attitude, via the forward window, on the Earth, momentarily. Over.
SC Roger.
CAPCOM Okay, that was the entire procedure for damping the rates, only - though I only gave you, said it was step 2; that was the entire procedure. Now, continuing on to what's printed on page 29; correction, you had one error in the readback under attitude control; it was pitch and roll to PULSE; yaw to DIRECT. Continuing on, on page 29 with the printed procedure; the first four lines, scratch. Step 3; scratch. Under AGS activation; one change, add a step: first step will be varify ASA CB16 in for 10 minutes. The rest of the AGS activation is as printed. Over.
SC Okay, varify ASA circuit breaker 16 in for 10 minutes; and I take it 10 minutes back in our procedures we'll have a note saying to put that in.

CAPCOM It's - the circuit breaker goes in on the circuit breaker activation page, Jim. So, by the time we get here and have the rates all damped we feel that — that the EPIPA's will be up to temperature by this time, and we can go ahead and turn it - turn the AGS on, at this time. Over. But we just want you to varify that.

SC Okay, and one other question, Charlie — I'd like to know if the note you gave me about damping the rates is before the other information on page 29?

CAPCOM That's affirmative. Add that into the top -

END OF TAPE

SC arrange is before the other information on page 29.

CAPCOM That's affirmative. Add that into the top of the page. What we are really doing - let's put it in to write before the AGS activation. The other procedure on the top of the page belongs with the DAP set gimbal trim and we're just omitting all of that procedure. So the addition on the damping the right should really go in right before the AGS activation. Over.

SC Understand.

CAPCOM What we are really trying to do is get you in a posture so that when you see the earth come through the window, you can damper out and hold the earth in the window. Proceeding on to the rest of page 29 under RCS press, scratch the entire 3 steps as printed. On page 30 scratch step 4 under the RCS press. Over.

SC Roger. Under AGS activation I included that step on the ASA circuit breaker and will do step 1 and 2 other AGS activation, but then we will scratch steps 1, 2 and 3 in the RCS press and on page 30 we will scratch step 4.

CAPCOM Affirm. Under DEPS press, step 1, line 1 scratch. Line 4 descent helium rig 1 talk back barber pole. Under step 2 scratch, step 3 scratch, landing gear deployed, scratch. Over.

SC Okay. Under DIPS press we'll scratch the first line and we'll have the descent helium rig gone back to barber pole. We'll scratch steps 2 and 3 and we'll scratch the landing gear deployed.

CAPCOM Roger. Now we got on the back of page 30, Jim, you've got a blank page on your checklist or should have and we'd like to add a procedure to get you to burn attitude. Over

SC Okay. A procedure to get the burn attitude.

CAPCOM Okay. First statement is a statement verify AGS and operate for 5 minutes. Then we go to AGS address 400 plus 5, then 400 plus zero. Attitude control PITCH and ROLL to PULSE. YAW mode control. Maneuver using TTCA PITCH and ROLL. The computer is controling YAW but you can override with ACA. You with me? Over.

SC Okay, Charlie. I'm with you so far.

CAPCOM Okay, Jim. When in attitude ACA out of detent to zero air needles. Then set event timer and we'll give you a countdown on that when you get to that step. Over.

SC Okay. When in attitude ACA out of detent to no needles, and set DET.

CAPCOM Roger. Now the burn attitude will be coming up on a pad but basically we are looking for a local horizontal retrograde burn which means that using a COAS if you put the horizontal line on the COAS on the horns of the earth and then ROLL to place the X-Axis in the direction of the sun, that will put us in both burn attitude and you can check that -

END OF TAPE

CAPCOM - we'll - that will put us in both burn attitude and you can check that via the sun which will be in the AOT detent 2. Should lie right along the cursor at the top. We'll have some more words on that for you momentarily. Now, I'd like to go on to page 31 if you're ready. Over.

SC Okay. I figure - I have a handle on the attitude of - the way the earth should look in the COAS and you're going to give me some words of what the sun would look like in the AOT. Is that right?

CAPCOM That's affirmative, Jim. We haven't got a picture of it yet. It's going to be in the top part of the COAS - correction, top part of the AOT at the top of the - the top of detent 2 and the top part of the AOT and it should in attitude if you're right on the sun should split the cursor though that roll angle is not too critical if we're in about 10 degrees, we'll be okay. We — but I think, we think you should be able to get it better than that. On page 31, under the DPS burn technique, you can scratch the bottom part below the little diagram there since the gimbal is locked. Over.

SC Understand scratch the bottom part underneath the diagram because the gimbal is locked.

CAPCOM That's affirmative and since the gimbal was trimmed out, at the big burn yesterday, we should be still through the CG and we'd like to make sure that Jack sits in the same place for this burn that he did yesterday and in that way we'll - you should have no trouble controlling attitude. Now I'm ready to go over to page 32. Over.

SC Okay. Let me see if I have that right. Now you want Jack to sit in the same attitude so that the gimbals are the same place and you don't have trouble controlling attitude. I got it.

CAPCOM Okay. Now page 32. Top of the page. First line, scratch VERB 76. Third line, mode control AGS at hold. At minus 6 minutes, scratch line 1, 2 and at burn attitude scratch VERB 40 NOUN 20. Scratch line 2, 3 and 4. Now at burn attitude, we want you to do a 400 plus 5 and then a Vert - a 400 plus 0. And we have a caution note at this point. Over.

SC Go ahead.

CAPCOM Okay. The caution is after 400 plus 0, do not go out of detent on ACA again. Over.

SC Okay. After the last 400 plus 0, do not go out of detent with ACA. Is that correct?

CAPCOM That's a rog, Jim. What happens is of course we said that when you go out of detent, you

CAPCOM - reset the AGS ATT needles and you and you loose your attitude reference. You establish a new attitude reference and it might not be the burn attitude since at the point we're controlling attitude with the TTCA. Now picking up with the VERB 37 ENTER, scratch. Scratch everything down to the 404 plus 0 and we want you to perform those AGS steps with 404 down through 470. Over.

SC Okay. Now we'll scratch everything down to 404 plus 0 and we'll perform those four steps.

CAPCOM Rog. Turning over to page 33. Minus 4 minutes. Okay. Moving down the page, it's about line 7 to engine and gimbal. Engine gimbal OFF; down to mode control. Make that read, mode control AGS at - -

END OF TAPE

CAPCOM - Make that read MODE control AGS ATT hold and then scratch propellant quantity monitor descent 1. Over.

SC Okay, in 4 minutes engine GIMBAL will be OFF. MODE control will be to AGS ATT hold, propellant quantity monitor descent 1 scratch.

CAPCOM Rog. Picking up in minus 1 minute. Scratch master arm ON. Minus 35 seconds. Scratch first 2 lines. At minus 10 seconds, change that to minus 9 seconds, so at minus 9 seconds, it will be manual ullage. At 2 seconds, scratch CMC MODE free and scratch ACA out of detent. At - After ignition at plus 1 second terminate ullage. Are you with me, over.

SC Okay, and in 1 minute master arm we scratch. At 35 seconds scratch the first 2 lines. Manual ullage will start at 9 seconds, we scratch the MODE in 02 seconds and the line beneath that at plus 1 second we terminate ullage.

CAPCOM That's affirm. Pick it up at plus 5 seconds. Scratch the rest of the page. TTCA attitude control and master arm OFF. Over.

SC Scratch the remainder of the page.

CAPCOM Okay, we would like to verify that under the 35 seconds the minus 35 seconds the only thing you have remaining is engine arm to descent. Over.

SC That's affirm, that's the only thing I have.

CAPCOM Okay, turn it to the next page and the last page, Jim - 34. Top of the page monitor DELTA-VX via 470. Scratch next 2 lines when propellant quantity equals 37 and the descent helim REG. Scratch TTCA Commander, reduce to 10 percent. Now we want you to add a line, shut - it's a shutdown criteria shutdown on burn time minus 1 second. Over.

SC Okay, the shutdown is on burn time minus 1 second. Let me give you an example - if we have a 30 second burn we are going to shutdown at 29 seconds, is that correct?

CAPCOM That's affirmative. We'll give you the PAD - it will be coming up here from FIDO in a couple of hours, and I guess we stabalize out on our tracking, the reason for if you're ready to copy out a couple of more steps here and then I will explain the reason we want to shutdown on this burn time minus 1 second. Pick it up on when DELTA-VX - when DELTA-VX equaled the final DELTA-VX, scratch that line. Scratch attitude control YAW to PULSE. Add - correction, scratch damp excessive rates via LM YZ translation and add at that point null arrow needles. Trim address 470 to 1/10 foot per second. Over.

SC Okay, going through. After we shutdown minus 1 second, we scratch the next line and we scratch attitude control YAW to PULSE, we scratch damp excessive rates via LM YZ translation, we add the line null arrow needles, trim - Null the arrow needles and trim address 470 to what was the value there Charlie?

CAPCOM .1 foot per second. The reason we are shutting down on burn time is since the ASA breaker has been out for so long we're not real confident that our AGS PIPPA's are - -

END OF TAPE

CAPCOM - the ASA breaker has been out for so long, we're not real confident that our AGS PIPPA's are going to be super short. So we want to make sure that we just get a burn - time, no overburn; so we're shutting down on burn time minus 1 second. And then that will allow us a plus X translation to trim 470 if it looks okay. If we had a over burn, we'd be in -

SC Okay.

CAPCOM - if we had an overburn we'd be impinging on our command module to try to trim it out, so that's our reasoning there. Over.

SC Okay, understand.

CAPCOM Okay, picking up in the middle of the page, that - a block CSM resume attitude control; scratch. Scratch the next line; probe VERB 96. Scratch the third line; propellant quantity monitor, OFF. Over.

SC Okay, we'll scratch the blocks, and we'll scratch the probe VERB 96; then we'll scratch propellant quantity monitor, OFF.

CAPCOM Roger. And at the bottom of that page, I have a procedure for you to reestablish PTC. Over.

SC To reestablish PTC. Go ahead.

CAPCOM Okay, first line - attitude control 3 to PULSE; line 2, roll with the TTCA until attitude is roll plus or minus 90; pitch 0; yaw 0. Over.

SC Okay, set one attitude control 3 to PULSE; 2, roll with the TTCA (static) pitch is 0 and yaw is 0, and I think that's because the AGS (garble).

CAPCOM That's affirm, Jim. You broke up there for a minute, Jim. We'll do that on the AGS ball from the burn attitude we just want you to roll either way 90 degrees, keep pitch 0 and yaw 0. Now, step 3; when at - when at attitude ACA out of detent. Step 4; attitude control yaw to MODE CONTROL; when rates are less than 0.05 attitude control yaw to PULSE.

SC Okay, Charlie. Can you hold up here a second, I'll log 2.

CAPCOM Roger.

SC I'll start with step 3, again, when attitude — when at attitude ACA out of detent.

CAPCOM That's Roger. Next step 4; attitude control to YAW; correction, attitude control yaw to MODE CONTROL. Over.

SC Okay, step 4 is attitude control yaw to MODE CONTROL.

CAPCOM Roger, step 5; when rates are less than 0.05 degrees per second; attitude control yaw to PULSE.

SC Okay, when rates are less than 0.05 degrees per second attitude control yaw to PULSE.

CAPCOM Roger. Step 6. Spin up to 3/10ths degree

CAPCOM - per second in YAW. And that takes about 21 pulses. Step 7; -
CAPCOM - Yes.
SC Okay, go ahead.
CAPCOM Okay, step 7; mode control AGS; OFF.
SC Okay, step 6 was spin up to 0.3 degrees per second in YAW; that's about 21 pulses. Step 7 was mode control AGS to OFF.
CAPCOM That's affirm. Step 8; power down per -

END OF TAPE

CAPCOM That's affirmed. Step 8. Power down per power - correction. Power down per contingency checklist page power 5. Over.

SC Okay. As (garble) power down per contingency checklist. Power 5 and I take it that's been revamped considering our situation. Over.

CAPCOM That's affirmative, Jim. That's the one we gave you last night after the big burn and we'll use that one as modified by - by us. This - we tried this PTC under AGS in the simulator and of course no slosh or anything but it seemed to work pretty good by nulling the rates using the TTCA in pitch and roll and letting the AGS do it in yaw. You'll null the rates by looking at the arrow needles and just watching those and when they don't when they stop moving and you've got it within the limits of what we want. Over.

SC Okay. And I guess Charlie you have no - you haven't had hold mode in pitch and roll at all in this configuration we're in or do we have to use the TTCA?

CAPCOM We feel like we have to use the TTCA. The AGS gains are not too good in pitch and roll in this configuration. It'll hold it in yaw but it won't in pitch and roll. Over.

SC Okay.

CAPCOM And you'll have - during the burn of course you'll be controlling pitch and roll via the arrow needles with the TTCA also and it's the little scheme that we've practiced in some of the sims. Over.

SC Right. Understand.

SC And Houston, want to make sure that we allow enough time to get to the proper attitude for the burn so that we can be sure we have established the proper attitude and don't have to rust the burn.

CAPCOM Rog, Jim. We're looking right now tentatively at starting this about 45 minutes before the burn and our sensitivity is off - not too bad on this burn we can go 30 minutes either way and not affect our DELTA V. Over.

SC Okay. Fine. And do you have a handle on just how long the burn will be?

SC In times.

CAPCOM It's looking like it about 7.8 seconds and about 15 - correction 7.8 feet per second and about 15 seconds. Over.

SC In about 18 seconds?

CAPCOM Negative. 15. 1 5.

SC 1 5. Okay.

CAPCOM And one other point is it - we'd like to remind you that this is going to be in blow down and both regs be closed but we've got plenty at the 10 percent.

SC Understand.

CAPCOM And Jim in the simulator, with our configuration that we had here the thing is real stable at 10 percent so we don't think you'll have to twig very much at all using the TTCA's. Over.

SC Okay. Understand.

CAPCOM And I'll give you back Vance. Thank you.

SC And thank you.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Jim, regarding your 2 battery we think that it's probably a sensor failure, a temperature sensor failure that's caused this alarm rather than an actual over temp of the battery. The reason being that we haven't seen any higher temperatures in the GLYCOL loop. We expect to put the battery back on about 101 hours. That'll be about 10 minutes and then we'll look at it some more there. Over.

SC Okay. Considering number 2 battery you think it might be a sensor failure because you haven't seen any changes and you're going to put the battery back on the line in about 10 minutes.

CAPCOM That's affirmed.

SC Okay.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC For information Vance, oh about a half hour ago, I guess Jack and I couldn't see constalations at certain spacecraft attitudes stars, we could see Scorpio and Sagittarius and we could see Adria or Acrux and Alpha Centura (garble) stars of that magnitude and our venting has stopped which allows us now to differentiate between the particles and the stars.
CAPCOM Roger, copy understand. You can see the stars pretty well. Were you at that time in an attitude facing away from the Sun, I presume this is very attitude critical.
SC Yea it is somewhat, Vance. If we have the Sun shining off the quads it sort of ruins our vision and also the Earth and the Moon are in the general field of view and we can't see anything.
CAPCOM Okay, thank you.
CAPCOM Aquarius, Houston.
SC Go ahead, Vance.
CAPCOM Jim, we're ready to put that battery back on the line. Request you open the cross tie bal LOAD circuit breaker panel 16 and then put back BAT 2 back on the line.
SC Okay, first of all we will open the balance quad tie breaker and then we will proceed.
CAPCOM That's affirm.
SC Okay, the cross tie balance load circuit breaker is now Vance. Now you want us to put battery 2 back on, is that affirm?
CAPCOM Did you say it was in, or did you pull it out?
SC No, it's in, do you want it out?
CAPCOM That's affirm, we'd like it out and then BAT 2 on the line.
SC Okay, coming up.
SC BAT 2 is on the line.
SC We have a master alarm and a battery light.
CAPCOM Copy. And we think that's probably an indication of the sensor problem, but stand by.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, it looks to us like your battery is good, that this is in fact a sensor problem, therefore, I request you close the cross tie bal LOAD on circuit breaker on panel 16 advise.

SC Okay -
CAPCOM Advise that you will not have any malfunction indication on any of your batteries now, but we can watch it from the ground. Over.
SC Okay, we'll close the cross tie bal LOAD circuit breaker at this time.
CAPCOM Roger, copy.
SC That's closed and we don't have any warning on any of the batteries, but you can monitor from the ground.
CAPCOM That's affirm.
CAPCOM And Jim we have a lengthy procedure here for powering up the CSM and turning on instrumentation so we can check the TM and this will take a large peice of scratch paper whenever your ready to copy
SC This is to power up the CSM.
CAPCOM That's affirm.
SC Okay, I'll tell you what, I'll have Jack get the figures, he can copy that down and - I'll we'll get the stuff. Stand by.
CAPCOM Okay.
SC Okay, Vance how do you read the Aquarius.
CAPCOM Okay, read you loud and clear, Aquarius. Is it cool in there now?
SC Okay, yea, it's pretty cool. This is the third officer on this LM crew here. Ready to copy.
CAPCOM Okay. Jack, this is a lengthy procedure take probably 2 or 3 pages it assumes that you are in your nominal configuration, which was - or in your day flying configuration, which was sent up to you earlier today.
SC Okay, I can verify that we are in that configuration, except for panel 382 the water accumulator, which I have left off in case we wanted to get some more drinking water out of the Command Module and I'll - -

END OF TAPE

SC - get some more drinking water out of the command module and I'll get - put those in their proper configuration before we do anything -

CAPCOM Okay, ready to copy.

SC Okay, go ahead.

CAPCOM Okay, panel 4; TEL COMM group 1 to AC1. Panel 5; close the following cirbuit breakers: ECS PRESS group 1 MAIN B; ECS PRESS group 2 MAIN B; ECS TEMP, MAIN B; ECS secondary loop transducer, MAIN B; ECS RAD control heaters, MAIN B; BATT RELAY BUS, BATT B. BATT CHARGER BATT B, CHARGE - or to B, CHARGE. Inverter control 2; inverter control 1; EPS sensor signal AC1; EPS sensor signal MAIN B; EPS sensor unit AC BUS 1. Waste and potable water, MAIN B. Instruments ESS MAIN B; that's essential MAIN B. Are you with me?

SC Okay, Vance. Are you with me?

CAPCOM Roger, why don't you read that group back and then we'll proceed on.

SC Okay, sounds good. Cause I don't know where I - how far I lost you. Okay, panel 4; TELE COMM group 1 to AC1. On panel 5, close the following circuit breakers: ECS pressure group 1, MAIN B; ECS pressure group 2; MAIN B; ECS TEMP, MAIN B; ECS secondary loop transducer, MAIN B; ECS RAD control heaters, MAIN B; BATT relay BUS, BATT B; BATT charger, BATT B; inverter control 2; inverter control 1; EPS sensor signal, AC1; EPS sensor signal, MAIN B; EPS sensor unit AC1, waste and potable H2O, MAIN B. Instrumentation essential, MAIN B.

CAPCOM Okay, that's all correct, is that reading rate okay for you?

SC Yes, that's fine.

CAPCOM Okay, and leave a little space if you can to the right of these because when we talk about the backup procedure, why then we can just use the same listing, and I'll - I'll tell you open instead of close these circuit breakers, or at least, most of them. Over.

SC Okay.

CAPCOM Okay, next panel 3; transponder, PRIMARY; power amp to PRIMARY, that's a verify; power amp, HIGH; mode voice to OFF; power SCE to NORMAL; PMP to NORMAL; S-BAND antenna OMNI D; that's Delta. Okay, why don't you read that one back.

SC Okay, on panel 3; transponder to PRIMARY; power amplifier to PRIMARY; power amp, HIGH; mode voice to OFF; power SCE to NORMAL; PMP to NORMAL; S-BAND antenna OMNI D; D as in Doggy.

CAPCOM Hey, very good. Okay, panel 225; circuit breaker flight BUS MAIN B -

END OF TAPE

CAPCOM Panel 225. Circuit breaker flight bus Main B to close. Circuit breaker CTE Main B, to close. Panel 250 CB BAT C BAT charger/EDS 2 to close.

SC Hey, Vance, just a minute slow down would you?

CAPCOM Okay.

SC Okay, I got distracted here and on panel 225 CB flight Bus Main B close and then I lost you after that.

CAPCOM Okay. After that CB - CTE Main B, to close. Next Panel 250 CB BAT C BAT charge slash EDS 2 to close. CB BAT C power entry post landing to close. Next panel 275, CB Main B BAT Bus B to close CB inverter power 2 Main B to close. Okay. Incidentlly anything that I've given you up to now is not sequenced critical. But from now on this should be - you should be sure to do it in the sequence we give you. Why don't you read that back, Jack.

SC Okay, let me give you all of panel 225 again, CB flight Bus Main B close CB CTE Main B closed On panel 250, CB BAT - B BAT charge, that should be BAT C - Charlie, isn't it BAT charge EDS 2 closed?

CAPCOM That's right.

SC CB BAT B power entery.

CAPCOM Okay, that should be BAT Charlie.

SC Let me finish. Okay, that's what I thought BAT Charlie BAT charge EDS 2 close BAT Baker power entry and post landing closed and panel 275 CB Main B BAT B closed. CB inverter power 2 Main B closed.

CAPCOM Okay, that's correct except for the second circuit breaker on panel 250 which is CB BAT Charlie power entry slash post landing close.

SC Okay, BAT Charlie power entry and post landing.

CAPCOM Okay, now back to panel 250. CB BAT BRAVO power entry post landing closed. Next MDC 3 AC inverter 2 to Main B. AC inverter 2 AC Bus 1 on up. Next panel 5 AC inverter AC Bus 1 to reset and then center panel 3. Up TLM to command reset vent OFF and then select best omni. Read back, please.

SC Okay, Vance. The following steps for sequence critical. Panel 250. CB BAT B power entry post landing closed. That's BAT BAKER. MDC 3 AC inverter 2 to Main B. AC inverter 2 AC 1 on. (garbled)

CAPCOM How do you read now, Jack?

SC Okay, Vance, did you - how far did you copy - did you copy any of my (garble) there?

CAPCOM Okay, I heard you through AC inverter 2 AC Bus 1 to ON and you were cut out by the noise. Okay, go ahead.

SC Okay. Now comes the one that I didn't understand you. Did you say go over to MDC 5 and AC inverter AC Bus 1 reset that center. And then back to MDC 3 up telemetry command reset then off and then select best omni

CAPCOM Roger, the reset is correct and let me recheck this, stand by. Jack, we were incorrect on panel 5, that should have been panel 3.

SC Okay, that's good. I got it.

CAPCOM Okay, now when you are in this configure-tion the following onboard read outs are required. Panel 3 BAT C voltage, PYRO BAT A voltage, PYRO BAT B voltage. SPS helium pressure and the following readouts on Panel 101. CMRCS injector temperatures. Those are positions 5 Charlie, 5 Delta, 6 Alpha, 6 Bravo, 6 Charlie, 6 Delta and the battery manifold pressure, which is 4 Alpha. And standing by to read back.

SC Okay, youu want me to read back on MDC 3 BAT B voltage, PYRO A voltage, PYRO B voltage SPS helium pressure on Panel 101 Command Module RCS injector temperaturee 5 Charlie, 5 Dog, 6 Alpha, 6 Baker, 6 Charlie, 6 Dog. The battery manifold pressure 4 Alpha.

CAPCOM Okay, now that was correct but I want to recheck the very first one, that was BAT Charlie, voltage, is that what you read back?

SC Okay, BAT Charlie, voltage. Seems like we're having a difference - I can't understand BAT Charlie from BAT Dog.

CAPCOM Okay, now that is the complete procedure for getting into it as far as getting into it is concerned. What I will give you now is how to back out of it after you're through with your readings. Are you ready to copy?

SC Okay.

CAPCOM Okay, now you'll back out fairly quickly after you go into this procedure. All we will need is about 5 minutes of TM and so if you are ready to copy here it comes.

SC Go ahead.

CAPCOM Panel 3 power amp to OFF. Incidentally, copy this down on a peice of scratch paper as I read it and then later I will refer back to your first list where you can write things in the right hand margin.

SC Okay.

CAPCOM Okay -

SC Go ahead. You want - Repeat the one on panel 3 again, Vance.

CAPCOM Okay, Power amp OFF.

SC Okay, go ahead

CAPCOM Transponder OFF. AC inverter 2 to OFF
Okay next Panel 25- -

END OF TAPE

CAPCOM Okay, next panel 250, CB BATT Bravo; power entry post landing to OPEN; standby one.

CAPCOM Okay, Jack. What I just gave you now on the back out is the only thing that's order critical. From here on, you can go to the steps for initiating the procedure, and back track, in other words, you should go to each of the panels that I read up, and put the circuit breakers back to the baseline configuration, or the switches. Over.

SC Okay. Okay, here's - Jack says - here's the sequence critical step; power amp, OFF; transponder, OFF; AC inverter 2, OFF; and the last one on panel 250; CB BATT Baker power entry in post landing, OPEN; and then hit the steps in reverse order that you gave them to me, and back out, like then, I wouldn't start on - FEC 3 up telemetry - to OFF; and then AC inverter - AC1 BUS 1 to OFF; and the AC inverter 2 to OFF; AC inverter 2 MAIN B to OFF; is that the type of order that you want to back out of?

CAPCOM That's affirm, but - just for kicks let's go through these panels again, and I'll give you the - the position, just to make sure there can be no doubt.

SC Okay, go ahead.

CAPCOM Okay, and once again, in the - in the area where I said order was not critical, it's still not critical when you back out. But now I'll go ahead. Okay, panel 4; TEL COMM group 1; AC1 - will not be AC1 it'll go to OFF. Panel 5; all circuit breakers on that panel, which were positioned will now come to OPEN. Over.

SC Okay, panel 4; TELE COMM group 1 will go OFF; panel 5, all the circuit breakers that we've closed will go back to OPEN.

CAPCOM Okay. Panel 3. The first three lines have been taken care of already in my beginning in the back out procedure, so starting with: mode voice, that should go back to VOICE. Power SCE, OFF; PMP, OFF; S-BAND antenna OMNI Bravo; panel 225; CB flight BUS MAIN B, OPEN; CB CTE MAIN B; OPEN. Readback.

SC Okay, Vance. That's when I had to switch OMNI's because I'm trying to get this data here.

CAPCOM Okay.

SC Okay, how do you reading on AFT OMNI?

CAPCOM Loud and clear.

SC Okay, on panel 3; the first three zips we took care of; mode voice to VOICE; power CE, OFF; power - PMP to OFF; and S-BAND OMNI would go back to Bravo. Panel 225; flight BUS MAIN B will go OPEN; and CB CTE MAIN B will go OPEN.

CAPCOM That's affirm. The two circuit breakers on panel 250 will go OPEN; the two circuit breakers panel 275 will go OPEN. Okay, the circuit breaker on panel 250 we took care of already. Panel 3; AC inverter 2 we took care

CAPCOM - of. AC inverter 2; AC BUS 1 should now go OFF. And, the remaining two switches on panel 3 we took care of. And, select as to OMNI (garble). Okay, readback.

SC Okay, the two switch - two circuit breakers on panel 250 will go back to OPEN; two circuit breakers on panel 275 back to OPEN; the power entry and postlanding circuit breaker we took care of earlier; AC inverter 2; we took care of earlier; AC inverter 2 to AC BUS 1 will go to OFF, the AC inverter - AC BUS 1 - we took care of - no, that will go to OFF; and up telemetry command reset will go OFF.

CAPCOM That's correct, Jack. Okay, that's it. And, I think we're about ready to go with this procedure whenever you are.

SC Okay, first we got to go through that procedure to power the CSM from the LM, is that Charlie?

CAPCOM No, no, this is independent of power from the LM. this is a - this is purely a CSM -

SC Oh, okay.

CAPCOM - this is purely a CSM power up, so we can take a look at your telemetry and see how cold the vehicle is, and that sort of thing.

SC Okay, it's going in work.

SC Okay, now I won't - I won't have any voice with you, so - Is that right? You don't want me to get connected up - You want me to just take these readings and come back and tell you what I have, huh?

CAPCOM That's affirm, there'll be no voice. And -

SC Okay.

SC Okay, in work.

CAPCOM I - we presume, though, that there'll be somebody in the LM that we can call if we have to get word to you.

SC Oh, yes. There'll be somebody to be standing by, and they'll run up into the bed room, and tell me to stop what I'm doing.

CAPCOM Okay, and let us know when you start.

SC Okay, I'm going to start right now, Vance.

CAPCOM Okay.

CAPCOM Aquarius, Houston.

CAPCOM Aquarius, Houston. Over.

SC Okay, Houston, Aquarius. Switching watches, and Jack's going up into the command module.

CAPCOM Okay, Jim. We have 4 steps here to give you to request that you get back on down voice backup, if you're ready to copy?

SC Ready to copy.

CAPCOM Okay, bit rate to LOW BIT RATE. Voice function switch to downvoice backup. Power amps CB; OPEN. Range function switch in RANGING; that's verify.

SC Okay, bit rate, LOW; voice function; downvoice backup; power amp S-BAND, OPEN; and range function to RANGE;

SC - and that's a verify. And I still have the BIOMED on a rise here, so we don't have hot mike.
CAPCOM Okay, thank you.
SC And, you want that in work, now?
CAPCOM That's affirm.
SC Okay.
SC Okay, Houston, Aquarius. How do you read?
CAPCOM Loud and clear, Jim.
SC Okay, I have a question for you, Houston, if you have time.
CAPCOM Sure, go ahead.
SC And, I'm copying down the reestablishing PTC maneuver that Charlie gave me. Step five was when rates are less than twice 05 degrees per second. Attitude control is YAW to PULSE. And, it well - might to get that rate down to .05 feet per second. I rated the meter, at the best, at .1 of a degree.
CAPCOM Stand by.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Jim, this has been tried in the simulator by Charlie and others and what they recommend is that you null your rates on the arrow needles until you see no movement whatsoever and then wait another couple of minutes and that should do it. That's the only way we can tell. Over.
SC Okay. I'll give it the old college try.
CAPCOM Okay. And if you can't attain that why of course just the best you can do. We'll have to give it a try. Maybe it won't be quite like the simulator.
SC Like -
SC Okay, Houston. Aquarius.
CAPCOM Go ahead, Aquarius.
SC Okay Vance. I've gone all the way through your procedure - all the way down to select best OMNIs and I'm not getting any MAIN BUS B voltage and this I don't understand.
CAPCOM Roger.
SC I can read batt - bagg bus B voltage at 36.5. (garble)
CAPCOM Okay, Jack. Do you rad now?
SC I (garble) Vance.
CAPCOM Okay. You faded out due to noise in your orientation. If you close the power amp circuit breaker, we can hear you better. Over.
CAPCOM That's panel 16.
SC Okay.
CAPCOM Okay. You faded out the very beginning so please go through that again. We understand you don't get anything on MAIN B.
SC Okay Vance. How are you reading now?
CAPCOM Okay. We're hearing you better. Stand by one.
CAPCOM Okay Jack. Please repeat back now your conversation. You were cut out awhile ago.
SC I don't have any idea where we cut out, Vance. I just said that we performed the procedures exactly as you say. We're down into the step critical portion to where I said select best OMNI. However, we're not getting any main bus B voltage reading. I can read batt bus B Baker and 36.5 batt Charley and 37.0 but I have negative Main Bus B reading.
CAPCOM Okay. Stand by
CAPCOM Okay, Jack. There are two - there's a switch and a circuit breaker that were positioned this

CAPCOM - morning that we'd like to have you check. Correction. Just the switch. Panel 5 check your bus tie. Main bus tie batt BC ON.

SC That is verified ON. I checked that.

CAPCOM Okay.

CAPCOM Okay, Jack. This is Houston. Over.

SC Go ahead, Vance.

CAPCOM Okay. We're getting data from you Jack so that much looks good. On panel 5, request verification that EPS sensor signal circuit breaker is MAIN B. Over.

SC Okay. Stand by.

CAPCOM That Main B is CLOSED.

SC Okay.

CAPCOM Okay Jack. And we see your Main bus B voltage at 28 and 1/2.

SC Okay. You can see it. Good. Okay then.

SC Okay Vance. That circuit breaker is IN.

CAPCOM Copy .

SC Well Vance, if you're still getting data from them. Let me go back up there and (garble).

CAPCOM Okay Jack. Please repeat your cutting out.

SC Okay Vance. Okay. We just changed OMNIs there. If you're getting data from us that's the important thing. Let me go back up into the bedroom there and get the readings you want so we can get this stuff powered down. Is that okay?

CAPCOM By all means and -

SC Okay, we've got (garble) down there.

CAPCOM Select best OMNI.

SC Okay Vance. We 'll go back up. We've got voltage now and we'll go back up and take the readings that you want.

CAPCOM Okay. And select best OMNI.

SC Okay. I'm going back up into the bedroom Vance. How do you read?

CAPCOM Loud and clear.

SC Okay. I'm going back up to the bedroom. We'll select best OMNI and continue on with the procedure.

CAPCOM Roger.

SC Okay Vance. Jim. How do you read?

CAPCOM Reading you loud and clear Jim.

SC And Houston, I noticed through the AOT and through the overhead docking window that we are venting again.

CAPCOM Okay Jim. Understand the service module is venting.
SC That's affirmed.
CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Jim, would you call into the bedroom and tell Jack that when he has his onboard readouts that we wish he'd use the backout procedure and shutdown again. Per the procedure we gave him.
SC Roger. As soon as he gets his onboard readout to use the powered down procedure and shutdown. Is that right?
CAPCOM That's affirmed.
SC Okay. Jack just told me that he's through and he's going to go through the back procedures again, the first ones he got, and shut down.
CAPCOM Okay.
PAO This is Apollo Control at 102 hours 6 minutes. We've got 7 minutes 37 seconds worth of telemetry data on the command service module during this power up of the command module. We powered up just enough to enable us to get telemetry signals and for the flight controllers to take a quick telemetry snapshot of the command module. They appear to like what they've seen.

END OF TAPE

PAO They appeared to like what they have seen. G and C reports propulsions systems, pressure and temperature all look good on the CSM. Apollo 13 is 160 331 nautical miles from Earth. Velocity 4295 feet per second.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Jack's ready to give you the readings if you are ready to copy them.

CAPCOM Stand by. Okay, go ahead.

SC Okay, Vance, the readings that you wanted are you ready?

CAPCOM Ready to copy, Jack.

SC BAT Charlie, 37.0 PYRO A 37.0, PYRO B 37.0, SPS helium pressure 3450 and just for kicks nitrogen A 2300 nitrogen B 2400, CM RCS injector temperatures 5 Charlie 4.5, 5 Dog 3.5, 6 Alpha 4.0, 6 Baker 4.6, 6 Charlie 4.0, 6 Dog 3.8, Battery manifold pressure 4 Alpha 1.4.

CAPCOM Okay, we got it, thank you very much.

SC Okay how does the telemetry look on old Odessey?

CAPCOM It doesn't look too cold. Looks pretty good.

SC Okay, thank you very much.

CAPCOM You bet.

SC We're going to need him.

CAPCOM How does it feel Jack?

SC I'll tell you Deke it's cold up in there, I don't know whether we'll be able to sleep up there tonight it must be about 35 or 40 degrees.

CAPCOM Yea, that's just what I was wondering about.

SC Right now we're getting 2 sets of PWG's on. It's not uncomfortable at all in Aquarius, but it is definitely cold in Odessey.

CAPCOM Roger.

SC Okay, Vance, this is Jim back on.

CAPCOM Go ahead Jim.

SC We just had to change them once that's all.

CAPCOM Okay.

CAPCOM Aquarius, Houston. Over.

SC Go ahead, Houston.

CAPCOM Jim, 2 items. In the Command Module we wish to verify that the PYRO battery selector was left in the Main position and we're ready to have the power amp circuit breaker on panel 16 being pulled whenever you are ready.

SC Okay, Vance. Fred just tells me that he put it there and we're checking that again about the PYRO battery selector in the Main position.

CAPCOM Okay, understand that you are checking it.
SC And I will pull the power amp circuit breaker.
CAPCOM Roger.
SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC How does number 2 battery look to you?
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Jim, it looks like it was probably a sensory problem, the battery number 2 is load sharing well and we see no indications of higher temperatures in GLYCOL loop or anything that would think that it was heating up.
SC Okay, thank you.
CAPCOM Roger.

END OF TAPE

AQUARIUS Houston, Aquarius.

CAPCOM Roger, go ahead.

AQUARIUS I just want to go over a little philosophy here. Fred told me that at one time you came up and told him that we were a little steep on the entry angle and now our burn is going to make it, give us a steeper angle. I just want to make sure that we're all talking about the same thing, and in this particular situation we're shallow. And we are going to increase the angle.

CAPCOM Jim. The situation is that at the moment we're a little bit shallow and retro grade mid course is going to put us more on the center of the corridor, over.

AQUARIUS Okay, fine. I just wanted to make sure. Fred had written down, some time ago, that our angle now was about 71 and we were going to do a mid course of 7 feet per second (garble)

CAPCOM Rog. And I guess it follows, but your perigee is a little bit high right now too, so that will be bringing it back, back down that is.

AQUARIUS (garbled)

CAPCOM One other question, Jim. Our readings down here say your LM cabin is about as cold as the command module cabin. Is that right?

AQUARIUS Well, we really don't know. There's two people in the LM cabin and it seems to be a lot more compact so we don't notice the coldness down here as we do in the command module.

CAPCOM Okay.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead.
SC Sometime ago I copied down a long COMM midcourse 7 corridor control burn at a DBM 134594298. Is that burn pad still valid?
CAPCOM Jim, that's affirmed. That pad is still valid.
SC And it is assumming you know midcourse 7 here at 105 hours.
CAPCOM That's affirmed.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Jim, we're setting up your burn for 10530 and we'll be working up pad et cetera based on that time. Over.
SC Roger. The time will 10 530.
CAPCOM And an additional point, I guess this ones for Jack. Do you have any idea why we couldn't read the MAIN BUS B voltage awhile back when first he didn't get it and then later he did?
SC Yeah. I think we have a reading of that. Stand by.
SC It appears Vance that the battery charge circuit breaker which appeared to be in - wasn't in. Fred pulled it and reset it and then he started getting readings.
CAPCOM Roger. What circuit breaker was that?
SC It was - it was the battery charge circuit breaker that allows you to read volts. I don't know the exact name for it yet.
CAPCOM Okay. Understand.
SC The name is battery charger BATT B charge Jack tells me.
CAPCOM Okay. Battery charger BATT B charge.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Have you opened your - just curiosity - Have you opened your food locker just aft of the LM data file? Over.
SC Yeh. It's been opened.
CAPCOM Okay. Just checking. Thanks
SC (garbled)
CAPCOM Okay.
SC It came at the right time.
CAPCOM Good.
CAPCOM Aquarius, Houston. Over.
SC Go ahead.

CAPCOM Jim, we have some CSM temperatures here for you that might be of interest if you're ready to copy.

SC Roger. Go ahead.

CAPCOM Okay. Your quad package temperatures range from 85 degrees to 44 degrees. Your CM RCS injectors range from 44 degrees to 21, and your heat shield is well above it's lower limits in all the various locations. Temperatures appear to be cycling based on sun angle, and it's no sweat. They all look very good.

SC Sounds good.

END OF TAPE

SC Were you calling, Houston?
CAPCOM Negative, Jim.
SC Okay.

END OF TAPE

SC And, Houston. How do you read Aquarius?
CAPCOM Read you loud and clear, Fred. How do you read us?
SC Okay, (garble).
CAPCOM Roger, we were just about to send you up some items of information pertaining to the burn. Are you ready to copy?
SC Standby.
CAPCOM Okay.
SC Okay, go ahead, Vance.
CAPCOM Okay, Fred. First of all, preparations for this starting with contingency checklist, page 24; we would recommend should start at 104:30 GET, and we'll be happy to receive any comments you have on that, though. The second point - when you're in the burn attitude you should see the Sun at the very top of the AOT; it'll be splitting the curser when you're curser's set at zero. One thing to be aware of, though, that it'll slip right out of the AOT very easily since it'll be very sensitive to roll and yaw. And that's in detent two, by the way. Next point, the burn is very insensitive to burn time, and attitude; in other words, if necessary we can slip it if there's any problem at all, and attitude isn't too critical. So that brings us to the point, that we only have one real burn rule, that is if - rate right on the axis get to 10 degrees a second, that's the limit to stop the burn. Next point, after you finish the burn, and before you trim; request that you leave DEDA address 470 up a while so we can take a look at it, and let us holler when we've seen it, and then proceed on. Over.
SC Okay, Vance. You're saying we should start into the prep in the contingency book at about 104:30, and I'll talk it over in a minute with Jim, and we'll get back with you on it. When in the burn attitude, we should see the Sun right at the top of the AOT And I assume this is descent number 2. Jim and I'd already been talking about that and - eye balling the terminator in the Earth, we figured the Sun at about something like a 70 degree angle - 65 degree angle so it ought to be right up there. We got one burn rule, and it says that if the rates are greater than 10 degrees per second, shut her down. And, after we trim, you want me to leave 470 up for awhile so y'all can have a look at it, and you'll tell me when to get rid of it.
CAPCOM That's right, Fred. And, if you have any questions at all, regarding the alignment; why please let us know. We'll be happy to answer them, like aligning on the Earth, as was described before. Also, you should know that the pitch is the most critical attitude so far as errors are concerned, in this burn, but, as I said, it's still not very sensitive.
SC Yes, the - and unfortunately the way we're

SC - looking out the window, through the COAS, we can align the yaw and roll pretty well, but it's the Sun that has to get us pitch.

CAPCOM Right, and - and a correction on this DEDA 470 thing. Request that we let you - give you a go before you trim. Over.

SC Say - say again, Vance, on that last.

CAPCOM Roger. We would like to see address 470, and give you a go before you trim. Over.

SC Oh, okay. I - I see. Okay, after burn, we'll leave 470 up awhile and wait for your word to do the trim.

CAPCOM That's correct. How was the sleep?

END OF TAPE

CAPCOM How was the sleep?
SC Okay. And — okay, Vance, are you there?
CAPCOM Roger. Go ahead.
SC Okay. The picture that Jim gave me on his view through the COAS was within partial earth, the lit portion laid in the top half of the COAS with the cusp laying right on the X — Y line. And so the - the whole dark part of the earth would be at the bottom part of the earth, except a very thin crescent of the dark part to a line above the yy line.
CAPCOM Okay. That is correct.
SC That in essence — that in essence would put our X axis pointing toward to sun.
CAPCOM That's correct. The plus X axis pointing towrd the sun and perpendicular to the terminator of the earth.
SC Okay.
CAPCOM Two other points, Fred. One is that we don't expect hardly any misalinement of your engine for the burn, so we don't really expect any rates throughout the length of the burn, especially since it's very low thrust. Second point, request you verify that your suit temperature rheostats in full cold. If it were in full cold, that might help your cabin temperature situation. It might bring the temperature up.
SC Okay. Okay. The latter was a good point. We had it in full hot.
CAPCOM Very good.
SC And roger on the - roger on the rates too.
CAPCOM Okay.
SC Okay, Vance. The TIG time going to be approximately - is it 105 or 105:30?
CAPCOM It's 105:30.
SC Okay. Your 104:30 time to start in. It sounds pretty good. That will give us lots of time to get set up with the attitude business, in case, if we have any trouble, stopping PTC and getting there and that will give us a little time to be setting and waiting all set up.
CAPCOM Okay, Fred. Good.
CAPCOM Aquarius, Houston. Over.
SC Are you calling, Vance?
CAPCOM Right, Fred. We just noticed a 2-pound drop in your water quantity. Have you guys had drink recently or do you know any reason why it might have dropped over?
SC Negative.
CAPCOM Thank you.

CAPCOM Aquarius, Houston.
SC Go ahead, Vance.
CAPCOM Fred, that may be a funny in the data. The rates gone back to normal and we'll keep an eye on it, but we don't think you should worry about it too much.
SC Let's hope not.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-15-70 CST 9:17P GET 104:04:00 445/1

PAO This is Apollo Control at 104 hours, 11 minutes. Apollo 13 now 155 111 nautical miles from earth. Velocity is 4,399 feet per second. We are an hour and 18 minutes away from the nominal midcourse burn time. As you heard Vance Brand tell the crew, this burn is insensitive or relatively insensitive at least to time and, if for some reason the crew is busy and can't make it at that time, they could at their option slip this burn as much as 30 minutes. However, at the present time we expect it will be done very close to the nominal time of 105 hours, 30 minutes. Approximately 30 minutes later at 106 hours we still expect the first disc on the supercritical helium tank of the LM descent stage to go and vent that helium tank overboard. We'll continue to stay up live for air-ground conversation.

END OF TAPE

AQUARIUS Hey, Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
AQUARIUS Are we going to get any sort of a pad on this?
CAPCOM That's afirm Fred. Estimating we'll have it to you in about 15 minutes.
AQUARIUS Okay. And Houston, you might let us know if there is any chance that we're going to slip further down the road, cause we're going to kind of hold to that 104:30 start time, and if you're going to delay it, we'll delay it accordingly.
CAPCOM Rog. We won't have any trouble making that, Fred, I'm told.
AQUARIUS Okay.

END OF TAPE

SC Apollo, Houston, Aquarius
CAPCOM Go ahead, Aquarius.
SC Roger. We have about 104 degrees now, how does that (garble)?
CAPCOM Okay, FIDO's hustling here, we'll try to get it right up to you, standby.
SC (Garble).
CAPCOM Aquarius, Houston. Over.
SC (Garble).
CAPCOM Aquarius, Houston. Over.
SC Vance, we have the quad heaters on, now.
CAPCOM Roger, copy, Jim. And the - Jack's going to read you the pad right now, so I recommend you go ahead and get started; you shouldn't be delayed by the pad at all.
CAPCOM Aquarius, Houston. I've got your burn pad.
SC Roger, Houston, standby. Are you ready? Standby to copy. Okay, ready to copy.
CAPCOM Okay, a P30 maneuver pad; on the DPS; purpose is midcourse 5. NOUN 33 -

END OF TAPE

CAPCOM on the DPS, purpose is midcourse 5. Noun 33 105300000, NOUN 81 is N/A, HA is N/A, perigee plus 00 19800078015 the rest is N/A. Shutdown the engine at 1 second fire to the end of burn time. Shutdown at 14 seconds manually. Ullage is 4 jets for 10 seconds, 10 percent throttle. Go ahead.

SC Okay, Jack, we've got at DPS midcourse 5. Noun 33 105300000, NOUN 81 is N/A, HA is N/A, plus 0019800078, burn time 015, rest of the pad is N/A. Shutdown manually at 14 seconds, ullage 4 jets for 10 seconds and the entire burn is at 10 percent throttle.

CAPCOM Okay, Fred, I want to verify that your DELTA VR is 00078.

SC Okay, I read you back 00078.

CAPCOM Okay. Good readback. You've got it.

PAO The CAPCOM on that call was Jack Lousma. We passed up the pad for this midcourse correction. The time 105 hours, 30 minutes elapsed. DELTA velocity 7.8 feet per second. A burn time of 15 seconds with the notation to shut down the engine manually at 14 seconds. The targeting for the perigee after this burn 19.8 nautical miles versus present perigee of 87 nautical miles. And at 140 hours, 7 minutes, Apollo 13's distance from earth is 153 971 nautical miles, velocity 4,421 feet per second.

CAPCOM Aquarius, Houston, I have some additional entry data that goes with the pad I just read up. It's 5 items. Let me know when you are ready to copy. It's on the maneuver pad.

SC Okay. I'll try to squeeze them in there, Jack. I'm rapidly running out of pads. Go ahead.

CAPCOM Okay. It's N/A all the way down to NOUN 61. Your latitude is minus 21 -

SC Hold on a minute, hold on. Hold on, Jack, I need the other pad, that CSM pad.

CAPCOM That's affirm.

SC Okay. Now, I'm ready.

CAPCOM Noun 61 latitude minus 2167 minus 16537 11631 36292 1424102. Read back.

SC Okay. NOUN 61 minus 2167 minus 16537 11631 36292 1424102.

CAPCOM Good readback.

END OF TAPE

PAO This is Apollo Control at 104 hours, 41 minutes. The splash coordinates for which this burn is targeted are 21.67 degrees south, 165.37 west.

SC And, you should have high bit rate now, Jack.

CAPCOM Okay, Fred. We're getting it now.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Did you have readouts on our quad temps to know when we can start? We're thinking of doing that. We'd just like a verification with you.

CAPCOM Roger. Your quad temps looking good from here.

SC Okay, Houston. Aquarius. We're going to start PTC at this time.

CAPCOM Roger, Aquarius. Go ahead.

CAPCOM How about if you do -

SC Say again, Jack.

CAPCOM Negits on my last, Fred.

SC Okay, Jack. How do you read now?

CAPCOM Go ahead, Aquarius.

SC Okay. I thought you called, Jack. We're maneuvering around here to fish for the earth.

SC And, Houston, Aquarius. How's the ASA package temp look now?

CAPCOM Okay, Fred. The ASA package temp is looking good. It's around 98 degrees, and we'd like to see it go up about 15 to 20 degrees.

SC Okay. Why don't you give me the word before I proceed with the AGS. We really don't need it right this instant.

CAPCOM Roger. We'll be watching it.

CAPCOM Aquarius, Houston. The ASA package temp is up now so you can activate the AGS.

SC Okay. Very good.

SC Okay, Jack. So we can make sure and get our timer set here, I wondered when your - you've got about 48 minutes to the burn which should be coming up pretty quick, you'd give us a hack so we could set our mid timer at 12.

CAPCOM Roger, Fred. I understand you want a mark at 12 minutes prior to the burn. Is that affirmed?

SC Roger. We think we got it set now. We just wanted to check it. If we don't, then I'll set it to 13, then you can give me another hack at 47 to go.

CAPCOM Okay. We got 33 to go. Mark. My mistake. It was 33 -

SC Right on.

CAPCOM Roger. It was reading 33 on my mark. Right?

SC Okay. You got about 10503 GET now down there?

CAPCOM That's affirmative, Fred. Going through

CAPCOM 105:03:45. Mark.
SC Okay.
SC Okay, Jack. Give me the next number you want me to set, then, and I'll take another hack here.
CAPCOM Roger. You're counting up, right?
SC Rog.
CAPCOM Okay, Fred. On my mark, be 35 minutes to the burn.
SC Standing by.
CAPCOM We missed her, Fred. Let's get it on the next minute.
SC Okay.
CAPCOM Okay, Aquarius. On my mark, it's going to be 24 minutes to the burn, and you'll be reading 36. Stand by. Mark.
SC Okay. We got it cranked up.
PAO This is Apollo Control at 105 hours, 8 minutes. Following this burn, passive thermal control will be reestablished, and the command module pilot, Jack Swigert, and the lunar module pilot, Fred Haise, will begin a 6 hour rest period.

END OF TAPE

PAO This is Apollo Control. We will wait until the burst disk on the super critical helium goes before we reestablishing passive thermal control, however. Apollo 13 now 152 604 nautical miles from earth. Velocity 4450 feet per second.

SC Okay, Houston. We have our attitude set.

CAPCOM Roger, Jim.

SC I hope the guys in the back room who thought this up right, knew what they said.

SC And I'm looking through the AOT there, Jack, and the sun's right in the top and it's about maybe 2 degrees to the right of the (garbled). So that's - looks real good.

CAPCOM Roger. Good going.

CAPCOM Okay, Aquarius. Attitude looks good here and your choice when you want to start the burn.

SC We're counting down aren't we or do you want us to start any time.

CAPCOM Your choice.

SC Too bad this isn't easy.

CAPCOM It's not time critical, Jim.

SC I heard that.

SC And, Houston, we reset our clock and we making the burn in about, I'll give you a hack here at 2 minutes to go.

CAPCOM Roger, Fred. And let us know when you're going to ullage, will you?

SC Okay.

SC Okay. Stand by. 2, 1, mark it. Three minutes to go.

SC Correction - 2 minutes to go, Jack.

CAPCOM Roger. Two minutes. We got it.

END OF TAPE

CAPCOM Aquarius, Houston. Check engine gimbal OFF, please.
SC It's verified to OFF.
SC And MARK it, 1 minute.
CAPCOM Roger, Fred.
SC Engine on the descent.
SC Ullage,
CAPCOM Ignition.
CAPCOM The thrust looks good.
CAPCOM It shut down.
SC 6470.
CAPCOM Roger we copy 7.4.
SC Roger 7.4 and I had about 2/10ths short I guess when we started.
CAPCOM Roger. We verify that.
CAPCOM Okay Aquarius. Trim it to 7.6.
SC Okay. You want plus X now to get 7.6. Is that correct?
CAPCOM That's affirmative.
SC Okay. You're looking at it Houston.
CAPCOM Okay. Looks good. Nice work.
SC Lets hope it was.
CAPCOM Okay Aquarius. We're ready to follow you through on setting up PTC and power down. Your choice.
SC Okay. We're pressing in to getting PTC established right now.
PAO This is Apollo Control at 105 hours 23 minutes. That trimming was done with the reaction control system. The burn looked good. Fido will want to get some tracking now and look at that for awhile before he can tell precisely what was achieved. Decision has been made to go ahead and reestablish passive thermal control prior to the super critical helium tank venting. There's enough uncertainty into the time when that will vent now that we're going to go ahead and establish the PTC. We can expect venting anytime up to and within the next 2 hours probably. We'll continue to standby for live air to ground transmission.
CAPCOM Aquarius, Houston. We'd like to change the number of yaw pulses we gave you before as 21. We'd like to reduce that to 12. 12 pulses yaw right and that'll take you about 3 seconds to get them in if you don't want to count them.
SC Okay. We'll make it 12 versus 21.
SC Okay Houston. It's just about there now and as soon as we get (garble)
CAPCOM Roger Aquarius.
PAO This is Apollo Control. Jim Lovell setting up the passive thermal control now. We're reading

PAO - a pressure in the super critical helium tank of 1834 pounds per square inch. The burst disc range is 1881 to 1970 per square inch. The latest prediction is that we'll reach the lower limit, the burst limit, the lower burst limit 1881 at in about an hour and a half. We're predicting a rise rate of 33 pounds per square inch per hour right now.

SC Okay Houston. I'm trying to damp rate now. We're at the proper roll attitude and pitch.

CAPCOM Roger Aquarius.

CAPCOM Working a little bit better this time

SC Are you copying any attitudes down there, rates et cetera.

CAPCOM Okay Aquarius. We're seeing some extremely low rates at this time. They're really below our capability to measure them.

SC Roger.

PAO This is Apollo Control at 105 hours 35 minutes. The flight dynamics officer expects a fairly reasonable estimate of the trajectory in approximately 2 hours.

END OF TAPE

SC Houston, I think I've got PITCH and ROLL just about squared away. I let YAW just slightly drift strictly to the clockwisedirection and I'm about set now to put in my 12 clicks to the right.

CAPCOM Roger, Jim, ready to look at it with you.

PAO This is Apollo Control at 105 hours, 37 minutes. Ignition time of that midcourse burn was 105 hours, 18 minutes 32 seconds. The total duration of both the descent propulsion system and the trim burn was 15.4 seconds. DELTA V achieved was 7.6 ft per second.

SC 12 clicks right.

SC Okay, Jack, are we clear now to proceed with the power down?

CAPCOM That's affirmative, Jack, we're ready to press on with power down and I've got two changes for you. Step 1 of the emergency power down on page power-5. Over.

SC Go ahead.

CAPCOM Okay and leave your power amplifier switch in primary vice OFF and put your ranging switch to RANGE, vice off reset.

SC Okay, we're in prime on the power amp and ranging on ranging.

CAPCOM Affirmative.

SC (garble)

SC There you go.

CAPCOM Aquarius, Houston, hold off 1 on power down please.

SC Okay. We'll hold off. We are looking at a she pressure, incidentally, of about 1830 now.

CAPCOM Roger. We concur with that. And it looks like you got a little pitch rate going on here, do you copy the same?

SC Okay. My pitch needle is just slightly up now. I could try to take it out if you want me to.

SC There you go.

CAPCOM Just hold off on it one, Jim, we'd like to take a look at it.

SC Okay.

CAPCOM Aquarius, we'll need high bit rate, please.

SC Flashlight, Jack. Jack, flashlight over here a minute.

CAPCOM Aquarius, we need the Apollo amplifier back in high bit rate, please.

SC You got it.

SC You got a couple in a row pretty soon. What is it? 1.7?

SC That was set up by the (garble). Now we got to turn on the heaters. We want to save ...

SC What's that twisting out there in the breeze? Are we venting again. Take a look, Jack.

SC Once we get squared away, Joe, I think I am going to have to go to the space center and take a real good healthy one -

END OF TAPE

SC - - we get squared away, Joe, I think I'm going to have to go to the space center and take a real good healthy one and we ate just about everything. I've held up long enough.

SC That's coming from above. Another one is just coming down right over here. Well, there's the old terminator at Fra Mauro. We'd be landing about 2 hours ago, huh? Right on the -

SC Houston, Aquarius.

SC Right on the terminator.

CAPCOM Go ahead, Aquarius.

SC Just for information, although I thought I'd never have to use it, that technique did look like it was a pretty good one.

CAPCOM Roger, Jim. And we'd like you to give us your idea of how the PTC looks. We're not sure we're seeing what we ought to here.

SC Okay. I still have my ball on forward up and I'm coming around past 270 right now. I've got a slight roll and pitch all fit in there by pitch needle about half way up and my roll needle is about 4 degrees over now.

CAPCOM Okay, Jim. With that info we're go on the PTC and let's proceed with power down.

SC Okay. We'll proceed with the PTC and proceed with the power down. I guess if we have to we can reestablish PTC at a later date. Okay. Okay. First row, your AGS on?

SC My what?

SC My what? Oh, yes. Go ahead.

SC Okay. The 4 inverters of the AB bus volt, Fred.

SC Okay. Go ahead.

SC Okay. Give me a few more seconds, Jack and I'll keep it all out. Okay? RCS system A. That's in. PCA's are going off. Why do they need the ISO valves in the ascent feed in?

SC You're not sucking any power unless you take these switches and move them.

SC How come we move without them in this burn?

SC Cause you didn't want them to get moved inadvertently, I guess.

SC It doesn't matter, Jim. They can be out or in for the purpose of the power down. They just don't count.

SC Okay. I got 1, 2, 3.

SC ISO valve should be in 2.

SC Yes. Okay. Third row. (garbled)

SC Jack, how do you read now at base band?
CAPCOM Reading you 5 square, Fred. How me?
SC Okay. I'll stay this mode if it's all right so we won't be hot miked.
CAPCOM Roger.

END OF TAPE

CAPCOM Aquarius, Houston. You're cleared to open the power amplifier circuit breaker and go to low bit rate, leaving the power amp switch in primary.

AQUARIUS Okay, I'll pull FM S-band power amp breaker and go low bit rate.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/15/70,CST 11:12P,GET 105:59:00,455/1

PAO This is Apollo Control at 106 hours 2 minutes. We're in the midst of a shift change over here in Mission Control at this time. Flight Director, Milton Windier and the Maroon Team of Flight Controllers are replacing Flight Director, Jerry Griffin and the Gold Team. Our Capsule Communicator on this shift will be Astronaut, Jack Lousma. One of our large LM status boards here in Mission Control would indicate that the power down in the LM is completed at this time. During the burn, the power levels off the LM were running around 25 amps. We're now showing the power somewhere between 10 and 12 amps. The target level during the power down is to keep it to at least 14 amps, so we're well below the minimum target, and in very good shape on LM power at this time. Flight Director Windler at this time is reviewing the status from each of his Flight Controllers, and at the present time Apollo 13 is 150 302 nautical miles from Earth. Travelling at a velocity of 4 498 feet per second. There will be a change of shift briefing. We do not have a time at the moment. We'll pass that along to you as soon as it is available. At 106 hours 3 minutes, this Mission Control, Houston.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC About how far out are we now, Jack?

END OF TAPE

SC About how far out are we now Jack?
CAPCOM Okay, Aquarius, you're 150 000 miles and you're coming in at 4500 feet a second. That's from the earth.
SC Okay, we're at 100 -
SC Yes.
SC - 150K, 4500 feet a second.
PAO This is Apollo Control. Our LM control officer reports that -
CAPCOM - how much TTCA control did you have to do in the burn.
SC How much, what was that Jack?
CAPCOM How much control of the TTCA did you have to do during the burn?
SC I wasn't noticing Jim too much. I'd say I put in maybe about 6 or 7 inputs. I don't think it ever got off more than a couple of needle points.
CAPCOM Roger Fred. Thank you.
SC And too it's probably the same for Jim. I wasn't noticing his input but the, his needle was hanging in there pretty good.
CAPCOM Roger. Thank you Fred.
PAO This is Apollo Control. Flight director Milton Windier has completed checking the status with each of his flight controllers at this time, and the general tenor all the way around was that we're in very good shape at the present time. A couple of the significant items discussed, the surgeon reported that the lithium hydroxide, the makeshift lithium hydroxide canaster appears to be doing an excellant job. We're presently reading a carbon dioxide level of 1.2 millimeters of mercury. The LM telcom, reported that they're beginning to see the effects of the engine burn heat soak back into the helium tank and related rise in pressure in the helium, which would indicate that the burst disk may go a bit earlier than originally predicted, although the heat soak back had been expected. The plot that we have on the pressure rise in the helium tank would indicate the burst disk going sometime between 107 and 108 hours, ground elapse time. The range on the burst disk is 1881 pounds per square inch to 1970 pounds per square inch and somewhere between this pressure range we would expect the burst disk to go relieving the pressure on the super-critical helium tank. The flight dynamics officer reported that when we get the burst disk rupture, they will be observing what they call Doppler shift, to see what effect the venting from the helium tank has on the trajectory. If there is no effect on the trajectory, we would expect to have a preliminary data on the effects of the midcourse correction within about 2 hours. That would be about 2 hours after the burst disk ruptures. If on the other hand, there is some change in velocity as a result of the burst disk rupture, the flight dynamics officer said that it would be at

PAO least 5 hours before we had a preliminary estimate on the trajectory, the new trajectory. We've noted that the communications has gotten somewhat noisier. This is related to the power down of the lunar module. One of the items that is turned off in the power down is the communications power amplifier. This increases the noise with respect to the signal and we do expect the communications to remain more or less noisier than they have been. This condition will vary as the spacecraft attitude changes and as the position of the antennas changes with respect to the tracking antennas on earth. The flight plan at this time calls for the command module pilot Jack Swigert and the lunar module pilot Fred Haise to get about 6 hours of rest. Jim Lovell will stay on the watch in the lunar module. At 106 hours, 16 minutes, Apollo 13 is 149 706 nautical miles from earth, traveling at speed of 4509 feet per second. And the clock in Mission Control counting down to entry shows that we have 36 hours, 24 minutes until earth entry. This is Apollo Control at 106 hours, 17 minutes.

END OF TAPE

CAPCOM Aquarius, Houston. How do you read?
SC I read you loud and clear, Jack.
CAPCOM Okay, Jack. What's your status, who's sleeping and who's working?
SC Well, right now we're all three kind of working. Do you have any recommendations?
CAPCOM Yeah. Looks like to us from here that you and Fred ought to get some sleep, and that you ought to eat in about 6 hours. And that the Skipper ought to go to bed about 113 hours.
SC Okay.
CAPCOM I've got some other information. We should have some good dope on your trajectory in about 2 hours. Looked like to us that the burn was real good, however, and we're taking a close look at it and we'll get back with you on that in about 2 hours from now. Another thing that we're expecting to have happen is that the SCH tank is going to reach it's burst limit. The earliest time we predict this will happen will be at 107 hours on about 25 minutes. And the latest probably time is at 110 hours, and this is suppose to be a nonpropulsive vent, but you might hear it and you might see something.
SC Okay. That's good news. We were wondering about that. And I'll relay all the other information you gave me.
CAPCOM Okay. And if the SCH tank does burst during this time frame before we get trajectory info why that will delay our trajectory info somewhat. Your consumables, your water is now good through 150 hours.
SC Jack, wait a minute. Let me copy some of this down.
CAPCOM Okay.
SC Okay. I'm ready now.
CAPCOM Okay. We're predicting that you still have more water than you need. And one thing we'd like you to do is when you're going to sleep up there in the command module take a look through the optics and see if you can see any stars.
SC Okay, Jack. I will do. Jim and I were able to spot constellations from the windows of the LM when there's no venting taking place. Could you give me some time on these consumables that you predicted once more? I think you started to give times. I didn't hear or was I just hearing things?
CAPCOM We started to give you some times. We think we might be able to give you some better ones pretty soon. But it looks like your water is good through 154 hours, and you've got tox on 02 through 272 hours, plenty of lithium hydroxide -

END OF TAPE

CAPCOM You got toxon 02 through 272 hours plenty of lithium hydroxide and your amp powers ought to be good through 199 or 200 hours. Over.

SC Okay. Good. Copy that.

CAPCOM We expect that your water rate is going to drop off and at the time DELTA will go up to 160 - 165 hours quite shortly. Another thing we're interested in is what your status on rest and medication.

SC Okay. None of us, I know of, had any medications and right now as far as rest, I suppose we're no tireder than normally in this situation. I'm going to relay the work sleep cycle.

CAPCOM Okay. And don't forget to look through the optics when you go up in the command module.

SC Okay. I'll do that.

SC Jack, as luck would have it, we just (garbled)

CAPCOM Aquarius, Houston. Sorry about that but (garbled)

CAPCOM Okay, Aquarius. Go ahead now. I think I can hear you.

SC Okay. Okay, Jack. I was going to say, as luck would have it, the command module picked this time to start venting again so I probably won't be able to get a good hack out of stars out of the telescope.

CAPCOM Okay. Thank you. And if you can think of it, when the time comes up, when your not venting, how about remembering to take a look through them and give us a word?

SC Okay. Will do.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead. Over.
PAO This is Apollo Control at 106 hours 45 minutes. The -
CAPCOM Did you call?
SC Yes, Jack. I just got a question - how long are you predicting the Command Module LIOH canisters to last in here?
CAPCOM Okay, Jack. We've got 14 cartridges that'll last 157 hours, plus we've got the LM primary cartridge with 23 hours, and we've got two PLSS cartridges with 7 hours a piece.
SC Okay. I was just curious as to how much time we've got out of these two cartridges.
CAPCOM Standby one. I've got a prediction on that. By the way, I hope you're keeping track of the ones you've used and the ones you've not.
SC Yeah. Right now, we have numbers 7 and 8 in the LM here.
CAPCOM Roger.
SC They were two brand new fresh ones.
PAO This is Apollo Control. The participants for the Change of Shift Press Briefing are leaving Mission Control now. We estimate that the briefing will begin in about 10 minutes, in the MSC main auditorium in the News Center.

END OF TAPE

PAO While we're waiting for the information which Jack Swigert requested on the expected lifetime of the two current lithium hydroxide canisters, we might recap some of the conservation between Swigert and Capcom Jack Lousma. Jack Swigert reported the crew had taken no medication and he said as far as rest they're no more tired than normally in this situation. He said they planned to switch to a rest cycle as indicated in the flight plan as soon as it's convenient. Now we passed up a consumable status to the crew. Also the status on the super critical helium tank burst disk we expect will be within the range where the disk could rupture within a matter of minutes. We're presently showing the super critical helium tank pressure at 1874 pounds per square inch. We'll hit the lower limit of 1881 pounds per square inch shortly and we'll be advising the crew when that level is reached. Jack Lousma advised them that they likely will hear the disk rupture and may see something from the LM at the time it ruptures.

CAPCOM Aquarius, Houston. In regards to the CO2 canisters, by the way the PCO2 is reading 1.6 down here now. We expect that we can get six more hours out of the two canisters that we have there. Six hours at least. However, at 112 hours, when we've got several people up, we're going to rig up two more and we have the new simplified procedure for doing this. However, in the meantime, should we need to have a canister change, we plan to switch to the LM primary canister. Over.

SC Okay. Copy that, Jack.

CAPCOM And Aquarius, how's your PTC holding up?

SC Well, we got a little bit off Jack. The - it starts high in the LMP window and goes low in the CDR window. So we've got a little bit of a wobble on it. Of course, the command module venting doesn't help either.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Jack, in reference to your question about the PTC, on this last complete revolution, the sun first appeared in the very top right corner of the LMP window. Passed over the CDR window, and was visible through the overhead window and now the moon is - it's pretty well through the center of both windows this last time.

CAPCOM Okay. Thank you, Jack. Good copying that.

END OF TAPE

CAPCOM Aquarius, Houston. We'd like to get a little better idea of how PTC is going. So what we'd like for you to do is what we did last time. And that is to give us a reading on the center of the Earth and the center of the Moon on the LPD.

SC On the LPD. Okay. It's shifted. Let's see, the Moon's gone by and the Earth didn't come into the LPD last night.

CAPCOM Okay. But when it goes by the plane of the LPD tell us where it was. Okay?

SC Okay. Will do.

PAO This is Apollo Control at 107 hours 11 minutes. Our displays based on telemetry information from the spacecraft currently show that we have pressure in the super critical helium tank of about 1889 pounds per square inch. This is within the range where the burst disk on the tank could rupture. The range is roughly between 1881 pounds per square inch and 1970 pounds per square inch. During the last 10 or 15 minutes there's been a huddle around the flight directors console. The subject of the discussion is what procedure we use if the burst disk does not rupture as expected. The pressure in the tank should not go above about 2000 pounds per square inch. If the burst disk does not rupture, we would need to use an alternative method of depressurizing the tank. These alternatives involve either depressurizing by venting all at once or by venting in stages, a little at a time. And a decision has not been made at this time on how the tank will be vented in the event it is necessary. But those are the options that we have as it appears right now. You've also heard Jack Swigart aboard the LM reporting the relative position of the Earth and the Moon and the Sun as the spacecraft rotates in the passive thermal control mode. As these bodies come into view through the windows, we've asked him to give a relative position of the Earth and Moon on the landing point designated, the grid on the LM window which is calibrated and will give us a bit more precise information on how the spacecraft is maintaining it's passive thermal control attitude. At the present time now we show Apollo 13 to be 147 186 nautical miles from the Earth.

SC I just passed the Earth. It came into view at the top left hand corner of the LMP window and was going down. However, when it passed it wasn't as high up as the last pass. It did pass into view at the CDR window but too high up to get an LPD reading.

CAPCOM Roger. Understand it went high in both windows then.

SC Yeah. Last time it wasn't even in view in the CDR window this time it was visible but too high to get an LPD reading.

APOLLO 13 MISSION COMMENTARY 4-16-7 CST 12:20A GET 107:07 461/2

CAPCOM Okay, Jack. That's good. Thank you.

END OF TAPE

SC Okay, Houston. This is Aquarius.
CAPCOM Go ahead. Over.
SC Okay. The moon came into view at the middle of the LMP's window, back through the CDR's window at an LPD of 5 degrees.
CAPCOM Roger. Understand.
PAO This is Apollo Control at 107 hours 31 minutes. We're presently reading a pressure on the super critical helium tank of 1897 pounds per square inch. Our LM control officer just advised the flight director that he expects the most likely time for the burst disk on the super critical helium tank to rupture would be within the next 15 minutes or so. At that time our indication in Mission Control that the disk has ruptured would be a drop in the tank pressure to zero. We presently show a current on the spacecraft electrical power system of anywhere from 10 to 12 amps. This is well below the minimum that we'd like to stay under. We'd like to keep it down to at least 14 amps and since the spacecraft is then powered down, we've been well below that figure.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Okay, Jack. On this pad the earth came into the view at the top part of the LMP's window and we got an LPD angle on it as it passed through the CDR's window of a minus 4 degrees.
CAPCOM Okay. A minus 4. Thank you, Jack.
SC It's about - okay. Are you familiar with the minus 4 being half way through the sky part, huh?
CAPCOM Affirmed.

END OF TAPE

SC Okay, Houston. Aquarius.
CAPCOM Go ahead, Aquarius.
SC Okay. On this pass the moon came into view at the top part of the LMP's window, came across higher. Jim estimates the LPD angle at a minus 15 degrees
CAPCOM Okay. A minus 15 on the moon and it sounds like it's set up pretty well.
SC Everybody's happy with it down there?
CAPCOM Aquarius, it's a little too early to tell exactly how the PTC is going. We'd like to get a few more points so keep reading them off and we're still looking for that super crit to go anytime.
SC Okay.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius
SC The Earth was just fairly high in the LMP's window at 14 degree LPD light.
CAPCOM Okay, Skipper, 14 degrees. Thank you.
PAO This is Apollo Control at 107 hours 59 minutes. That report on the relative position of the Earth and Moon through the spacecraft windows is coming from Jim Lovell. That's the first time we've heard from Lovell recently. A check with the flight surgeon. As far as we know at this time, all 3 crewmen are still up. However, the fact that Lovell is now on watch might indicate that Jack Swigert and Fred Haise are planning to get a rest period. In mission control, flight director Milt Windier has been discussing the situation with the super critical helium tank and what options we've got if the burst disk does not rupture as it is expected it will. And as we've mentioned before, at that time it appeared the options were either to vent the super crit - vent the pressure from the super critical helium tank at a series of small vents or to vent it all at once. After looking at the situation, it's been decided that the procedure, should it be necessary to relieve the pressure by venting would be to vent it all at once. In this event it is felt that the fuel in the fuel heat exchanger would be frozen and we would not be able to thaw it out again. This would render the descent propulsion system unusable for further maneuvers, however, we have adequate consumables in the LM ascent stage, adequate propulsion in the ascent stage. It's also felt that if a subsequent midcourse was needed probably closer into the Earth entry, we would be able to perform this midcourse using the ascent propulsion stage of the lunar module. The present pressure on the super critical helium tank as read from telemetry data here in mission control is 1913 pounds per square inch. The rise rate has slowed down somewhat. Recapping again the predicted range for the burst disk rupture is between 1881 pounds per square inch and 1970 pounds per square inch. We wouldn't begin to get concerned about the pressures on the super critical helium tank until it got up around 2000 pounds per square inch. And the LM control officer anticipates that we would not get up around the 2000 pounds per square inch in the event the burst disk does not rupture until about 114 or 115 hours ground elapsed time. Experience we've had with ground tests on the super critical helium burst disk indicates that it should be rupturing around the pressure we've got now in the low 1900's. And we're continuing to watch that. The LM power is continuing to run as it has since power down between 10 and 12 amps, and we look very good in that respect. There's also been no change in the status

PAO of any of the other consumables aboard the spacecraft. They all continue to look quite good at this time. Apollo 13 is presently 144 958 nautical miles from the Earth, traveling at a speed now 4613 feet per second. We're now 34 hours 37 minutes until Earth entry. At 108 hours 4 minutes this is Mission Control, Houston.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead Aquarius.
SC The moon went by the LPD at 6 degrees, plus 6 degrees.
CAPCOM Okay, earth at plus 6. Thank you.
SC That's the moon, the moon.
CAPCOM Okay, the moon. Thank you.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC The moon passed by at a minus 8 degrees on the LPD. No that's the earth. The earth passed by at a minus 8 degrees.
CAPCOM Okay, the moon went by at a minus 8 degrees.
CAPCOM Okay Jim, we got it. The earth went by at a minus 8 degrees. On a basis of the -
SC That's right.
CAPCOM On the basis of the data we had so far your entry angle is 5.99. The block data we gave you on a pad for a no-Comm midcourse 7 last night is no longer valid because we made this midcourse.
SC Okay. Understand, the no-Comm pad is no longer valid because of the midcourse. Entry-angle based on the last 2-hour tracking is 5.99, and I take it you're going to keep tracking for some time now to see if we'll need another midcourse or not.
CAPCOM That's affirmative.
SC Are you planning any no-Comm midcourse at 134 and change anyway right now, or are you going to wait?
CAPCOM We're discussing that now Jim and it looks like we're going to wait on the tracking. For the time being, since you're in the corridor, why there's no need to pass it up, but we're going to keep looking into tracking and we'll probably come up with one.
SC All right. I'm not too sure what the venting is going to do to us so, when this SCHE tank ruptures, what it's going to do for us.
CAPCOM Roger. We don't presently expect the SCHE tank to have any effect in your trajectory, and the pressure is up to 1921 now.
SC It's going a lot better than we ever expected. What a way to get a data point.
SC And Jack, just think, you thought you were going to sleep through all your watches.
CAPCOM Say again, Jim.
SC I said you thought you were going to sleep through all your watches.
CAPCOM Well you keep waking me up.
SC Sorry about that.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 1:41A GET 108:28:00 466/1

No voice communications this tape.

PAO This is Apollo Control at 108 hours 52 minutes. The flight dynamics officer hopes to have a preliminary set of numbers on the effects of the midcourse correction. At about 109 hours 30 minutes or a little over 37 minutes from now, the burn was targeted to give the spacecraft a flight path angle of minus 6.52 degrees at entry interface. Now we won't have a confirmation of this, of course, until the flight dynamics officer is able to complete the tracking and compilation of data to come up with some preliminary numbers. But the targeted value of that course was to give us a flight path angle of minus 6.52 degrees. The entry corridor which is the width of the flight path angle that we feel we can withstand is about minus 5.25 degrees to about minus 7.4 degrees of flight path angle. We're still watching the super critical helium pressure aboard the LM descent stage increase gradually. The pressure is now reading 1937 pounds per square inch. I would like to cover again the procedures which we mentioned have been worked out in the event that the burst disk did not rupture as it is expected to do. The burst disk, of course, is in there to relieve pressure on the tank, on the super critical helium tank when the pressure gets above a certain specified limits. The disk is designed to rupture at between 1881 pounds per square inch and 1970 pounds per square inch. In the event the disk does not rupture, Flight Director Milton Windier as flight controller has worked out a procedure that will be followed to relieve the pressure on the tank, and we see the pressure dropping at this time. The Control Officer reports that the burst disk has ruptured. We just as we were making this announcement -

CAPCOM See anything?

SC Yeah, Jack. I was just about ready to call you. Underneath QUAD 4 I noticed a lot of sparklies going out.

CAPCOM Can you hear or feel anything?

SC I sure did, but I think it changed our PTC. Let me check it through the (garbled)

CAPCOM Okay. She's going down through 600 now.

SC I think we're probably going to have to reestablish PTC. Yeah we got pretty fast YAW just then, Jack.

SC Houston, Aquarius. What are your plans?

CAPCOM We're thinking about them right now. Did you say it yawed some?

SC Yeah. I was in a right YAW and now I'm in a left YAW, at a much faster rate than the one we put in PTC.

CAPCOM Okay, Jim. We're talking it over. Stand by.

PAO While we're waiting for conversation to resume between the CAPCOM and Jim Lovell aboard Aquarius, we'll summarize the situation as we were talking about the

PAO procedure that would be followed in the event the burst disk did not rupture. Lo and Behold the disk ruptured. That occurred at a pressure of about 1937 pounds per square inch at 108 hours 54 minutes 40 seconds ground elapsed time. We saw -

SC - Jack.

CAPCOM Okay, Jim. It's going through 125 pounds now. And we understand you to say that they reversed your YAW. Is that affirmative?

SC Sure did, Jack. It reversed my YAW completely and put in a little PITCH, I think.

SC More than anything it reversed my YAW.

CAPCOM Roger. Have you effectively established PTC in the opposite direction then?

SC Well, you can say that. I'm not too sure what kind of PITCH or ROLL I've got coupled with the YAW. I just saw the Earth go by the LMP window here not too long ago and I (garbled) the direction.

SC Perhaps you can tell how fast I'm having to shift OMNI.

CAPCOM Yeah, we can tell the COMM cycling back and forth

SC Is that what they call a nonpropulsive vent?

CAPCOM Right. I'd hate to see a propulsive one.

SC You and me both.

END OF TAPE

SC Is that what they call a nonpropulsive descent?
CAPCOM Right. I'd hate to see a propulsive one.
SC You and me, both.
CAPCOM It's going through 50 pounds now, so are you seeing fewer sparklies?
SC Yes. Much fewer. Not any at all, now. I'm not sure whether that's in the reverse Yaw and Roll - left Roll. That's - if that's what it gave me.
CAPCOM You say you think it might have given you some left Roll as opposed to opposite Yaw?
SC I'm sure it gave me Yaw, but I'm not too sure (garbled).
CAPCOM Okay, we'd kind of like to watch it. See what happens for a little while before we make a recommendation. However, we'll need some inputs from you on that
SC Well, we're in no trouble up here as far as - as far as the Yaw goes. Everything's fine. It's faster than we put up before. We wanted to get it above the thermal constraints and it's going to take me 15 minutes to get the thrusters up anyway.
CAPCOM Okay, Skipper. We don't see any thermal problems as a result of this change. If we see some communications problems, we may have to do something different. So far, so good. We'd kind of like to hear from you on LPD numbers if you get anything going by the window.
SC Okay. Will do.
SC Okay, Jack, the Earth just went through at an LPD of 26 degrees.
CAPCOM Okay. The Earth went through at 26 degrees going in the opposite direction this time. Going left to right. Is that right?
SC From left to right. That's affirmative.
CAPCOM Of course, the only other thing that we'd be concerned about is what changes in your velocity you might have had or with DELTA-V imparted, and we'll have to look at that for awhile before (garbled). If there is no significant change, why, we prefer just to leave it the way it is.
SC Okay, Jack. We'll try to get a time on a revolution here, and maybe that'll help you out.
CAPCOM Right, and for your information, the tank went at 1 937.
SC That's two thousand — 1 937?
CAPCOM Right.

SC Okay, Jack, the earth went through again at 18 degrees on the LPD.
CAPCOM Okay, Earth at 18. Thank you.
SC Okay, and we didn't see the Moon that time.
SC Okay, Jack the Moon went througthat time' at 32 degrees on the LPD.
CAPCOM Roger. Moon at 32. Thanks.
SC Okay, Jack. We didn't get the Earth that time. The Moon came back through at about 10 degrees. Now we'll get the Earth again. Standby.
SC Okay. The Earth came through the LPD at 62 degrees that time. And the total time -

END OF TAPE

SC Okay. The earth came through the LPD at 62 degrees that time. And, the total time for the two revolutions, I missed the earth revolution before, but the total time (garbled) for the earth's 2 revolutions (garbled) 60 seconds.

CAPCOM Say again the time and also the LPD number. Your in the background noise, Jack.

SC Okay. Okay, Jack. LPD that time was 62 degrees and that was for 2 revolutions being at that distance we missed the earth and the time before we didn't see it. And the time was 3 minutes and 50 seconds.

CAPCOM Okay. Three minutes and 50 seconds. Is that rate uncomfortable for you?

SC Jack, Jim said it isn't uncomfortable. It's a little annoying as for the OMNI's procedure and also (garbled).

CAPCOM Roger.

SC Okay, Jack. We've got a master alarm and we've got a battery light flickering.

CAPCOM Okay. Copy your battery light. What battery?

CAPCOM Aquarius, how about cycling the power ten monitor to find out which battery it is please.

SC Yes. That's in work, Joe.

SC Okay. It's that same old (garbled) Jack. (garbled)

CAPCOM Okay, Fred. I can hear you now. Say again please.

SC Okay. It's the same old - same old one. The only light I'm getting is on bat B.

CAPCOM Okay, Fred. W e copy - we copy the assemble print battery 2. Can you give us high bit rate for a while please?

CAPCOM Aquarius, Houston. High bit rate please.

SC How you getting it now, Jack?

CAPCOM We got it.

PAO That's flotation and communications officer reports we have high bit rate now. We're taking a look at the battery here in Mission Control to see if we see anything unusual. Battery 2 earlier in the - earlier yesterday caused a master alarm to go off. We took a look at it at the time and could see nothing wrong with it. The battery was put back on the line and at the time it was felt that the problem was a sensor problem rather than a problem with the battery itself.

CAPCOM Okay, Aquarius. You can go low bit rate, power amp off and downvoice backup now. Voltages and currents look normal in battery 2 so ignore the battery light.

SC Okay, Jack. Power amp off, back to low bit rate and I'll go back to sleep.
CAPCOM The battery light staying on?
SC Yes. We got a steady on bat 2, bat fault light and the battery caution light.
CAPCOM Okay. And is the skipper in the sack now?
SC Say again.
CAPCOM Is the skipper in the sack now?
SC Okay. Hold on a minute Jack.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead Houston.
CAPCOM Okay Jim, since the antenna switch is kind of annoying we've talked them into buying only half of the data if it gets too troublesome for you to switch antennas, why just leave it on one antenna and we'll listen to you half of the time.
SC Okay. It's not very much trouble that's all we're doing about it. We'll try to keep up with it. And you're satisfied with this strategy so far, huh. I guess you're going to watch the thermal and find out whether we're going to have to go to some other PTC attitude.
CAPCOM Roger. Thermal appears to be no problem. We're looking at what DELTA V might have been imparted due to this, and it looks like we're not going to change the PTC attitude.
SC Okay. Then DELTA V was a part of helping to raise that angle a little bit.
CAPCOM Yes. We'll be looking at the data here and give you a better answer in next 30 minutes or so.
SC Okay. Meanwhile, back to the drawing board about the no-pro vent.
CAPCOM And with your kind of luck it probably lowered the angle some more.
SC Thanks for the confidence.
CAPCOM And Jim, we're going to have a handover here pretty soon, but in 3 minutes we may lose up-blank for 30 seconds or a minute.
SC Okay.
PAO This is Apollo Control at 109 hours, 27 minutes. Capcom, Jack Lousma, was advising Jim Lovell that we'll be handing over from the tracking site at Goldstone, California to the Honeysuckle, Austrailia site in about 3 minutes. During this handover, for a period of about 30 seconds to a minute we will not be able to up-link to the spacecraft. At about 109 hours, 13 minutes the crew reported a master alarm and a battery light flickering. We had them turn up the, turn on the power amplifier and give us high bit-rate datas so that we could look at the batteries here on the ground. After a look at them they telemetered the LM electrical systems engineer in Mission Control. He said that he was confident the problem was the same one that we'd seen yesterday, in which we probably have a sensor problem rather than a problem with the battery itself, and the sensor is triggering the alarm. The crew is advised to put the battery back on line and leave it there. The super critical helium Burst-Disk ruptured at about 108 hours, 54 minutes, 40 seconds after reaching a pressure of 1937 pounds per square inch. Lovell reported at the time seeing particles coming off, and also the pressure of the escaping gas, which was thought ahead of time to be a - was predicted to be a

PAO non-propulsive vent, turned out to be a very much a propulsive vent. Lovell said that the spacecraft stack which had been rotating about its longitudinal axis at a rate of about 3 revolutions per hour. This rotational rate was stopped by the vent and started up again in the opposite direction, and it is now rotating about one revolution every 2 minutes. One revolution a little less than every 2 minutes, as compared with a revolution every 18 or 19 minutes in the opposite direction prior to the vent. So, that was very much a propulsive vent. Hence, the remarks from Lovell, back to the drawing board on non-propulsive vent. The crew asked if there was any problem with the rotational rate they had as far as the structure of the vehicle and the temperatures on board. After a review of this situation in the span engineering room it was reported that there would be no problem, either with vehicle temperatures or structure, leaving this rotational rate as it is, and we advised the crew to let it continue to rotate at that rate, and the only problem might be in switching from one antenna to the other. Now, this of course, is function -

SC Houston, we're handed over. How do you read?

SC Bringing on a crew Jack.

CAPCOM (Garbled) hear you now and (Garbled)

SC How do you read now?

CAPCOM Okay, that's a lot better, and we figure you're battery glitch was just that thermal switch triggered a mal - a caution and warning just cycled once and triggered a master alarm again. We'll watch the batteries for you, since you don't have any caution warning on them now.

SC Okay, appreciate that.

PAO This is Mission Control. As we were saying, the only problem we, potential problem that we could see with the rapid rotation rate or the more rapid rotation rate of one revolution every 2 minutes might be that the crew would have to switch from one antenna to the next and it was felt that this might be troublesome, however, Lovell reported that it would be no problem and they would attempt to keep up with it. In the event that they miss an antenna switch we would lose data for perhaps 1 minute while the spacecraft rotated around in a position for the other antenna to be received on the ground. At the present time Apollo 13 is 140 934 nautical miles from the earth. Our velocity is up now to 4700 feet per second. The very gradual velocity buildup we've been seeing since crossing the sphere of influence line, the imaginary line in which the earth's gravitational force becomes the dominant gravity force acting on the spacecraft, and we begin to see at that point a gradual acceleration due to earth's gravity.

END OF TAPE

CAPCOM Okay, Jim. Your luck is holding. Your entry angle is gone up to minus 6.24. This is on the basis of all the data we've collected between the midcourse up to the time the SCHE tank went. So we will continue to look at it and see if SCH tank had anything to do with it at all. So it's the data has gone from 5.9 to minus 6.24.

SC That sounds pretty good. We're getting in there.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/16/70,CST 2:58A,GET 109:45:00,472/1

NO VOICE COMMUNICATION ON THIS TAPE

APOLLO 13 MISSION COMMENTARY,4/16/70,CST 3:07A,GET 109:54:00,473/1

CAPCOM How are you doing, Jim?
SC (garlbed)
CAPCOM Is Jack in the sack or is he you?
SC Jack and Fred both are going to sleep. It's sort of humerous, Fred's sleeping place now is in the tunnel, up-side down with his head resting on the ascent engine cover. Jack is on the floor of the LM, with a restraint (garbled) - harness wrapped around his arm to keep him down there.
CAPCOM You say Jack is on the floor, and Fred is with his head on the ascent engine.
SC That's right with his feet up into the tunnel.
PAO This is Apollo Control at 110 hours 2 minutes. That was Jim Lovell reporting that Fred Haise is sleeping at present time in a rather unusual position. Fred sleeping with his feet up into the docking tunnel, and his head is resting on the ascent engine cover which is on the floor of the LM. Relatively up-side down as you in a normal standing position in the LM. Jack Swigert sleeping on the floor of the LM.

END OF TAPE

PAO This is Apollo Control at 110 hours 8 minutes. We estimate that the amount of velocity change imparted to the combined stack of vehicles by the disk rupture and the super critical helium tank was about 2/10 of a foot per second. This amount of velocity DELTA V addition to the spacecraft was able to stop the rotational rates in one direction and start them up in another. The rotational rate had been about 1 revolution every 18 - 19 minutes.

CAPCOM - - hanging in there. Your water's good up to 161 hours now.

SC Hey, that sounds great.

PAO Jack Lousma just advised Jim Lovell that current estimates of water would indicate that he's got - the crew has sufficient water on the LM for 161 hours.

CAPCOM - - for command module water.

SC Very good. Jack, I'd just like to know what plans are being contemplated for the PLSS's or the OPS, whether we're going to use our LiOH canisters or take the devices back in the command module with us or just what will be your plans.

CAPCOM Yes. We're talking all that over now. We haven't decided.

SC Okay.

PAO Jack Lousma was advising Lovell that we have - as I said before, about 161 hours of water on the LM ascent/descent stage based on current consumption rates and this does not include water in which we have available in the command and service module or in the portable life support systems, which would extend that margin somewhat beyond the 161 hours.

PAO And for some 45 minutes or so a fairly sizable group - about a dozen people or so, have been gathered around the flight director's console, discussing the procedures to be followed during reentry. Lovell just asked Jack Lousma what their procedure was being planned for the oxygen purge systems, the emergency oxygen supply carried with the backpack and lithium hydroxide canisters available. On these, Lousma told him that we haven't reached a conclusion on that. The meeting going on around the flight director's console at this time, is involved with that sort of thing. As well as what procedures to be followed as far as jettisoning the LM and service modules - all of these things being considered and discussed. At the present time Apollo 13 is 139 164 nautical miles from the earth travelling at a speed of 4745 feet per second. Also like to clarify again the situation with respect to the super critical helium tank and the burst disk which ruptured at about 180 hours when the pressure got up to some 1937 pounds per square inch. This burst disk is in the tank for the express purpose of keeping

PAO pressure from going above levels which the tank can withstand. Had the disk failed to rupture, we had a backup procedure worked out whereby the tank would be vented manually. Of course, it was not necessary to put this backup into effect because the disk ruptured at about the level it was expected it would. With the burst disk rupturing, what we have effectively lost is the ability to resupply a pressure to the tanks as this pressure is drained off by burning the descent propulsion system engine. However, we do have what is called blow down capability in the engine. That's the pressurization that already exists and which is not lost by depressurizing the super critical helium tank. This - the pressure that is in the propellant tanks remains there, is isolated from the super critical helium tank and is not lost when the first disk ruptures. With this pressurization we still have some 800 feet per second of DELTA V remaining and usable in the descent propulsion system engine.

CAPCOM Everything's running real smooth over in Timber Cove, Jim.

SC Sounds pretty good. How about in El Lago?

CAPCOM Same. Everything's smooth there too.

SC Good.

END OF TAPE

CAPCOM Jim, we've had a lot of people working on the entry procedures, and they'll be continuing to do so. We got a few ideas we'd like to toss at you so you can start thinking about them if you think you're in a position to discuss them without waking up the other guys. What do you think?

SC Yes, go ahead. It's okay.

CAPCOM Okay. One of the first things we want to do is charge the battery in CSM so we can get some LM power over there to do that, and we have procedures gined up to do it. In regards to reentry, we're planning our last midcourse at 5 hours before entry interface, if we have to make one that is. We'd like to jettison the service module at 4 hours and a half roughly before entry interface and take the next 3 to 3 and a half hours for taking pictures bringing up the lunar module G&N, taking care of stowage, and other odds and ends. And we'll hang on to the LM until 1 hour before entry interface, then we'll jettison that. These procedures are going to be run integrated in the CMS and LMS tomorrow morning, and hopefully later on in the day we'll do it again with Mission Control on the loop. A couple of other things we'd like to toss at you. One question is what do we do with the OPS. The thought is that there is adequate 02 in the command module. And that the OPS represents high pressure source and stowage problem, and people are thinking about leaving them in the LM. The other thing is that we think you might want to make this a suited entry, suiting up prior to LM jettison, because what we're doing is when we jettison the LM, we're going to do it like we did in Apollo 10. Just let the beauty go and if we weren't suited , betting on the hatch seal to take care of us. So we thought we'd toss these few ideas at you. Some of them are ones that are particularly impertent questions at this time.

SC Okay. Suited entry was (garbled) back and forth at that time. (garbled)

CAPCOM I'm loosing you, Jim.

END OF TAPE

CAPCOM We're losing you, Jim.
SC Okay. (garbled). Is that right, Jack?
CAPCOM Affirmative, Jim. Mid-course 5 hours prior entry interface.
SC If that's the case, well, all I'm worried about and would like to have squared away is long before that (garbled) I want everything in place. (garbled) stored away, all the bio instruments ready to go (garbled) to Command Module (garbled) power up, jettison the Service Module, and then know exactly how to get into the LM.
CAPCOM Roger. All those procedures will be worked out precisely and we agree that the stowage and all of those verbal details ought to be taken care of before a mid-course.
SC And again as a last resort (garbled) that mid-course fairly early, if we have the power to do so. Mainly becaue of attitude control, this last part is fairly easy, and I'm not too sure how long to configure (garbled). I have the confidence that if everything is under control as it is now, we'll probably be going long before entry.
CAPCOM Yes, that is what we were thinking. I guess the 2 things that are somewhat unresolved are what to do with the OPS and what to do about the suited entry. We thought we'd pass those at you to see what you thought about them.
SC Okay. As far as the OPS is concerned, we have enough oxygen (garbled) to get us through (garbled) Command Module (garbled) prior to entry (garbled).
CAPCOM Jim, I'm sorry. We're not catching what you're saying. The Comm is getting kind of bad right now
SC Okay, Jack. How do you read now?
CAPCOM I've still got you with quite a bit of background noise, but if you talk up, I think we can hear you.
SC Okay. My only concern about leaving the OPS and/or the PLSS in the Command Module(garbled) Command Module consumables prior to entry and the PLSS, and has (garbled).
CAPCOM It sounds like the general jist of your comments are that if things remain pretty much as they are now in the Command Module, you'd just as soon leave the OPS in the LM. Is that affirm?
SC That's affirm.
CAPCOM Okay, and maybe you'd like to think over the suited entry bit a little while.
SC Okay.

SC Houston, Aquarius.
CAPCOM Go ahead.
SC (garbled) how we can aline the Command Module guidance for entry, especially if you have a (garbled DAP. Over.
CAPCOM Roger. That's one subject that's been getting a lot of attention, and let me see if I can get some general ideas on that at the moment.
SC Okay.
CAPCOM Jim, I can give you the general idea. The proposed procedure for bringing the Command Module G and N up. It's the presently proposed one. We may come up with a better one, but here's what we're looking at right now. First thing we plan to do is to use the LM COAS - site on the Earth with the LM just as we did in the mid-course. Then we'll do a body acc -

END OF TAPE

CAPCOM - earth with the LM just as we did in the midcourse. Then we'll do a body axis align 400 plus 5 on the EGA, to put the EGS ball at 000. And, then we can give you an EGS ball attitude to fly to, to point the CSM optics at the moon, and if you can see stars, why we can use those too. Then we can give you an equivalent set of CDU angles to put into noun 20 and to torque the platform over. So, now we're course aligned. Then we do a fine align by shooting at the moon and then at the sun. Do you follow all that?

SC Okay Jack, let me see if I have it. What we do is point the LM at the earth as we did for the midcourse (Garbled) Then we do a body axis align on the EGS. Then you give us an EGS ball attitude to fly to. Do this with the LM, then we (garbled) point the CSM EGS at the moon. Then you give us the update - give us some lines to use to coarse align and the fine align using stars, or moon or earth. Stand by. Okay, we had another master alarm Jack. I don't see the lights on there except the battery lights still there. We put an EGS displace (garbled) Okay, number 2 battery still has a light on it. I expect it is the same problem that we had before. (Garbled)

CAPCOM Okay, let us talk it over a second and we'll tell you what to do.

CAPCOM Jim, is the battery light kind of flickering?

SC Yes. That's affirm Jack. Yes, the battery light's flickering and it triggered off the master alarm.

CAPCOM Okay. Well, that - temperature sets are on battery 2 is kind of cycling back and forth and everytime it does it triggers a master alarm Jim.

SC Okay, same old problem huh?

CAPCOM Yes.

CAPCOM And Jim, finally on the P52 we're considering using the moon and then the sun for the fine align.

SC Okay, The moon and the sun for the fine align. Understand. We'll go through this again here.

SC Okay Jack, once I get the spacecraft at the proper attitude - (garbled)

CAPCOM Jim I didn't copy your last question due to background noise.

SC Okay. Once you get the EGS ball aligned (Garbled) (Garbled) command module.

CAPCOM After we do the body axis align on the EGS we can tell you what attitude on the EGS ball to fly to in order to point the CSM optics at the moon or at some star, and then we can, according to where the optics are pointed, give you an equivalent set of CDU angles to put in noun 20 to torque to platform.

SC Okay, okay.

CAPCOM That's the current thinking. It may change between now and tomorrow, but right now that's the way

CAPCOM it looks Jim. It will probably be some take-off on that anyway.
SC Okay. Are they planning on a G&N entry or another system, GNS (Garbled) or something like that.
CAPCOM It will be a G&N entry.
SC Nothing like going first class.
CAPCOM Yes. That will be a switch won't it.
CAPCOM Jim have you broken it -

END OF TAPE

CAPCOM Jim, are you broken into the food locker in the LM yet?
SC That's affirm, Jack. I sure have. I just put a meal away.
CAPCOM You say you did find everything in order in there?
SC Yes, everything is straight.
CAPCOM Okay. I'll pass it.
CAPCOM I had a question about that earlier.
SC Right.
SC Houston, Aquarius.
CAPCOM Go ahead.
SC I understand that one of your reasons for a suited entry is the fact that the command module hatch (garbled) is still acting good. Out hatch doesn't seem to be any different than any other (garbled) other spaceships..
CAPCOM No. The situation, Jim, is that your hatch is as good as any other hatch, but that we won't have a chance to verify it still so late in the game like 1 hour before entry interface, in this case, whereas before, we had a chance to evaluate it in lunar orbit. Over.
SC Oh, okay.
CAPCOM And that might make your timeline a little too crowded, getting your suits on there at the last minute, say less than an hour before entry interface.
SC Okay.
CAPCOM Jim, the next action item we want to persue is transferring some LM power up to the command module main B so we can start charging battery and I guess what we ought to do is start on that one when somebody else gets up to help you. So when you decide to get the other guys up or to have someone to help, why let us know and we'll start working on that.
SC Okay. I'll let you have Jack and Fred (garbled) When are the timeline (garbled)
CAPCOM Say again, Jim. I didn't catch that.
SC When in our timeline do (garbled) do you plan (garbled)
CAPCOM Jim, I didn't catch all of what you said, but I think you wanted to know when the procedures for entry are going to be available and read up to you. If that's the case, why we're talking about 120 hours or so. As far as the - charging battery A, we want to do that as soon as the other guys get up to help you. We've already passed up some of that procedure and we have a couple of DELTA's to it.
SC Roger. And Jack, (garbled)
CAPCOM Jim, we're having trouble hearing you. The next order of business is to charge battery A and when you get somebody to help you there, why we'll go - get

CAPCOM on with it.
SC Okay, Jack.
CAPCOM And before you start working on it, let us know because we've got some DELTA's to be battery charging procedure.
SC Roger. I'm yelling back on the line now (garbled)
SC (garbled)
CAPCOM Aquarius, did you call?
SC Yes, Jack. I'm on the line (garbled)
CAPCOM Okay. Go ahead now. I can hear better.
SC Okay, Jack. Joe Kerwin passed me up the procedure for powering the CSM from the LM (garbled)
CAPCOM Yes. If you'll get that out, I'll read you the DELTA's.
SC Okay. I've got it.
CAPCOM Okay. The second step was in the LM circuit breakers panel 11 16, ascent ECA control, close two of them - cross that out. In the next line we had battery applied normal feed on, cross out battery prime and put battery 6 in there. In the next line was - -
SC Jack (garbled) Jack, I have for step 3 I have bat 5 and bat 6 normal keyed on. Do you just want bat 6?
CAPCOM That's affirmative. Just bat 6, Jack. And the next line, you had battery 1 and 3. Make that battery 1, 2, 3, and 4. Just add bats 2 and 4. All 4 descent bats.

END OF TAPE

CAPCOM - And the next line you had battery 1 and 3 make that battery 1, 2, 3 and 4. Just add bats 2 and 4, all 4 descent bats. And then the next two lines about waiting 30 minutes, cross that out. And the next line about batteries 2 and 4 off reset, cross that out, too.

CAPCOM And Jack the -

SC Okay. Let me read -

CAPCOM Go ahead.

SC Let me read you all the steps as I've got them and make sure we've got them right. Step 2 will now be BAT 6 (garbled) on. Step 3 bat 1, 2, 3, and 4 off reset.

CAPCOM Okay. That part's alright, Jack. And we had about 11 or 12 steps for the command module. They go as is with no change. And we had another couple procedures for the LM. Stand by one.

SC Okay. Jack, let me read you the command module procedures just to make sure that I have them right, also.

CAPCOM Okay. Go ahead with the command module procedures.

SC Okay. Connect LM and CSM umbilicals. Step 2, panel 5 LM power 1 ac and 2 ac closed, circuit breakers. Step 3, panel 5 (garbled) closed. Step 4, panel (garbled) then there's step 5 main B batt B bus B closed. Down 58 holding then switch to LM power to CSM. Step 7 main B bat bus B open. Panel 15 bat power entry and post landing open. Verified main bus holding.

CAPCOM Okay, Jack. CSM procedures okay, and then we had to go back to the LM and do something. And the first line is okay, cross out bat 5 and 6 off, delete that. And delete the next line also, that says panel 1116 ascent ECA control open. Then we had a couple of notes which remain the same. Go ahead.

SC Okay. I didn't get the dope but I'll read you the steps as I have them now. One step bat 1, 2, 3, and 4 (garbled) have batteries 1, 3, 4 and 6 on. Is that affirmative.

CAPCOM That's affirmative. So now we have bat 1, 2, 3, 4, and 6 on, and I got 2 notes. Number 1 is your circuit breaker protection limites the current to 15 amps. Number 2 note is now the umbilical between the LM and the command module is hot. And the main bus voltage can be monitored by selecting main B.

SC Okay, Jack. Keep those circuit breaker protection limits current to 15 amps. The tube, the umbilical between the CSM and LM is hot. I can monitor main B for a bus voltage.

CAPCOM That's affirm, Jack.

SC Okay, Jack. One question here. If we transfer power like this, we're not going to cut it short

SC on power remaining in the CSM. (garbled)
CAPCOM Say it again, Jack. I didn't get it.
SC Okay. Stand by. If we configure the CSM for powering the LM, we aren't going to cut it short on LM power requirement to get us back in entry interface are we.
CAPCOM That's a negative, Jim. According to the latest update, we've got ampere hours out to 203 hours.
SC Stand by.
SC Jack, one question from Jim is he wants to know whether the procedure (garbled)
CAPCOM Okay. Try it again, now, Jack. What did Jim want to know?
SC Okay. He would like to know whether the procedure has been tried and whether it has been found to be okay. And there's no danger of shorting out any of our batteries or anything we have on board the LM now.
CAPCOM Okay, Jack. This procedure has not been tried out as such however the hardware paths through which the current flows are the same ones as we used during trans-lunar trajectory and there's not a problem which short a descent battery. Over.
SC Okay. I'll relay that to Jim.
CAPCOM Jack, of course the reason for all of this is that we see we're 20 amp hours short on one of the entry batteries, and we've got to juice that up to get you home with.
SC Okay.
CAPCOM Okay. Now, what we owe you from here on out is the actual battery A charge procedure and then a procedure to turn this -

END OF TAPE

CAPCOM Okay, what we owe you from here on out is the actual Battery A charge procedure, and then a procedure to turn this all around again.

SC Okay. Do you have it there, and how long is the (garbled)

CAPCOM Okay, Jack, I have the procedure in front of me. It's about 18 steps, and the reason it's so long is because we're starting from this basic configuration which we gave you earlier. It concerns a charge on Battery A, of course, which is our low one. So, when you're ready to copy it, let me know.

SC Okay. Let's go at it.

CAPCOM Okay. Are you ready to read - copy it?

SC Go.

CAPCOM Okay. On Panel 250, circuit breaker Batt A, power entry/post landing - CLOSE. On Panel 275, circuit breaker inverter power 2, Main B - CLOSE. Next several circuit breakers are on Panel 5, circuit breaker Batt relay Bus, Batt A - CLOSE. Circuit breaker DPS sensor unit, AC Bus 2 - CLOSE. CB DPS sensor signal, AC 2 - CLOSE. CB Battery charger, Main B - CLOSE. Are you still with me?

SC Okay, Jack. I'll read back those steps you gave me so far. Panel 250 CB Batt A, power entry/post landing - CLOSE. Panel 275, CB inverter power 2, Main B- CLOSE, Panel 5 CB Batt relay Bus, Batt A - CLOSE, CB DPS sensor unit, AC Bus2 - CLOSE. CB DPS sensor signal, AC 2 CLOSE, CB Battery charger, Main B - CLOSE.

CAPCOM Okay. Good readback, Jack. The only one is number one - number 4. I didn't get your readback, but it's DPS sensor unit AC Bus 2 - CLOSE. You got that?

SC Yes. I read that back, Jack. CLOSE.

CAPCOM Okay to continue on. The same Panel Panel 5. Circuit breaker, Battery charger, AC power - CLOSE. Circuit breaker Battery Charger, Batt A charge - CLOSE. Circuit breaker inverter control 2 - CLOSE. Circuit breaker ionverter control 3 - CLOSE. I've got a switch for you. Main Bus Tie, Batt A/C, OFF, and another switch, Battery Charge, AC 2. Read those back.

SC Okay, Jack, CB Batt Charger, AC power CLOSE. Standby. Okay, I had to get a light here. CB Batt Charger, Batt A charge - CLOSE. CB inverter control 2 - CLOSE. CB inverter control 3 - CLOSE. The two switches, Main Bus Tie, Batt A/C, OFF, and the second one Batt Charger 2

CAPCOM Okay. That's a good readback. How

CAPCOM How about reaching over there on your right hand side and turning the biomed out. To see if we can improve the comm a little bit

SC Okay. How do you read now?

CAPCOM Okay. I'm reading you real good now, and I want to verify that the Main Bus Tie that we switched OFF was PAD ALPHA Charlie.

SC That's fine. Main Bus Tie BATT ALPHA Charlie. (garbled).

CAPCOM Okay, and in Panel 3. We've got a switch for you. AC inverter 2 to Main B.

SC Okay. AC inverter 2 to Main B.

CAPCOM Okay, and switch inverter 2, AC Bus 2 to ON. Another switch AC Bus 2 Reset - to Reset, and center. Switch Battery charge to ALPHA. Switch DC indicator select Batt charger, and then what we want you to do is to report the charger current and voltage to MSFN every 10 minutes for the first half hour, and then once every 30 minutes after that. And that'll be on our call, Jack. Read back the switches that I just gave you.

SC Okay, Jack. Panel 3 AC inverter 2, Main B, AC inverter 2 , Bus 2 - ON. AC Bus 2 Reset to Reset and center. Batt charger A, AC indicator select Batt charger. Report in amps and volts to MSFN every 10 minutes for the first 30 minutes, and then every 30 minutes on a MSFN call.

CAPCOM Okay. That's a good readback, Jack. Now the only thing we owe you is a turnaround that you missed which you will have.

SC Okay, let me ask one question. About how long do you think it'll take to charge these batteries?

CAPCOM It'll take you about 15 hours.

SC Jack, about how many amperes of LM power will this (garbled)

CAPCOM Standby, we'll get it for you -

SC How many, Jack? (garbled)

END OF TAPE

CAPCOM Stand by. We'll get it for you.
SC (garbled)
CAPCOM Okay, Jack. That's going to take 120 amp hours out of the LM which is equivalent to 10 hours, which will put us back to 193 hours and that's plenty.
SC Okay. Let me relay that to Jim here.
SC Okay, Jack. One question here. If we have any problems sending up this LM power to the CSM, is the quickest way to get out of it, return to the normal configuration as it would be to just switch the LM power to CSM to reset then off?
CAPCOM Stand by one.
SC I would like to give one quick step that gave Jim report some sort of problem for us to get out of it quickly.
CAPCOM Okay. Let us talk it over a few minutes here.
SC Okay. Real fine.
SC And while you guys are talking it over you might read back, have you got the procedure for reversing this I'll copy that..
SC Okay, Jack, are you with me?
CAPCOM Yes. We're still here, Jack. We want to do is follow you through on this so we're going to get high bit rate to do it. In answer to your question, to undo this procedure quickly, in the event of a problem develops,be sure that you don't touch the LM power switch cause it's got a reset position. But the way to undo it is go to the CSM and on panel 5 open two circuit breakers. And they're some of the first ones we read to you. Open LM power 1 main B and open LM power 2 main B. You copy that?
SC Okay. Understand. If I want to get out of this real quickly I have to open just 2 circuit breakers in the CSM, that's on panel 5, LM power 1 main B, LM power 2 main B.
CAPCOM Okay. And before you go ahead with those, let's establish the high bit rate and wait one on that. And then as we go through the procedure we want you to wait when you get power on main B so we can take a look at main B without any lobes on it before we start charging batteries.
SC Okay. I understand you want high bit rates on the LM or CSM just before we start this.
CAPCOM That will be high bit rate on the LM and stand by for it.
SC Okay.
CAPCOM Okay, Jack, before we go ahead with this what we want to do is read you the reverse - normal

CAPCOM reverse procedure.
SC Okay. I'm ready to copy.
CAPCOM Okay, Jack, I got the start on how you reverse this procedure. Ready to copy?
SC Go ahead, Jack.
CAPCOM Okay. First you want to reverse the battery charge procedure. To do that on panel 3, switch battery charge off, ac inverter 2 off, panel 5 main bus tie bat ALPHA CHARLIE on up, panel 250, circuit breaker bat Alpha, power entry and post-landing open. Readback
SC Okay, Jack. On panel 3, battery charger off, ac inverter 2 off, for panel 5 main bus ties Alpha Charlie on, panel 250 CB bat A, power entry and post-landing open.
CAPCOM That's affirmative, Jack, and then if you'll go back to 'the rest of the circuit breakers on that list, just opposite - open them all up - stand by one.
CAPCCOM Okay, Jack. Go back to the battery charge procedure I gave you. And in order to terminate charge just - you'll just have to write open and off next to the circuit switch that I gave you. So on panel 250, that circuit breaker you've already opened. On panel 275, inverter power 2 main B open, panel 5 bat relay bus bat A open, EPS sensor unit ac bus 2 open, EPS sensor signal ACQ open, battery charger main B open, battery charger ac power open, battery charger bat A charge open, inverter control 2 open, inverter control 3 open, you've already done the main bus time, bat charge switch to ac 1. Over on panel 3, you have already set the ac inverter 2 to off then inverter 2 ac bus 2 off, ac bus 2 reset to off

END OF TAPE

CAPCOM reset to off. You have already put the battery charger switch to off, and your DC indicator select main B. Over.

SC Okay Jack, do you want me to read it back to you?

CAPCOM No, if you've got something in the right-hand column for all of those we don't have to do it. And now one more thing I owe you is how to untransfer LM power to the CSM, and I'll get that for you in a jiffy.

SC Okay, I'll be standing by to copy it.

CAPCOM Okay. We have a last minute change to that.

PAO This is Apollo Control at 111 hours, 30 minutes. The procedure being read up to the crew by Capcom Jack Lousma, is for recharging one of the three entry batteries on the command module, battery A which is down about 20 amp-hours. A full load on the entry batteries is nominally about 40 amp-hours, and we understand the other two batteries, B and C are essentially fully charged. Battery A is down about 20 amp-hours and their plan is to replace the energy in the command module battery A with electrical energy from the lunar module. This procedure will require about 15 hours of charging time, and will draw a total of about 8 amps from the LM.

SC (Garbled) but I just want you to figure up (Garbled) and show me when to power up and (Garbled) Yes I think so. (Garbled)

CAPCOM Go ahead.

SC Okay Jack. What thing - I guess you probably all have considered it, but what heavy things can we store down there where the SRC normally goes to help increase our L/D?

CAPCOM I understand the question is what kind of heavy things can you store where the SRC goes.

SC Yes. They go down under the LAT underneath the computer and the heavier things you have down there increases the L/D. We don't have and SRC so I was just wondering what heavy things - -

SC We could probably put some cameras, television cameras, things like that that normally pretty heavy down there in that inner SRC - no we can't put them there (Garbled) put in them in that container down there which would help decrease our L over D. Anything else you can think of would be greatly appreciated because we don't even have a throw away station so we're down a little bit in L over D.

CAPCOM Okay, let me pass that question along and get somebody working on it.

CAPCOM Souvenirs I guess.

SC What souvenirs? All I've got is a Marine Corps foxhole digging shovel.

CAPCOM You've got all you need then buddy.

CAPCOM Okay, ready to copy the power removal from

CAPCOM the command module LM umbilical.
SC I'm ready to copy. Go ahead.
CAPCOM Okay. This one assumes that all the descent batteries are in line and ascent battery 6 is on normal feed, as we said earlier. First thing you do is go in the CSM and look on panel 5 circuit breaker. LM power 2 main B open. LM power 1 main A open, circuit breaker APS sensor signal main B open.
SC Hey Jack.
CAPCOM Go ahead.

END OF TAPE

SC (garbled) got just a little bit scratchy there because of the antenna problem. (Garbled)

SC Okay. What I got, Jack, was the procedure assumes that all these descent batteries are on and bat 6 is on normal C. Now we're going into the LM and on panel 5 we take LM (garbled) LM 4 2 BC open. And that's as far as I got.

CAPCOM Okay the second one is on panel 5 also. Circuit breaker, LM power 1. Main A open, circuit breaker EPS sensor signal, main B open. Okay, read those back with the CSM and I'll give you some steps in the LM.

SC Okay.

SC Okay. CB LM 4 2 BF open, CB LM 41 main A open, CB EPS sensor signal main B open. Stand by one.

SC Jack, I don't think we ever closed CB LM 41 main A. We closed LM 42 BC and LM power BC. Both of them on main B

CAPCOM Yes, you're right. Both of them should be main B.

SC Okay. Copy that.

CAPCOM Okay. Ready to copy the LM.

SC Okay.

CAPCOM Okay. On panel 16 circuit breaker APS bat B ties, 2 open, and now you've got to listen real carefully for high volts and low volts. Battery 1 high volts, to off reset, battery 2 low volts to off reset and then on, battery 2 high volts to off reset and then on, battery 1 high volts on and in the circuit breaker on panel 16 EPS. Bat B ties, both of them closed. Read back.

SC Okay. On the LM side of the house is on panel 16. CB APS bat B ties 2 open, battery 1 high voltage off reset, battery 2 low voltage off reset then on, battery 2 high voltage off reset then on, battery 1 high voltage on. Panel 16 CB batt B ties 2 closed.

CAPCOM Okay. That's a good readback. It concludes the procedure going both ways and now we just have to stand by.

SC Okay when do you plan to start this.

CAPCOM Start them soon.

SC Did you say not soon?

CAPCOM No, we're going to do it pretty soon, but we want to have high bit rate and we don't want you to give that to us till we tell you.

SC Okay. I think I'll go back and to undamp a bit. Do you have anything more for the command module?

CAPCOM We're discussing two items. We don't have them ready right now.

SC One of them, I hope is a full proof alignment

SC procedure.
SC Okay, Jack. J ust for curiosity sake, does FIDO have any information to whether that helium - that dump effected our trajectory at all.
CAPCOM Okay, Aquarius, our tracking data shows that since your helium dump our entry angle has not changed from it's value of 6.24 and somebody calculated that if we had a propulsive vent that helium could roughly at the maximum only in part DELTA-V of a half a foot per second or less anyway. But we're continuing to track and as soon as we get some more info we'll pass it along.
SC Okay. That's swell, Jack. Thank you
CAPCOM Sure.
SC Your 6.24 sounds good.
SC (garbled)
CAPCOM They said it would be a while because they want to get a high bit rate. They don't want (garbled).
CAPCOM Okay, Aquarius, we're ready. So we want some high bit rate. To do that go over to panel 16 under COMM and close the primary S-BAND power amplifier. On your COMM panel -
SC Okay. Okay, Jack. Wait one. I'd like to get (garbled) up if you don't mind.
CAPCOM Okay.
SC (Garbled).

END OF TAPE

CAPCOM Okay.
SC (garbled) want to transfer power. I want to go to high bit rate here first, then want to transfer LM power to CSM (garbled).
CAPCOM Aquarius, there's no great big rush, if you want to let Fred come up to speed feet slowly, why maybe it'll help out.
SC Houston, Jack (garbled) before he stood up.
CAPCOM Say again, Jim.
CAPCOM Aquarius, how do you read?
SC Loud and clear.
CAPCOM Okay. I'm hearing you now. I think I missed your last transmission, Jim.
SC Okay. Jack is showing to Fred the procedures, want to get him familiarized with (garbled) how to get out of any problems before he proceeds.
CAPCOM Roger. No rush. Just let us know when you're ready. We don't want old Fred-0 to slip a gimbal there.
SC Yes. We're watching him.
SC Boy, if you took another 20 hours out. Okay. Have I done what?
SC Houston, Aquarius.
CAPCOM Hello, Fred. Go ahead.
SC Okay. I guess the only question I have is in the first - the very first portion involving the LM here. Where I have to turn on the only Batt 6, and then turn off all the descent batteries. You still read me?
CAPCOM Okay. I read you until after turn off Batt 6 - correction turn ON only Batt 6.
SC Okay. The question is the only one, one ascent battery that sticks on the line immediately followed by turning off 4 descent batteries. Is that correct?
CAPCOM That's affirmative, Fred. That question has been banged around and we decided to go that way.
SC Let's see, we will be powering other bus (garbled)
CAPCOM That's affirmative, and we're reading a turn on llamps right now.
SC Okay. Okay. I guess I'm ready. How many amps?
CAPCOM And, after you turn Batt 6 on align, then you might as well take a look at the Batts 1 through 4 and so forth, and make sure that it's okay to turn them off.
SC Roger. Are your ready, gang?
CAPCOM Yes, we're ready for the power amplifier and the high bit rate, and the normal voice. And, your function switch please.
SC Okay.

CAPCOM Okay, gang, we've got the high bit rate now.
SC All right.
CAPCOM Okay, we see Batt 6 on and it looks good, Fred-O.
SC Okay, am I cleared to proceed with the next step?

END OF TAPE

SC Correct.
CAPCOM Okay. We see bat 6 on and it looks good, Fred.
SC Okay. Am I cleared to proceed with the next step, getting 1, 2, 3, and 4 all free sets.
CAPCOM Affirmative. You're cleared for bats 1 through 4 on resets.
SC Okay.
CAPCOM Okay. Still looks good.
SC Okay, Houston. We need a call from you when to have Jack to proceed up into the Odyssey and start up there.
CAPCOM Okay. Aquarius. And Jack can get with it right now.
SC Okay.
SC Okay, Houston. Aquarius. We've completed the power up and things look good up stairs. Are we go for proceeding with battery charges?
CAPCOM Okay, Aquarius. You're go on the battery change.
SC Roger.
SC Boy, this is really a switch, isn't it, Jack?
CAPCOM That's an understatement.
CAPCOM You're not known for that.
SC Yes. I think if you add up the - yes - if you add up the operating time, I think the LM beats the CSM at considerable margin on this flight.
CAPCOM Grumman just hired you.
SC Yes.
CAPCOM You're out there at 134 thousand, coming in at about 4900 feet a second.
SC Very good.
CAPCOM The super crit tank went off at about 1937 just about like it expected.
SC Yes. It also must of not did very much except the rates. I was asleep then and I didn't hear a thing.
CAPCOM Is the command - service module still down?
SC Jack said it was just before he went up. Right now the sun's over there and I can't really tell. I'll look again in a munite.
CAPCOM We asked a long time ago if he was able to see any stars out the optics. I don't think we ever got an answer.
SC Okay.
SC That's a pretty good sleep station

SC ahead there rigged up, Jack. I took one of the sleep restraints out of the command module, zipped up in it and then hooked the tie right in the top of the zipper onto the LM upper hatch handle. So it kind of held me there and then stripped it up in the tunnel upside down with my face toward the hatch so the sunlight didn't get in my eyes and that worked pretty good.

CAPCOM Did you sleep pretty well that way?

SC Yes. No problem at all.

PAO That's Fred Haise talking.

CAPCOM - - that way now or is he standing next to you?

SC He's standing next to me.

CAPCOM About time for him to go to bed.

SC Okay. The voltage upstairs is 34.3 and the charger is reading 2.5 amps.

CAPCOM Okay 34.3 and 2.5. And (garbled)

SC (garbled) pretty cold. Good.

CAPCOM Say again your last.

SC They both came down here rubbing their hands shivering. It's pretty cool upstairs.

CAPCOM Are you keeping warm in the LM?

SC Yes. It's pretty reasonable down here.

SC Okay. And right now (garbled) Right now it looks like the command module is finished, Jack so I'm going to try to take a look at the optics.

CAPCOM Okay. You say it is not running?

SC Yes. That's the word. We're going to do AOT and you can't fit anything back there.

CAPCOM Okay. And everything's fine in El Lago.

SC Very good.

CAPCOM Aquarius, we're ready to secure the high bit rate.

SC Okay.

END OF TAPE

SC Houston, Aquarius. How do you read?
CAPCOM There's a lot of background noise, Aquarius.
SC Okay. How now. I just switched OMNI again.
PAO This is Apollo Control at 112 hours 18 minutes. The crew at this point has successfully completed the transfer of power from the LM onto the Command Module Main Bus B, and from there into the Battery Charger which is charging Battery A, one of the 3 entry batteries used for entry and post landing electrical power aboard the Command Module. The hope is to bring this battery from its current level of 20 amperes up to about 40 amperes which would be essentially a full charge on Battery A. The other two batteries, Battery B and C already being at full charge. The charging operation on Battery A is expected to required about 15 hours, and it began at 112 hours, 12 minutes ground elapsed time. You heard Fred Haise report that Jim Lovell and Jack Swigert had gone into the Command Module to power up the Battery Charger and check on the readings there. When they came back down, Fred said they were rubbing their hands, and noted that it was a bit chilly in the Command Module. At the present time Apollo 13 is 133 158 nautical miles from Earth and the spacecraft velocity is up now to 4 891 feet per second. We're 30 hours 20 minutes 50 seconds from reentry, and according to the revised flight plan at 112 hours the three crewmen should be getting something to eat and also you heard CAPCOM, Jack Lousma advise Jim Lovell that it appears to be about time for him to get a bit of rest. The crew rest cycle has been left up to them. Our flight plan on one of the large displays here in Mission Control has some suggeseyd times for sleep, but the crew has generally been working out their own sleep schedules as convienent for them, and following it, and we don't have an extremely good idea of when they plan to in advance, but only add to the fact when they report to us that they have gotten some sleep. At 112 hours 21 minutes, this is Apollo Control, Houston.
CAPCOM Aquarius, could you get an amps and volts readout from Odyssey please?
SC Okay. Standby. CMP is dotting across there. You'd be amazed at how proficient you get at transferring to the tunnel after the first thousand passages.
CAPCOM I didn't get your last there, Fred-O. We'd like you to verify that your power amplifier circuit breaker is open.
SC Okay. That's verified. Power amplifier breaker is open.
CAPCOM Roger.

SC Okay. Jack, that's 34.6 volts and just a little bit under 2.5 amps.
CAPCOM Okay, Fed. Copied 2.5 amps. Say again the volts please.
SC 34.3 and that was just a little bit below (garbled).
CAPCOM 34.3. Thank you.
CAPCOM Fred-O, I didn't copy the last. Say again please.
SC Okay and the voltage is 34 -

END OF TAPE

SC Okay. And, the voltage it's 34.6, 34.6 amps slightly below 2.5.
CAPCOM 34.6 and a little below 2.5. Thank you.
SC We're (garbled) side here, Jack. Get in some intervals here, Jack, where we can't hardly get a reading with either OMNI.
SC Houston, Aquarius.
CAPCOM Go ahead Aquarius.
SC Okay. Jack reports from upstairs that he can see stars and constellations out of the optic with the sun angle is such that it is reflecting off the portion of the LM QUAD (garbled) right now.
CAPCOM Okay. The part I got was that he can see stars and constellations and there is some sunlight reflected off the QUADS. That's all I got.
SC The point being that at least in the present orientation you have to kind of wait till the sun isn't reflected off the LM.
CAPCOM Okay. What you're saying is that you're going to have to wait till the there is no sun reflection on the LM to see the stars. Is that right?
SC Yes. That's for the present orientation, of course - but later on if you stop the moving around (garbled)
CAPCOM Okay, Fredo. We need a volt and amps reading.
SC Okay. Bring it back upstairs.
2.
SC Okay. The volt 35.0, amp 2.4.
CAPCOM Okay. 35.0 and 2.4. Thank you.

END OF TAPE

CAPCOM The weather prediction for your landing area still good, 2000 scattered high scattered, 4 foot seas, 15 knots wind. There's a hurricane 500 miles to the west, which doesn't hold a problem.

SC A hurricane or a typhoon?

END OF TAPE

CAPCOM Aquarius, Houston. We need another readout on amps and volts and that will be our last one for a half hour. Over

SC Okay, the reading is 37.8 volts, 2.3 amps.

CAPCOM Say again Fred.

SC 37.8 volts, 2.3 amps.

CAPCOM 37.8 and 2.3, and that will be our last one for a half hour. Thank you. And I'm about to exercise my fifth general order here and pass it along to Joe.

SC Yes, it must be getting around a mealtime.

PAO This is Apollo Control at 112 hours, 50 minutes. We're in the process of a shift handover at the present time in Mission Control. Flight director Glen Lunney is replacing flight director Milton Windier. The capsule communicator on the upcoming shift will be astronaut Joe Kirwin. At the present time Apollo 13 is 131 712 nautical miles from earth. The spacecraft velocity is up now to 4928 feet per second.

PAO Repeating a figure passed on a little while ago, the flight dynamics officer reports that as a result of the midcourse correction the flight path angle at entry is within the entry corridor. The flight path angle currently appears to be minus 6.24 degrees at entry interface. The nominal flight path angle is 6.5 and that is what the midcourse correction was targeted for. 6.24, a negative 6.24 degrees is within the entry corridor and a descision has not been at this time as to whether any subsequent midcourse corrections will be required. At 112 hours, 51 minutes, this is Mission Control, Houston.

PAO This is Apollo Control at 112 hours, 55 minutes. EECOM, the command module electrical and evironmental control engineer reported that the power transfer to the command module main bus B is continuing to function smoothly and the battery charging operation also progressing well at this time. Battery A, one of three entry batteries aboard the command module, is being recharged, and EECOM reports that it appears to be taking a charge well. At 112 hours, 56 minutes Apollo 13 is 131 400 -

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 6:09A GET 112:56:00 490/1

PAO - - at 112 hours 56 minutes Apollo 13 is 131 426 nautical miles from earth and travelling at a speed of 4935 feet per second. We're now 29 hours 44 minutes from reentry.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/16/70,CST 6:19A,GET 113:06:00,491/1

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Okay this is your friendly do-it-yourself kit along with a suggested procedure in the lithium hydroxide situation. You're looking good. We read 1.8 millimeters, and you do have sufficient LM food to last you the rest of the flight. However, being on the conservative side, we would like to use one more set of Command Module canisters to guard against some possible problems (garbled). I have a central flight procedure to do (garbled).
CAPCOM I think I read you through already (garbled) this consists of getting a second pair of cartridges out of the Command Module. Putting one band of sticky tape that is the gray tape with the sticky side out around the sides of each canister near the top. Taking a piece of EVA cue card and cutting it into 4 squares about -

END OF TAPE

CAPCOM Taking a piece of EVA cue card and cutting it into 4 squares about 2 or 3 inches on each side, bending those at a right angle to form corner support. Attaching them to the sticky tape, so that they'll stick up and overlap the old canister, and then simply putting the old canister next to the new canister and taping it up real good so that it sticks together. The only other procedure is to remove the towel plug from the old cartridges and put it in the bottom of the new cartridges, and that's it. Over.

SC Okay, as I read you, we get the LM tape and fold it so that we get around the outside of the canisters (garbled) overlap the base of the (garbled) take the towel (garbled)

CAPCOM Okay, Fred. I think you got it. I didn't completely copy your readback, but it's just that simple, by just putting the new cartridge - the top of the new cartridge against the bottom of the old one, moving that towel plug, using the cue cards as little corner of stiffeners and taping it off .

SC Okay. The top of the new against the bottom of the old.

CAPCOM Roger that. That way you don't have to touch the hose.

SC (garbled)

CAPCOM Okay. Go ahead.

SC (garbled)

CAPCOM I'm afraid I didn't copy that Fred, and while I was listening E Comm told me that he'd like another battery charge in the hour.

SC Houston, Aquarius.

CAPCOM Aquarius, Houston. Go.

SC You wanted to (garbled) this lithium hydroxide (garbled).

CAPCOM It's not time critical, Fred, but if you have the people awake now, you might go ahead and do it. Incidentally you probably know this, but the next several hours are going to be pretty quiet from our point of view. We're working on the entry procedures and should be ready to read them off to you in about 8 hours, and between now and then there's not an awful lot that's going to be going on, so you guys could be catching up on your sleep schedule.

SC Okay.

CAPCOM We would like to have a readout on the amps and volts.

SC I heard you.

SC Okay the volts go at 38.9 and the amps at 1.9.

CAPCOM Okay. Copy that, Fred. Thank you very much. 38.9 and 1.9, and E Comm is simply making a smooth a plot as he can to verify the amount of beams you're putting back into the battery. That's why he wants it at half hour intervals. If that schedule begins to interfere seriously with your rest cycle or so, give us a call.

SC Okay.

SC Jim is sleeping now, and Jack and I are awake and I just finished sleeping around another 5 or 6 hours to go. I think we'd planned to go back to sleep now.

CAPCOM Okay.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 6:40A GET 113:27 493/1

PAO This is Apollo Control 113 hours 28 minutes ground elapse time. The Black Team of flight controllers is presently taking over here in the Mission Control Center. We're estimating about 15 minutes for the Change of Shift Press Briefing with Maroon Team Flight Director Milton Windler. in the MSC main autorium. It appears that the shift will be primarily a sleep shift with a few minor items to be taken care of by the crew such as attaching additional lithium hydroxide canisters to the devices that were fabricated on board the spacecraft yesterday. Instead of taking the canisters out, they will simply attach another one in parallel with the canisters that are in the plastic bags attached to the SUIT hoses. Presently, Apollo 13 129 791 nautical miles out from Earth. Approaching at a velocity of 4977 feet per second. At 113 hours 30 minutes ground elapse time and standing by, this is Apollo Control.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC Okay. We've got one of them ready to go and it looks like we could do a pretty good job just using the (garble) strips. First combine the two together and then just use a piece of paper (Garbled)
CAPCOM Hey, okay Fred. We suspected that you'd gotten at least one on. We've noticed a partial pressure drop from 1.8 to 0.8, which is real good.
SC Okay. You might run that by the (Garbled) improve our in-house MOD.
CAPCOM Roger Jack.
CAPCOM Aquarius, Houston.
CAPCOM Aquarius, Houston.
SC Go ahead, Joe.
CAPCOM Roger. We're convening the CPCB on that change Fred, but flight has given you an interim go ahead. Over.
CAPCOM Okay.
PAO This is Apollo Control. Participants in today's, this morning's change of shift press conference, Milton Windler, maroon team flight director, is now en route to the main auditorium, should be starting within the next few minutes and this is Apollo Control.

END OF TAPE

SC And let me read that.
CAPCOM Not too bad, Fred.
SC Okay. We've got both canisters completed now.
CAPCOM Okay. Roger that, Fred. And you're reading 0.1 again in the CO2. Incidentally, are - -

END OF TAPE

CAPCOM Not too bad Fred.
SC Okay, we've got both canisters completed now.
CAPCOM Okay, roger that Fred and you're reading 0.1 again on the CO2. Incidentally, are you guys having good luck getting water out of the Command Module?
SC We - we haven't tried that yet today.
CAPCOM Okay.
SC Bill this is quite an apparatus hanging on to these coasters now and that ECS (GARBLE) doesn't seem to work.
CAPCOM Roger, that.
CAPCOM And, Aquarius, Houston at your convenience we'd like another volts and amps readout.
SC How do you read, Bill?
CAPCOM Pretty good, Fred.
SC Stay about 39 point zero and 1.7.
CAPCOM 39.0, 1.7. Thank you.
CAPCOM Aquarius, Houston. Go ahead. You're pretty weak.
SC I'm disappointed, Joe.
CAPCOM Say again.
SC I just squawked.
CAPCOM Oh, sorry about that. Incidentally, Fred, if switching OMNI's every couple of minutes bugs you you can skip it for now. We can always wait til you come around.
SC All right that's the last (GARBLE)
CAPCOM Okay.
SC (GARBLE) Okay, it's just good to know you are standing by.
CAPCOM Roger that, except I'm sitting by.
SC Did that (GARBLE) get done?

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST7:21A GET 114:08:00 497/1

NO VOICE COMMUNICATION.

END OF TAPE

SC Joe, (garble) my right over here? Are we coming back to the (garble)

CAPCOM Okay, Jack, the clock shows you about 130 000 miles out which is about 8 or 10 thousand miles closer than you were when you came out a couple of hours ago. and let me check the flight up to you. Ready to play.

CAPCOM Hey, Jack. Over.

SC Go ahead.

CAPCOM Your smiling fido says you're making 5040 in a 5000 miles zone.

SC Okay. (garble)

END OF TAPE

CAPCOM Aquarius, Houston; over.
AQUARIUS Joe, Go ahead.
CAPCOM Roger, Jack; hate to keep bugging you, but we would like another volts and amps reading. Over.
AQUARIUS Okay - I'll get it for you.
CAPCOM Good show.
AQUARIUS Joe, did our (garbled) MOD on that (garble) canister work? How is our (garbled)?
CAPCOM Jack, I think you asked if the canister MOD was working and the answer is it sure as hell was.
AQUARIUS I got the voltage - 39.0 and 1.75.
CAPCOM I copied; 39.0 and 1.75.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 7:47A GET 114:35:10 500/1

PAO This is Apollo Control 114 hours 46 minutes ground elapsed time. Rather quietat the present time, very little communications with the spacecraft, which now is 126 029 nautical miles out from earth, approach velocity 5076 feet per second, electrical power usage hovering around 12, 13 amps, partial pressure carbon dioxide in the lunar module cabin 1/10th of a millimeter of mercury. The addition of the 2 command module lithium hydroxide scrubber canisters to the homemade device rigged up yesterday by the crew of Apollo 13 has reduced this quantity of carbon dioxide from slightly over 1 millimeter piped down to 1/10th. Apollo 13 total weight standing at 87 740 pounds. There goes a call I believe to the spacecraft.

PAO Apparently it was an accidental nudge of the king switch at the capsule communicator's console causing the familiar beep beep sound. In some other spacecraft onboard readings we're showing now 33.17 pounds of oxygen in the descent stage, 2.25 pounds is ascent tank 1, 2.67 pounds ascent tank 2. Water quantities: Descent 51.9 pounds; ascent tank 1, 42.1; ascent tank 2, 42.1 pounds; cabin pressure, 4.98 pounds per square inch, showing a temperature of 51 degrees, which is - the measurement is taken at the outlet and does not represent the free air temperature in the cabin, which is probably up around 70. As mentioned earlier, Apollo 13 gross weight of both vehicles is now 87 740 pounds. Of this weight 58 728 pounds are rocket propellant, about 29 tons. This computes out to 67 percent of the total vehicle weight in propellants. Apollo 13 is the fifth time that a manned spacecraft has made the return from the moon. Apollo 8 back in December of 68 was a somewhat conservative approach using the command and service module only, and going into lunar orbit, having quite a large margin of propellant available to go into lunar orbit and to make trans-earth injection out of lunar orbit back toward earth. Apollo 10, the all up spacecraft, went into lunar orbit, did everything but the actual landing, including the descent orbit down to about 8 miles above the moon, stopped short of making the descent and here again there were adequate margins of propellant and with Apollo 11 the landing was made. And Apollo 12 was essentially a repeat as far as the amount of propellants and the spacecraft performance were concerned. At any rate, all of these had smaller amounts or smaller quantities of propellant available than Apollo 13 does at the present time. The service pro-pulsion system propellant on Apollo 13 stand untapped at 40 796 pounds. This was for planned total DELTA-V or velocity change of some 6975 feet per second with various vehicle combinations, not just command/service module alone, but in some cases, such as lunar orbit insertion and DOI where you have the total LM and command module combination, and others, the transearth injection where only the command and service

PAO module would use up some 3147 feet per second. There are 11 093 pounds of descent propulsion propellant remaining. However, not all of this is available since the supercritical helium burst disc relief valve blew during the night. There's about 800 feet per second blow down -

END OF TAPE

PAO Relief valves blew during the night. There is about 800 feet per second blow down or ullage volume in the descent propulsion tanks so not all of this 11 000 pounds are available. In the untapped ascent propellant tanks we have 5242 pounds loaded. Service Module reaction control system 1342 pounds are still relatively untapped except for the small attitude usage that was made during the trans-lunar coast prior to the time that the fuel cells gave up the ghost. In the Command Module reaction control system this is still a sealed dual ring system in the Command Module for attitude control during entry. There are 245 pounds of propellant available there. When the service module and lunar module are jettisoned prior to entry approximately 29 tons of what is jettisoned to enter the atmosphere and burn up will be propellant. The spaceflight meteorology group of the weather bureau said this morning that weather conditions would be acceptable for Apollo 13's landing in the Pacific Ocean, Friday, April 17, and the planned recovery area which is centered about 560 miles Southeast of Samoa, skys will be partly cloudly with widely scattered showers. Easterly winds at 15 knots and seas about 4 feet are expected with 75 degree temperature. Helen a small, weak, tropical storm is predicted to be about 500 miles west of the recovery area and should not affect the landing or recovery of Apollo 13. Conversation underway with Apollo 13, let's join in.

CAPCOM Gee whiz, Jack, I - when did it happen. Over.

SC Just now. I just gotten back.

CAPCOM Oh, okay. We had a handover but that was about a half an hour ago and I didn't call you on it. Let me check with ENCO and see if he thinks everythings okay. Your COMM sounds just as good as its ever been.

SC Yeah, we're in good shape.

CAPCOM Jack, Houston. Over.

SC (GARBLE)

CAPCOM Rog. We're checking into it. We think we've lost (GARBLE) in Madrid for a while.

SC (GARBLE)

CAPCOM You're getting a little weak. Did you say you wanted to verify what - what your (garble) perigee is, over.

SC Yes. (garble)

CAPCOM Jack, Houston. Over.

SC All right, go ahead.

END OF TAPE

SC Hi, Go ahead.

CAPCOM Okay. The good fido give us a vacuum perigee at the present time of 23.6 with a flight path angle of minus 125 degrees. That's without a midcourse. He's kinda tossing around the idea of doing a midcourse 7 maneuver at 5 hours before entry. If we do it, it looks like it won't be more than 2 feet per second.

SC Okay.

CAPCOM And, Jack, Houston. We verify that that comm problem was a ground problem.

SC Okay. Thank you. And fido is really good for the day.

CAPCOM Oh, he's having a ball.

SC It must be because we haven't made any waste water dumps.

CAPCOM (Laughter).

SC Okay. You can tell Jay and David that I went for a whole flight and didn't use the bathroom.

CAPCOM (Laughter). He copies that. David, here, he says you've kept him so busy he hasn't had time to work at his sterio all week.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Jack, we'd like another voltage check.
SC Okay, Houston. It's 39.2 volts 1.6 amps.
SC Okay. Thank you. We copy. 39.2 volts and 1.6 AMPS.
SC Right.

END OF TAPE

PAO This is Apollo Control 115 hours, 14 minutes ground elapsed time. Some of the other clocks in the mission control operations room here showing time to entry, 27 hours, 25 minutes, time to ignition on midcourse correction number 7, I suppose, 9 hours, 56 minutes, this would be if done, it would be about 2 feet per second to lower the vacuum perigee from its present 23.6 miles to around 20 nautical miles. Apollo 13 now 134 626 miles out from Earth, appraoching at 5 114 feet per second. Predicted velocity at 400 000 feet, or entry innerface, 36 210 feet per second; velocity would build up at the time of perigee of 23 miles to 36 431 feet per second. The prime recovery vessel Iwajima is steaming toward the aiming point in the Southcentral Pacific and its estimated arrival time at the aiming point is at 9 AM Central Time on the 17th. Partial pressure of carbon dioxide still holding at 1/10th of a millimeter of mercury in the lunar module cabin; cabin pressure 4.98 pounds. Holding steady. At 115 hours, 16 minutes, 115 hours, 17 minutes ground elapsed time, and standing by, this is Apollo Control.

END OF TAPE

PAO This is Apollo Control 115 hours 28 minutes ground elapsed time. To correct an earlier error regarding mid-course correction burn number 7, the clock at that time was showing 9 hours to ignition. Now it's showing the correct value of 22 hours 11 minutes, which is entry interface minus 5 hours. At 115 hours 29 minutes, this is Apollo Control standing by.

END OF TAPE

SC (GARBLE)
CAPCOM Aquarius, Houston. Go.
SC (GARBLE)
CAPCOM Okay, Jim. Good morning and I understand you relieved the watch and the rest was kind of worried, did you have any questions?
SC No questions, Joe. Just one of those (GARBLE) communications.
CAPCOM Okay. That was - that was loud and clear, that one there. Now we don't have a heck of a lot going on as you know we're working on the entry procedures. I've got preliminary copies but we're not ready to pass it up to you. Looks like you're about 125 000 miles out, starting to really pick up speed and the Astros won last night and that's about all I've got.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay, Jim. It's about time, at your convenience, for another volts and AMPS reading on the command module. For your information, we put 6 amp h ours back in the battery already and we've got about 14 to go. It's looking real good, and I also just got the word that the reentry weather tomorrow is looking better all the time. Really looks great.
SC Okay. When I went to bed last night (garble)
CAPCOM Didn't copy that, Jim. Sorry.
SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC Roger. 39.2 on the volts. 1.4 on the AMPS.
CAPCOM 39.2 and 1.4. Thank you.
CAPCOM Aquarius, Houston.
SC Go ahead, Joe.
CAPCOM Roger. Just for your information. In case it happened when you were off watch. The master caution circuit breaker is still pulled, and we're seeing a malfunction indication on the descent battery now, but all the perimeters still look just as good as ever, and that's just for information.
SC Okay. I see the battery light flickering now.
CAPCOM Okay. Recommend you ignore it.
SC Okay.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Jim, it's volts and amps time again, at your convenience.
SC Okay.

END OF TAPE

AQUARIUS Houston, Aquarius.
CAPCOM Go ahead Aquarius.
AQUARIUS Aquarius, Houston, if you gave me those readings I didn't copy them.
AQUARIUS Houston, Aquarius, do you read?
CAPCOM Aquarius, Houston, okay, go ahead.
AQUARIUS -39.3 1.25
CAPCOM Okay, copied 39.3 and 1.25; did Jack tell you what your trajectory looks like; over.
AQUARIUS Haven't (garble) how bout giving me a run down?
CAPCOM Okay, we are looking at a vacuum perigee right now of 23.6; flight pad manual minus 6.25, and if we decide we want to trim that up, we're looking at a midcourse at about 2 feet per second; your consumables of course are getting better all the time; we've got 163 hours of water, 230 hours of oxygen and 172 hours worth of electrical power; over.
AQUARIUS That sounds good.

END OF TAPE

PAO This is Apollo Control 116 hours 35 minutes ground elapsed time, the spacecraft position now 120 598 nautical miles out from earth, approach velocity 5227 feet per second, countdown clocks now showing 26 hours 4 minutes to entry interface or 400 000 feet above the surface of the earth. Time to ignition or mid-course correction burn number 7 now tentatively 21 hours 4 minutes. This is entry interface minus 5 hours. Cabin pressure still holding at 4.78 in the lunar module, average voltage or amperage usage still hovering around 12, 13, 14 amps in the lumar module, vehicle weight still 87 740 pounds. At 116 hours 37 minutes ground elapsed time, this is Apollo Control.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 9:53A GET 116:41:30 511/1

PAO This is Apollo Control. An advisory to newsmen in the Houston News Center. Donald K. (Deke) Slayton, Flight Crew Operations Director at Manned Spacecraft Center is now enroute to the main auditorium for the 10:00 briefing. Should arrive there within about 5 minutes. This is Apollo Control.

END OF TAPE

CAPCOM Aquarius, Houston, over.
AQUARIUS Go ahead Houston.
CAPCOM Okay, Jim, we would like to get another check from you on the propellant tank temperatures as we did yesterday and the procedure is to on panel 16, circuit breaker propellant display slash engine over logic to CLOSE; then go to your display and read the tank 1 and tank 2 temperatures for us, and then open the circuit breaker again; over.
AQUARIUS Okay, I'm closing now — the display (garble)
CAPCOM Roger.
AQUARIUS Okay, the reaction control temperature now is
END OF TAPE

SC Again the reaction control temperature are 65 in a nd 65 in B.

CAPCOM Okay, Jim, we'd like the descent (garbled)

SC 67, the oxidizer is 63, descent stage (garbled) is 65 the oxidizer is (garble)

SC Houston, did you copy the (garble) temperatures?

CAPCOM Jim, I copied 63 and 64 which I think were the descent 1 temps and that's all I got.

SC Okay, I'm going to get a (garble) now and the fuel is about 64 and oxidizer is 65 and descent 2.

CAPCOM Okay, thank you very much.

SC Our descent 2. Okay I've got our descent 2 and they're right up on 67 and 66.

CAPCOM Rog. We copy that and once again we'd like to get the volts and amps check in the command module. Over.

SC Okay, I'm going to go up there and get it Jack is (garble)

CAPCOM Okay. Real good.

SC Houston, Aquarius.

CAPCOM Aquarius, Houston. Go.

SC volts 39.3, amps 1.20.

CAPCOM Okay, we copy 39.3 and 1.20, and Jim, I've got one more item for information for you. That, in about 45 minutes or so, you will get an H2O quantity caution light on the descent tank. We expect this. It occurs at 16 percent. It's no problem, because we intend to run the tank dry just for drill. To reset the light on Panel 2 just set the 02 H2O quantity monitor to the caution point and reset position and the light will go away. Over.

END OF TAPE

CAPCOM Reset position and the light will go away. Over.

SC Okay, I understand we're going to get a heat flow warning light here shortly and obviously.

CAPCOM Okay, good deal.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 10:24A GET 117:11:30 515/1

ALL DEAD AIR.

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 10:29A GET 117:16:40 516/1

PAO This is Apollo Control 117 hours 30 minutes ground elapsed time. Apollo 13 now 117 810 nautical miles out from Earth. Approach velocity 5308 feet per second. Entry flight path angle still holding at minus 6.24 degrees. Countdown clocks: entry 25 hours and 9 minutes from now; ignition on the proposed midcourse correction burn number 7 now 20 hours and 9 minutes away. Lunar module cabin temperature hovering around 4.74, 4.78 pounds per square inch. Flight plan now showing rest period for the command module pilot to begin at 116 hours, about an hour and a half ago. At 3 pm in the main auditorium at the Manned Spacecraft Center, Neil Armstrong, commander of Apollo 11 will hold a press conference to discuss the various aspects of Apollo 13. And at 117 hours 32 minutes ground elapsed time, this is Apollo Control.

SC Houston, Apollo 13.

CAPCOM Aquarius, Houston. Go ahead.

SC Okay, Joe, we've just got a water warning light.

CAPCOM Okay, Roger that.

END OF TAP$_E$

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay, Jim. The experts would like another volt and amp reading.
SC Okay, have them stand by.
CAPCOM Okay.

END OF TAPE

SC Voltage 39.3, amps 1.26
CAPCOM Copy 39.3 and 1.26
PAO This is Apollo Control, 117 hours 51 minutes ground elapsed time. Distance from Earth 116 748 nautical miles.
CAPCOM Aquarious, Houston. Go.
SC Joe, you might pass (garble) for me.
CAPCOM I guess you need them up there, too. Did - is anybody sleeping in the command module right now?
SC I think it was just too cold in there. I got - Fred's stashed over into the LM. He's asleep and Jack's (garbled). Over.
CAPCOM Roger.
SC You can eleminate the chill down procedures for entry.
CAPCOM Well, we figured we were in that mode, now.
PAO Velocity now 5342 feet per second. Henry H. Wilson, Jr., President of the Chicago Board of Trade has forwarded the following message to the Mission Control Center: "The Chicago Board of Trade will suspend trading at 11 A.M. today for a moment of tribute to the courage and gallantry of America's Astronauts and a prayer for their safe return to Earth." At 117 hours 53 minutes ground elapsed time and standing by, this is Apollo Control.

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/16/70 CST 11:09A GET 117:55:40 519/1

PAO This is Apollo Control, 118 hours, 8 minutes ground elapsed time; at the present time in the Houston News Center main auditorium, is a briefing just beginning with Mr. Keith McClung of North American Rockwell who will discuss the various hardware aspects of the Friday morning entry of Apollo 13. This is Apollo Control, standing by.

END OF TAPE

CAPCOM Aquarius, this is Earth; over.
AQUARIUS Go ahead Earth; Aquarius here.
CAPCOM Roger; Earth is here also, and Jim it is time for another one of those volt/amp checks for your infomration we've got that battery back up to 30 amp hours; over.
AQUARIUS Hey that sounds great; over.
AQUARIUS Jack, just a second.
CAPCOM All right
AQUARIUS Aquarius, Earth.
CAPCOM Go ahead.
AQUARIUS You know, I think Aquarius is beginning to (garble)
CAPCOM We've got garble now Jim; I'm sorry.
AQUARIUS I said Aquarius is coming in.
AQUARIUS Houston, Aquarius.
CAPCOM Go ahead.
AQUARIUS Voltage 39.3, amps 1.26.
CAPCOM Okay, copied that Jim.
CAPCOM Jim Houston. You guys put on any extra clothes to try and ward off the nip of Jack Frost? Over.
AQUARIUS Well, the lunar men are in 2 pairs of underwear, and everyone is calling (garble) temperature change.
CAPCOM Yep.
AQUARIUS We were reluctant to break out the suits.
CAPCOM Yeah, that's understandable; you can always use them if you have to; I guess it is pretty hard to get extra coveralls on, huh?
AQUARIUS Well Joe I didn't think we had any extra inflight garments aboard; but we're gonna check right now.
CAPCOM Well, stand by.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Roger. Jim, we notice you just went to AUTO and back to CLOSE on the suit relief valve. Everything okay?
SC We didn't do that intentionally. Stand by.
CAPCOM Okay if you didn't. Incidentally, you're less than 24 hours to go.
SC Roger. What happened was our lithium hydroxide device here got caught in the suit relief valve. It is closed now, that's where you want it, right?
CAPCOM SC Okay.
And Joe, just a reminder, now that you mentioned that it's less than 24 hours to go, what I'd like to do when I have aboard all the procedures that you're working up I can run through them with the crew and make sure that we get all our signals straight.
CAPCOM Roger that, Jim. We are trying to get the procedures finished and up to you as quickly as we can. They exist. What's going on now is the guys are running them in the CMS/LMS integrates to make darn sure that the attitudes are correct and the timeline is nice and relaxed and all that good stuff, and they won't be finished that run for another few hours. However, we expect to have an overall timeline and a sequence of events for you before that time and we'll start with the procedures as soon as they get them ready. Over.
SC Okay, that's good. I think we should drop and go back to the original procedures we have on board and modify them as we have the time to.
CAPCOM Okay, Jim, Roger. We're going to do that to the maximum extent possible. It looks reasonably feasible. To begin with in the command module we're going to have to send you some separate sequences for powering it up a little bit at a time. The closer we get to entry the more we get on the checklist. By the time we're about at EI minus 45 we're on the checklist all the way.
SC Okay.
SC And just as a reminder don't forget our stowage problem. We still have to do quite a bit of storage with the probe and drogue in the LM etc.
CAPCOM Roger that. We've got a team working on that and incidentally one of the information items that they want to know is which lithium hydroxide containers in the command module are empty. They just want to know that for weight and balance, and there's no rush about it.

END OF TAPE

SC Aquarius, Houston.
CAPCOM Go ahead, Aquarius.
SC Another note of interest to the crew systems people. Tell them that they don't have to bother putting the refrigerator onboard. I just went out for some hot dogs and they might be freezing.
CAPCOM Okay, we copy that, Jim.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, we'd like another volt AMP read, Jim.
SC Okay, stand by, Bill.
CAPCOM Roger.
SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC Volt 39.4 amp 1.23.
CAPCOM Okay. Roger that. And Jim we ought to have an entry timeline to discuss with you in one hour.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 12:27P 119:15:00 524/1

PAO This is Apollo Control 119 hours 17 minutes ground elapsed time. Spacecraft position 112 224 nautical miles out from Earth. Velocity continuing to build up. Now 5 478 feet per second. Looking now at entry interface time of 142 hours 40 minutes 42 seconds which according to the count down clock is some 23 hours 22 minutes from now. Got a midcourse correction burn something less than 2 feet per second which may or may not be done some 18 hours 22 minutes from now which is entry minus 5 hours. Cabin pressure aboard Aquarius holding around 4.7 pounds. Communication still rather scratchy, from time to time spacecraft Communicator Joe Kerwin requests the crew to give amp pressure and voltage readouts on the battery charge going on and has been underway since about 112 hours. At 119 hours 19 minutes ground elapsed time this is Apollo Control.

END OF TAPE

PAO This is Apollo Control 119 hours 44 minutes ground elapsed time. 22 hours 56 minutes to entry interface 400 000 feet. 17 hours 56 minutes to next midcourse correction, if it is indeed performed. Cabin pressure in the Lunar Module holding at 4.94 pounds per square inch. Partial pressure of carbon dioxide in the cabin 1/10 of a millimeter of mercury. And in the consumables for the Lunar Module, the remaining lifetime of various consumables, total usable remaining water 111.4 pounds. The present usage rate is 2-1/2 pounds an hour and the time remaining at this present rate 163 hours ground elapsed time when the water would be defunct. Oxygen aboard 33.43 pounds, using .26 pounds per hour. This oxygen would run out at 247 hours. Electrical power total usable remaining amp hours 974, using about 17.9 amp hours or amps at the present time. This would be exhausted at 173 hours ground elapsed time. Lithium hydroxide cartridges total remaining 180 hours. This is for the LUnar Module standard consumables, does not include the life time on the portable life support systems. At 119 hours 46 minutes ground elapsed time and standing by this is Apollo Control.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Guess what.
SC What.
CAPCOM Pulse and amps time, Jim.
SC That goes like the Amos and Andy show.
SC Houston, Aquarius. Guess what.
CAPCOM Aquarius, Houston. What. Over.
SC 39.4, 1.27.
CAPCOM Are you really going up there and looking at them?
SC That's what the meters say.
CAPCOM Okay, we copy, Jim.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay, Jim. We show the suit circuit relief valve us back in the auto position and we'd like to have it off for good scrubbing. Over.
SC Do you (garbled) down there?
CAPCOM Okay, thank you, Jim.
SC (garbled)
CAPCOM Roger, no sweat. Jim, in a few minutes I'm going to be coming at you with the overall timeline for tomorrow morning. You might want to think about taking a few notes, although we don't have detailed procedures for you at this time. Maybe you want to have Fred or Jack listen. Over.
SC Right. We're all set to copy.
CAPCOM Okay.
PAO This is Apollo Control at 120 -

END OF TAPE

PAO This is Apollo Control. 120 hours 20 minutes Apollo 13 is 108 867 nautical miles from Earth. Velocity 5585 feet per second. We're drawing an average of 18 to 19 amps from the descent stage batteries now that we continue to charge the Battery A in the Command Module. Lunar Module cabin temperature 51.

SC Houston, over.

SC Go ahead.

CAPCOM For our benefit while we do this briefing, Jim we'd like to have the COMM better and we can sure stir the power so we'd like you on panel 16 to close the power amplifier circuit breaker and on panel 12 we'd like you to move the voice function switch to voice. Over.

CAPCOM Okay Aquarius, Houston, How do you read.

SC Read you loud and clear.

CAPCOM Okay.

CAPCOM You're real good. It's a - it's a pleasure not to have all that noise. Let me tell you what I want to do Jim. As I said, we're not going to give you detail procedures now. What we expect to have for you shortly are procedures which we'll try and get up to you in the following form. First we'll have a timeline, sort of a flight plan thing, which will have the times of all the measure events and any configurations, switch settings, and so forth which are peculiar to our configuration and which therefore you won't find in the checklist. This, for instance, will be true of the way we power up the command module and second, of course, we'll have any red lines to the checklist so that you can enter the checklist where possible to perform functions and the timeline will simply refer you to the checklist when that's appropriate. Okay?

SC Okay. Sounds good. You're going to give me an overall timeline now, I take it, is that right?

CAPCOM That's affirm. I'm going to first of all just quickly run through the times of the major events and then we'll go back and fill in some of the details. Okay. entry interface is at 142 hours 40 minutes. 6-1/2 hours, roughly prior to that or at about 136 10 we'll start this whole thing going by applying IMU heater power, by checking the CM/RCS temperatures and pre-heating the CM/RCS if required and we suspect we'll probably want to do that. We'll have detail procedures up for it later. At about 6 hours prior to EI or about 136 40 we will commence powering up the LM, powering up the AGS using the modified LM/DPS RCS 30 minute checklist which you have used for the previous midcourse. Then shortly, just before 5 hours, prior to EI or at about 13 740 we'll want you in the attitude for a

CAPCOM LM AGs, body axis alinement, using the Earth terminator like we did before and as soon as we have that we'll perform MCC7 which looks like now about a 2 foot per second burn for about 15 seconds of RCS. And I'm told that it's down to 1-1/2 now, so it's comfortably within the RCS marking. Okay, when we do that we'll immediately start the maneuver to the service module jettison attitude which will be in plane since we're jettisoning it earlier than we usually do. We don't need and don't want the out of plane component. So it'll be in plane with the service module pointed back out along the radius vector. We will then commence to get the command module ready for service module SEP, including Command Module RCS checkout and hot fire at approximately 4 hours and 30 minutes prior to EI or 138 10 we'll jettison the service module We'll -

END OF TAPE

CAPCOM approximately 4 hours 30 minutes prior to EI or 138:10 we'll jettison the service module, we'll pitch the LM up until we acquire the service module in the hatch trying to get some photographs, but we're not going to fool around with the LM's translation maneuvers for pictures because we don't want to foul up your flight path angle at that time. Okay, that gives us 2 hours of more or less open time here to finish up. If we're late on that, go on over the checklist and prepare for powering up the command module. We're going to start the command module full powerup at EI minus 2 hours and 30 minutes or 140:10 GET. We'll get the computer on the line, we'll get the IMU up, we'll start uplinking your state vector and so forth and alineing the command module platform. At about 1 hour and 30 minutes at the latest, giving us an hour to do this command module stuff, we will start the maneuver to the LM jettison attitude. We'll not start to close out the LM. (GARBLED) waiver for this. We'll close the hatch, do a pressure integrity check and at EI minus 1 hour or 141 hours and 40 minutes, we'll jettison the LM. As soon as we do that, you can start the maneuver to the entry attitude. When you're there, do a sextant star check, take down the optics, and at that point we'll be giving you your final entry pad. You can initialize the EMS and you'll essentially be right back on the checklist at that point. There's one little difference from your nominal entry. You're a little bit earlier (garbled) It's going to be (garbled) when you get to EI. However, we're fortunate enough to have the moon in a perfect position for a horizon check. We'll give you a moon check instead of a horizon check and you can track it right down to moonset, which is going to be at EI roughly minus 3 minutes, and that's it for the quick timeline. Do you have any questions right now?

SC I don't believe so, Joe, right now. We'll have to look at those timelines and think about it for a little bit.

CAPCOM Okay, real fine. We're ready to talk in some more detail about the alinement procedures, the CM powerup procedures, etc., but why don't we give you a few minutes to digest what you've already heard.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Two questions so far on heating up the CM RCS. We assume that's LM power and we assume that we're going to have to power up both CM buses, right?

CAPCOM Okay, Jim, I didn't want to talk about that because we're not quite ready to recommend a procedure. We can't power up the CM RCS per the normal checklist on the LM power because we haven't got quite enough amps. It may be that we'll want you to heat to do the preheat one ring at a time and we're looking at that. Another possibility is that we may

CAPCOM want to take down LM power at that time, do the preheat, and then go back to LM power until we have to take it down finally. Over.

SC Okay, understand. Second question, when we finish MCC 7, that maneuver to SM jet attitude will be angles given to us by you using the AGS aline ball, right?

CAPCOM That's affirmative. Once we get that AGS alined and get a time hack on it, the good people down here will be able to give us AGS, AGS-8 ball attitudes for the service module separation attitude, for the command module alinement attitude, which we are going to pass you up a moon/sun P52 type alinement. We'll have AGS 8 ball attitudes for those and we'll be able to uplink through the command module once we get the computer up. A preferred REFSMAT, which will be identical to the LM attitude at the time of the burn, and we'll go into details on that later.

SC Okay. Just stand by one. I'll give you (garble)

CAPCOM Will do.

END OF TAPE

AQUARIUS Houston, Aquarius.

CAPCOM Go ahead.

AQUARIUS We would like to have plenty of liquids and then the control characteristics are of the LM command module and whether we can use the attitude control only to maneuver the combination to photograph the service module at 4 plus 30.

CAPCOM Okay, good thinking. We are - its — there has been a lot of consideration of what kind of maneuver to let you do to photograph the LM, I mean the service module. We considere it quite low priority; the feeling is that it will be real nice to get pictures of the service module but they are not required for our trouble shooting program. As far as the attitude control authority, and so forth, we will give you more detailed word on that later, we are working it, it appears that using the ACA instead of the TTCA after the service module jet will give you excellent attitude control authority, and thats what we recommend.

AQUARIUS Okay and I'm - use an AGS hold configuration to keep the attitude - turn the LM jet attitude.

CAPCOM That's affirm. We are probably going to recommend a tight dead band ags attitude hold for that.

AQUARIUS Okay.

AQUARIUS Houston, Aquarius.

CAPCOM Go ahead.

AQUARIUS Okay - the star check and the entry attitude is it a sextant star check or a COAS star check?

CAPCOM It'll probably be a sextant star check Jim. It really depends on how good that platform is that we get - star check.

CAPCOM While we are at it - I want to mention one thing to Jack; as I said, this CSM alinement procedure we are going to recommend is a moon/sun, and there are sun filters stowed they are stowed in compartment R1, however, they are for the telescope only of course, not the sextant, one is for the long eye relief piece, the other for the normal eye piece. And if he has any questions about that, we'll be glad to talk about it.

AQUARIUS Okay.

AQUARIUS And - because it will be too late to do much about a hatch integrity check of the LM, you want us to have our suits on sometime during this period?

CAPCOM Okay Jim, we are laying for you on that one; it is a subject that we wanted to bring up with you. We have been considering it, and our feelings are - of course - it is up to you - as we see the pros and cons, you just put your finger on the pro - we do a hatch integrity check shortly before EI minus 1 hour, and if we busted, you would have a hard time scrambling into the suits; on the other hand, the disadvantages of wearing

CAPCOM the suits are that they might slow you down considerably not even counting the time you don them, and someone is even very concerned that after such and such a period of time in the suits, you might get the warm, and we might have to power up the suit loop to ventilate the suits and we don't particularly want to do that cause it cost quite a bit of power. Consequently, our recommendation would be not wear the suit, since we have no reason to believe that the integrity check will show us anything but a slightly increased leak rate and we can certainly hack that.

CAPCOM What do you think? Over.

AQUARIUS Well, I have confidence in the hatch, as long as it goes in and locks in smoothly; I see no reason why we need the suits and one thing we are going to do during our spare time is to practice putting that hatch on, make sure we get it on and locked.

CAPCOM Okay, real good. And with that precaution, I think we can concur on that decision.

AQUARIUS And that's all the questions we had about the time line you gave us.

CAPCOM Okay, let me take a check here and see if there is anything anybody -

END OF TAPE

CAPCOM concur on that decision.
SC And that's all the questions we had about the time line you gave us.
CAPCOM Okay. Let me take a check here and see if there is anything anybody else wants to input to you right now.
CAPCOM Aquarius, Houston.
SC Roger. One detail, that I thought you ought to know about the service module jet is that we're going to recommend a push pull manuever, that is in the attitude I described. We'll want you to go half a foot per second plus X on the LM, then jettison the service module and go half a foot per second minus X, which will be less time because your suddenly a heck of a lot lighter. Over.
SC Okay. Understand. You want me to go a half a foot per second plus X, jet the service module and go a half a foot per second minus X.
CAPCOM That's affirm. We think that will give you plenty of separation, and also will be a slow enough rate so you'll have a chance to get some photos.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, one more thing we want to update you on with a little detail. As we told you, the ascent sep attitude was in plane and the LM jet attitude will be more similar to a normal service module SEP attitude, that is it will be LM UP out the radius vector and 45 degrees right out of plane toward the south. We are going to recommend that prior to jet, the configuration be with the LM overhead hatch CLOSED, with the vent valve OPEN, and we'll jet with the tunnel pressurized. Over.
SC Okay, Joe. Understand that the LM jet attitude will be similar to that of service module normal jettison, which will be up and out of plane, and as soon as I finish manuevering the left jet attitude, I'll scramble up and close the LM hatch, making sure the vent valve is open, and then we'll jettison with the tunnel pressurized.
CAPCOM That's affirmative. And Deke says, don't forget to close the command module hatch on your way in.
SC I'm already scared that Jack will have it closed before I get up there.
CAPCOM (Laughter) Okay, Jim. I Think that's about all we have for you right now. Whenever you feel like you don't have any more questions at the moment, we'd like you to reconfigure for downvoice backup and we'd like you to do that to move the voice functions switches downvoice backup switches (garble) but instead of pulling the circuit breaker, we'd like you to throw the power temp switch to OFF. Over.

SC Okay, Joe. I have one more question here. If we get a little bit ahead of time on the command module full power up, after we jettison the service module, I'd like to go to LM jet attitude early and make sure we get that part squared away and sit there for awhile before LM jet of 1 hour. Now, will we be using LM power up to that time? There are 2 cables that we'll probably have to disconnect on the way up through the tunnel or are we still going to use LM power?

CAPCOM That's affirmative. Let me get word on when we expect to go off LM power.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Roger. We expect to go off LM power at the time we start powering up the CSM or about minus 2-1/2 hours. That is not a hard number and we'll be updating you on it. As far as going to the LM jet attitude. That's completely permissable as soon as you have a powered up command module and a satisfactory platform, you can go there immediately. We're giving you a maximum of 1 hour just for grunts. Over.

SC Okay. Fine, and

END OF TAPE

CAPCOM - Just for grants. Over.
SC Okay. Fine, and then we'll be a LM maneuver, I assume, because you want the service module, so no strain there.
CAPCOM Fine.
SC And, Jack, we'd like to know what entry angle the midcourse will give us?
CAPCOM Oh, it'll put us right in the middle of the corridor, Jim.
SC Okay.
CAPCOM 6.50 degrees.
CAPCOM And, Jim, Houston. I just, as a last item, we expect that it will take us about an hour to update your checklist in your timelines sometime later on today, and we'd just like you to consider that. I expect it'll be 3 or 4 hours before we have all that stuff ready.
SC Okay, we'll be standing by for that and, now power amplifier switch is going to go off, and then we'll be going to down-voice backup.
CAPCOM Okay.
PAO This is Apollo Control at 120 hours 47 minutes. Flight Director, Glynn Lunney, of the Black Team is on his way to the MSC Auditorium for a change of shift news conference. Glynn Lunney is on his way to the MSC Auditorium for a news conference.

END OF TAPE

PAO This is Apollo Control, the change of shift news conference will begin momentarily.
CAPCOM Aquarius, Houston. Go ahead.
PAO Cap Com now is Astronaut Vance Brandt.
SC Houston, Aquarius.
CAPCOM Rog, Jim. We're receiving you now. Go ahead.
SC Okay. I thought you were calling. I guess we had (GARBLE) down there.
CAPCOM Yeah, we lost the lock for a little while there Jim. Well, good day, could you give us Battery A voltage reading, please and battery charger current, as you have been doing.
SC Okay, Vance, stand by.
CAPCOM Okay.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC Okay, voltz are 39.5. amps 1.25.
CAPCOM Roger, copy 39.5 and 1.25. Thank you.

END OF TAPE

PAO This is Apollo Control, the Neil Armstrong News Conference will begin momentarily in the MSC auditorium.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Aquarius, here. Go ahead Houston.
CAPCOM Say, Jim, could you give us another reading on the Battery A voltage and bat charger current on the CSM please.
SC Bat amp coming up.
CAPCOM Okay. And sometime when you have some time to copy I have an entry stowage list to give you which specifies which equipment will be moved between vehicles before splash down.
SC Okay. I'm ready to copy that now.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Volts 39.4 and amps 1.25 (garble)
CAPCOM 39.4 and say again amps.
SC 1.25.
CAPCOM Roger. Copy. Thank you.
SC Okay, Vance. We're ready to copy the stowage list.
CAPCOM Okay, Jim. Now I'll give it to you in two parts. The first is LM to Command Module equipment transfer. The second part will be to reverse command module to LM equipment transfer and both parts represent DELTA's from the launch stowage and here comes the first list. LM to Command Module equipment transfer - first DSEA and I'll give you the stowage location too, that goes in R13.
SC Vance, what was that again?
CAPCOM DSEA that's recorder in, will go in the Command Module, is recommended you stow it in R13. Over.
SC Okay, the DSEAS recorder will be stowed in R13.
CAPCOM That's affirm. Next. LM flight data file that will go in R1, R2, and R3.

END OF TAPE

CAPCOM 1, and R2 and R3. Next, 3PPK's in A8.
AQUARIUS Okay.
CAPCOM Okay. 16 millimeter and 70 millimeter exposed film in R13.
AQUARIUS Okay.
CAPCOM 02 hose and screen caps on the 02 hoses. Next, 2 70 millimeter Hasselblad cameras and stow these in B6, in the empty LIOH volume. Okay, next, black and white TV camera and recommend stow that on top of A7 and A11 in decomtamination bag. Next, flag kit, stowage location A8. Next LM fecal bags used R9, waste management system chute. Okay, that's the first list Jim.
AQUARIUS Okay.
CAPCOM And if you want to read that one back, why then I'll give you the second one.
AQUARIUS This the LM to command module transfer. And this is (garbled) Number 2, LM point status ball in LO 1, 2, and 3, three PPK's in A8. And used fecal bags in R9.
CAPCOM Okay, that's afirm Jim. We had a lot of noise and we didn't get the middle part, but I think that's fairly, should be fairly clear to you, don't bother with the read back of that what we missed, unless you have any doubts. And then I'll, as you're ready to copy, I'll give you the second list.
AQUARIUS Okay.
CAPCOM Okay. This is CM to LM equipment transfer. Cabin fan filter and bag and that in the LM should go in the ISA Okay, next, decomtamination bags, except for the ones used to wrap camera should go in the ISA.

END OF TAPE

CAPCOM - decontamination bags; except for the ones used to wrap camera should go in the ISA

CAPCOM Okay. Two LCG's, if you don't have them on, already - to the I - ISA. I realize you wouldn't have them on, cause you're cold enough already.

SC That's right.

CAPCOM Okay, and finally, four LiOH cans, the ones used in the LM; and those can go in the jettison bag in the LM.

CAPCOM Okay, a couple of notes. After loading the ISA, recommend secure it to the right-hand restraint system.

CAPCOM And, secure the jettison bag to the PLSS on the floor. That's all.

SC Okay, Vance. (Garble) on the LM; cabin (garble) bags to the ISA; decontaminations bags, except for the one we use for the TV camera in the ISA; two LCG's in the ISA; four LiOH cans in the jet bag; and we'll secure the ISA on the right-hand side; (garble) and we'll secure the jet bags to the PLSS on the floor.

CAPCOM Roger, that's it.

END OF TAPE

CAPCOM Aquarius, Houston, over.
CAPCOM Aquarius, Houston.
AQUARIUS Go ahead.
CAPCOM Jim, would you give us PCM to high bit-rate. We think maybe we might be able to lock up on your high-bit rate. Over.
CAPCOM Aquarius, Houston.
AQUARIUS Go ahead.
CAPCOM Okay, Jim. We're getting it intermittently we think we might get it steady and improve circuit margins if you would, in addition, on panel 16, open the primary power amp circuit breaker and I'll give you the next step in a minute.
AQUARIUS Okay. Primary power has been opened.
CAPCOM Okay, and on panel 12 power amp to primary.
AQUARIUS Power amp to primary.
CAPCOM Roger.
CAPCOM Aquarius 13.
AQUARIUS Go ahead Houston.
CAPCOM Er, rather Houston. Jim it looks like we got a lock on which is going to improve our data flow here. Only, thing is, we'll probably lose data and probably voice too, during a portion of each roll, so you might expect that. The other thing is, that if any one has on any bio-med, would you switch your switch, your bio-med switch to that position.
AQUARIUS Understand the first, Vance, and no one has on a bio-med, Fred and Jack are maneuvering things around right now, mine is long since departed the scene.
CAPCOM Okay. Copy.
AQUARIUS Vance, you might be interested, the way we're, the way we got this thing arranged, we have one helmet attached to the com line attached to the LM hoses and the guy that's got the duty wears the helmet, so the other people are free to maneuver.
CAPCOM Right, that's understandable. One guy's on the leash, huh?

END OF TAPE

PAO This is Apollo Control, at 122 hours, 24 minutes. We plan to take another telemetered look at the command module before too long. Readout the thermos parameters. Apollo 13 is 102 019 nautical miles from Earth; velocity 5819 feet per second. Current load now is about 19 amps. Cabin pressure is 4.98 pounds per square inch. Temperature 52 degrees.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Jim, when you get finished moving your stowage around, and it's convenient we'd like to terminate the battery charge for a little while to bring up the CM — TM so we can take a look at the temperatures again, like we did yesterday. Advise that right now on your batteries you have 111 amp hours, and eventually, we hope to have them up — peaked up to about 116. One other point, we - we can either read that procedure up again, which involves cranking up the telemetry, or if Jack still has it, we can use his notes and — But I have one or two changes to - to make on them. Over.

SC Okay, understand that you want us to terminate battery charge for awhile, and crank up the CM TM to readout temperatures. And you have a few changes to Jack's checklist, and I'll turn the COMM over here to Jack shortly; as soon as he's finished; and we'll get along with it.

CAPCOM Okay, we'll be standing by for - there's no hurry on it.

END OF TAPE

SC Houston, Aquarius.
CAPCOM Go ahead, Jim.
SC Just out of curiosity, Vance, what's are distance and velocity now?
CAPCOM Hey, stand by one. You're speeding up, I think. Jim, we have you 101 000 miles out and your velocity is 5848. Starting to speed up.
SC Okay. Thank you.
CAPCOM Good enough.
SC Okay, Houston, Aquarius.
CAPCOM Go ahead, Jack.
SC Okay, Vance, Jim said that you want to terminate battery charge on battery A.
CAPCOM That's affirm, Jack. Request to - before you terminate it get the usual readouts on voltage and current and we'd also like a time of termination and understand that you have the termination procedures. Is that affirm?
SC Okay. That's affirm. Stand by. Let me just make sure I've got everything here before I go off on a tangent.
CAPCOM Okay, Jack, and your battery charge termination procedure remains unchanged but when we go to power up the CM and look at your TM, we have a couple of additional steps.
SC Okay, Vance, I do have the procedure for stopping the battery charge and do you want me to copy this procedure now or do you want me to come back and give you the volt amps and time after I complete this termination?
CAPCOM Okay. Just give us the volts and amps just before you start the termination of the procedure and understand you say you have the procedure for taking the charge off. Is that affirm?
SC That's affirmative.
CAPCOM Okay. And just give us a hack on the time.
SC You want to review it at all?
CAPCOM Negative. Unless you want me to. I'll tell you what. I can run through it very quickly just to verify that we are getting started off on the correct path here.
SC Yes. Okay, the first four or five things I have is panel bat charge to off panel 3, AC inverter 2 off, panel 5, Main bus 5, bat AC on, panel 250, CB bat A, py-entry post-landing open, panel 275 inverter power to main B open and that

END OF TAPE

SC - py-entry post landing OPEN; panel 275 is inverter power 2 MAIN B; OPEN; and then, just to go ahead and reverse the position of the switches and circuit breakers that I started out with and these don't have to be in reverse order. Is that, Charlie?

CAPCOM Roger, that's - that's Charlie. Have at it.

SC Okay, we'll get a volts and amps right now.

CAPCOM Okay.

SC Okay, Vance. The volts and amps 39.4; amps 1.25.

CAPCOM Okay, Jack. We copy that.

CAPCOM Incidentally -

SC Did you say we're going up the tunnel? (Garble), Vance.

CAPCOM Never mind, Jack. I'll bring this up later when you've finished the procedure.

SC Okay, I'm going off the air, I'll put Fredo on, I'm going to stop the battery charge.

CAPCOM Okay.

SC Now, how do you read, Vance?

CAPCOM Hey, loud and clear, Fred. Understand you've been doing some spring housecleaning; moving stowage around up there.

SC Boy, you wouldn't believe this LM right now; there's nothing but bags from floor to ceiling.

CAPCOM Hey, that brings up a question. We were wondering where you guys plan to stow the progue and drogue? It occurred to us that one possibility was to stow it in the LM; down about where the LMP normally stands underneath the IS - ISAer. Perhaps you have a better idea? Over.

SC Yes, I do, Vance. That would go in the LM, but I thought maybe we ought to stow it where the CDR stands. How's that?

CAPCOM Okay, I can tell that you're just getting — getting that one over cause Jim just got off the loop.

SC Hey, he's sleeping. No, that's - that's actually where we normally had been stowing it for normal LM jettison.

CAPCOM Okay, and - Hey, we just - we'll record that, and figure that you'll stow the probe and drogue over in the - where the CDR stands. We have a - a change to this - equipment transfer list that I just read up to Jim. Why don't you make a note of this one item? Forget about the LM -

SC Standby, standby one.

CAPCOM Okay.

SC I think Jack hauled off the piece of paper with that - all that on it. Why don't you hold it until Jack gets done doing the battery charge?

CAPCOM Okay. And Fred request PCM on LOW BIT RATE, now.

SC Okay. And there was one piece of flight

SC - data that we needed that we didn't bring along this time.
CAPCOM What was that?
SC That's a big book with a lot of just plain old blank pages in it.
CAPCOM Yes, when you - when you get off the nominal, why you just need scratch paper, don't you?
SC Yes.
SC Okay, Vance. I got the stowage list, now.
CAPCOM Okay, I gave you two lists -
SC And Jack - and Jack said he's completed — the - secured the battery charge, now.
CAPCOM Okay, and we're recording the time that that was complete. You have two lists there; one is LM to CM equipment transfer; and the second list is the reverse. Request you scratch the last item on the first list; which is; returning used bags back to the CM.
SC Okay. We didn't have any of those, so that didn't pose any problem any -

END OF TAPE

SC We didn't have any of those so it didn't pose any problem anyway.
CAPCOM Okay.
CAPCOM Aquarius, Houston.
SC Okay, Vance. Aquarius is back on.
CAPCOM Okay, Jack understand you completed securing the battery charge. Now if you are ready to copy, Jack I would like to give you the changes that we have to the power up for the CM procedure. Over.
SC Okay, Stand by one.
CAPCOM Okay.
SC Okay, Vance you say you have some changes in the procedure that I use before to get telemetry to check out the CSM.
CAPCOM Yea, that's correct, Jack, they are pretty simple. About half way through the procedure we have a step on panel 3 which is power in HIGH we would like to change that to power in LOW.
SC Okay, copy power in LOW.
CAPCOM And the next change, Jack is Panel 275 scratch the step CD Main B BAT B CLOSED. BAT Bus B CLOSED.
SC Okay, you want delete the step CD Main B, BAT Bus B CLOSED.
CAPCOM Rog. As you know we are going to do this on LM power, so this reflects that.
SC Okay, real fine.
CAPCOM Okay and have at it, we'd like to have the TM up for about 5 or 10 minutes to look at the data for the CM, look at your temperatures, et cetera and after that we will go back to charging the battery again and the charge will probably go until around GET 126.
SC Okay. You want the same read outs from me that I gave you before?
CAPCOM That's affirmative, Jack and just to make sure that there is no mistaking the procedure it starts out for the backout part, Panel 3 power amp OFF transponder OFF; AC inverter 2 OFF; then gose to Panel 250, et cetera.
SC That's the way I read it.
CAPCOM Okay
SC Okay, going back up into the refrigerator.
CAPCOM Hey, I thought it was the bedroom.
SC Well, it's got a new name now, because it is about 30 degrees cooler.
CAPCOM Roger, returning to the deep freezer.
SC Hey, there is one thing that I wanted to ask you - on the stowage list where you have us putting the black and white camera on top of A7 in a decontamination bag, I was wondering if it would be possible - if there would

SC be any problem in putting it in B6 along with the 270 millimeter Hasleblad camera.

END OF TAPE

SC - along with the 70 millimeter Hasselblad camera.

CAPCOM Jack, I don't think there will be any problem if you can get it in but let us work that and get back with you. Okay.

SC Alright, I was just thinking. I'm trying to get as much weight as possible, down there in that LEB. We have no SRC's and then our waste tank is rather depleted. I think it is about down to 40 percent or so. So I'm trying to get as much L over D as I can and any heavy items we can get down there, it will be greatly appreciated if you will bring it to our attention.

CAPCOM Okay. We copy that and we owe you an answer on your last question.

SC Okay. And I'm in work and going to give you some telemetry.

CAPCOM Okay.

PAO This is Apollo Control at 123 hours, 2 minutes. Apollo 13 is less than 100 000 miles from earth now, 99 868 nautical miles. Velocity 5897 feet per second.

CAPCOM Aquarius, Houston, we're receiving CSM data now.

SC Roger.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Say again, Vance.
CAPCOM Fred, just lost data on Jack, would you have him select best omni, please?
PAO This is Apollo Control at 123 hours 9 minutes. We are using LM power for this Command and Service Module telemetry check. The current is up now to 24 amps.
CAPCOM Aquarius, Houston.
SC Allright, go ahead.
CAPCOM Fred, we have enough data, recommend that Jack take off the TM and power back down again, using his backout procedure, just let us know when he does it.
SC
Okay.
CAPCOM
And after that we will start the battery charge and we'll have to know when he starts that.
SC Okay, he's starting to backout now. Just out of curiosity are ya'll going to read out on what the cabin temp was up there?
CAPCOM Yea, we're getting 45 to 46 degrees.
SC Now you see why we call it the refrigerator.
CAPCOM Yea, it's kind of a cold winter day up there isn't it? Is it snowing in the Command Module yet?
SC Is it what, Vance?
CAPCOM Is it snowing in there yet?
SC Oh, snowing, no - no not quite, the windows are in pretty bad shape and I guess the Service Module will be trying to shoot out of the LM window, because every window in the Command Module is covered with water droplets. It's going to take a lot of scrubbing to get those cleared off.
CAPCOM Roger, understand.
CAPCOM Pete says to tell you you'll have some time on the beach in Samoa to thaw out after this cold experience.
SC Hey, that sounds great.
SC Vance, have ya'll thought about what cameras ya'll wanted to use. Right now we have got configured a Hasleblad with a 250 and I've got the lunar surface number one Hasleblad and I've got the lunar surface sequence camera also rigged and ready to go. Did you have any other druthers about the (garble)
CAPCOM You are referring to the photography of the Service Module, is that right?
SC That's right.
CAPCOM We have some procedures in work and I've seen them, Fred. I think pretty soon we'll be shooting them up to you to specify which camera and setting. But that

CAPCOM sounds pretty close.
SC Okay, you might let them know that if they had thought of it we've got this lunar surface sequence camera onboard which has it's own battery pack set up and it shoots quite a few pictures and that could also be used.
CAPCOM Rog. I know that we are planning on using that camera among others.
SC Okay.

END OF TAPE

SC Okay. Houston, Aquarius. Jack has backed out of powering up the CM and now he is proceeding to start battery charge on bat A.

CAPCOM Okay. REal good, Fred. We copy.

SC Okay and we are charging bat. A.

CAPCOM Roger. Charging bat A, Fred. And, Fred, request now first reading of voltage, bat A voltage and charger current. Over.

SC Okay, Vance. Thank you. I could give it to you. I read it right after I started it. Bat A voltage was 39.4 and the current had jumped up to 1.4.

CAPCOM Okay. 39.4 and 1.4 Thanks, Jack.

SC Okay. You ready for some more readouts.

CAPCOM Ready to copy.

SC Okay. Bat B 37.0, pyro A 37.0, pyro B 37.0, SPS helium pressure 3400 and Nitrogen A and B just thrown in for kicks, 2200 and 2400 respectively and the injector temperature - stand by - the sun went down. Okay, the injector temperature, 5 Charlie, 3.9, 5 dog 3.2, 6 alpha 3.6, 6 baker 3.9, 6 Charlie 3.5, 6 dog 3.4, the battery manifold pressure 1.4.

CAPCOM Okay. WE copy all that, Jack. Thank you.

SC You say you figure you are going to be charging bat A until about 126?

CAPCOM Roger. About 1 26 30 is the estimate, Jack.

SC Okay. You figure it will be fully charged then, huh?

CAPCOM Yes. That's right. We'll have all the batteries up to about 116 amps hours.

SC That's good news.

CAPCOM That's better than 99, huh?

SC You're right.

SC How did all our systems look on (garble), Vance?

CAPCOM I didn't hear any complaints. Just a minute let me make a detailed check.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM It's a general statement. It looks like temperatures have cooled off the ball park of 6 to 8 degrees cooler than what they were yesterday. Looks like everything is still within tolerance, but we're working up a detailed sheet of temperatures to send up to you for your interest.

SC Okay. That sounds good.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.
SC Vance, Joe brought up the alignment at EI minus 2 plus 30. You'd better set up or have a discussion about that later on.
CAPCOM That's correct, Jack. We just about have procedures in hand detail checklist type procedures to send to you. In other words, a timeline with reference to entry checklist and any changes in the entry checklist so if you have a few pages of scratch paper, I think we'll have that to you within an hour. One other thing, Jack, you still with me?
SC Yes. Go ahead. The stowage people have tried out this black and white TV camera into B6 idea and they say even with the lens off, they can't get it in so I still recommend that it be stowed where we had it on the list. That's A7 -
SC That's no problem.

END OF TAPE

SC All right, go ahead.
CAPCOM Jack request another voltage readout on BAT A and current on BAT charger.
SC Okay, Vance, the Modes 39.3 amp 1.3
CAPCOM Roger, copy 39.3 and 1.3.
CAPCOM Aquarius, Houston, over.
SC Go ahead, Vance.
CAPCOM Jack, looks like the LM suit release valve has been bumped to AUTO again, request it CLOSED. Over.
SC Okay. It worked.
CAPCOM Okay.
SC How's that right there.
CAPCOM Okay, they say it looks good.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, Jack, we need another one of those voltage amps readouts and then maybe we will get off of your back for a little while.
SC Oh, don't worry about it, we kind of like to have you talk to us. Volts and amps coming up.
CAPCOM Okay.

END OF TAPE

SC Okay, Vance. Volts 39.4, amps 1.25.
CAPCOM Okay. EECOMS got it newly recorded.
SC John Aaron on?
CAPCOM No, Gee I don't know what shift he is on. He comes in later I guess.
SC Actually all the shifts are morning shifts to us.
CAPCOM Say that one again.
SC All of the shifts are morning shifts to us, because the sun is always shinning.
CAPCOM That was a short night.
SC Just for curiosity sake are we still holding entry angle at 6.5?
CAPCOM Okay, Jack right now we're told that it's closer to 6, but they would like to track it some more, looks like your next midcourse will be in the order of 2 to 3 foot per second.
SC Okay.
PAO This is Apollo Control at 123 hours 48 minutes. Apollo 13 is 97 232 nautical miles from Earth, velocity 5996 feet per second. We are 18 hours 52 minutes away from entry at 4000 feet. And if the crew is satisfied with the integrity of the Command Module tunnel hatch, they will make this reentry unsuited.
SC We have got a good view of the Southern Cross (garble) Houston.
CAPCOM Go ahead, Jack.
SC Okay, we're still in good shape as far as water goes in the LM?
CAPCOM Okay, we copy.
SC The reason I ask is because I am assuming that we are and I have no idea each time I pressurize the surge tank to get water out of the Command Module, how much I drop that surge tank and if we are in good shape as far as water goes in the LM we'd like to fill a couple of drink bags to get some water for drinking purposes.
CAPCOM Okay, have you run out of CM drinking water yet, Jack?
SC Oh no, we have plenty of drinking water, I think the - I don't have any idea what the (garble) tank pressure is.
CAPCOM Okay, it's 7 - it's 750 Jack.

END OF TAPE

CAPCOM Okay. It's 750, Jack.
SC Okay. 750.
CAPCOM Aquarius, Houston. Stand by, Jack, and we'll give you an indication of how that water situation on the LM is which is your question. Right?
SC Okay. But I guess what I was really asking is if you'd have any violent objections if we filled two drinks bags from LM water rather than repressurizing the thirst tank.
CAPCOM Okay. Stand by.
SC Also Jim is asleep up there and we didn't want to bother him either.
CAPCOM Okay. We understand. And, Jack, we'll be changing stations in one minute so we may have a temporary dropout in COMM.
CAPCOM Aquarius, Houston.
SC Okay, Vance, go ahead. Loud and clear.
CAPCOM Okay, Jack, we're going to bargain with you on this one. Instead of two, we wish that you would get just one bag full. That shouldn't do any harm; however, we are not all that fat on water that we want to do any drinking out of the LM as a regular thing after this one bag. So would you let us know when you get the water out and give us a mark on it so we can watch the TM. Over.
SC Okay. Fred-o is about to withdraw the water now.
SC Okay. We've withdrawn about 8 ounces of water.
CAPCOM Okay, Jack, how does it taste?
SC It's kind of good. It's not quite as gassey as that in the command module.

END OF TAPE

PAO This is Apollo Control at 124 hours 15 minutes. Apollo 13 now 95,638 nautical miles from earth; velocity 6,057 feet per second. The temperature in the LM cabin now reading 51 degrees, pressure 4.98 pounds per square inch; carbon dioxide partial pressure 2/10ths of a millimeter of mercury.

CAPCOM Apollo 13, Houston. Or rather, Aquarius, Houston. Over.

SC Go ahead.

CAPCOM Hey Jack, we need another reading.

SC Okay. They're coming up.

END OF TAPE

SC Vance, you won't believe this, but Fred-o says it's 39.4 and 1.245.
CAPCOM Okay, our EECOM is recording those numbers. Charlie Dumas this time.
SC Oh.
CAPCOM Not changing very fast is it?
SC How far out are we?
CAPCOM Okay, 953 and 6068 on velocity, per FIDO.
SC Okay.
CAPCOM Bill Stoval.
SC Thank you.

END OF TAPE

AQUARIUS Houston, Aquarius, over.
CAPCOM Go ahead, Aquarius.
AQUARIUS Are the flowers in bloom yet in Houston?
CAPCOM No, not yet, still must be winter.
AQUARIUS Suspicions confirmed.
CAPCOM Yes, I doubt if they will be blooming even Saturday, when you return.
Aquarius Thank you.
CAPCOM Hey, Jim, we have some photo information to pass up to you. Discussed this briefly with Fred earlier. It's instructions or suggestions for which photos, which cameras and lenses to use during your service module photography, over.
AQUARIUS Okay, stand by one.
CAPCOM Okay.
AQUARIUS Go ahead.
CAPCOM Okay, we have three cameras here, two of them to be used for picture taking from the LM, one to be used from the number 5 window on the CSM. First off get the LM cameras. And this camera that I mention now has first priority and is considered the one to give you the best results. That's the 70 millimeter DC Reseau camera Hasselblad that is with the 80 millimeter lens, from box A13. Suggest fresh magazine of 3400 black and white film.
AQUARIUS Okay.
CAPCOM Okay, suggest either magazine R or magazine S from A13. Transfer all of this to the LM...

END OF TAPE

CAPCOM - and recommend the following settings. LM/DC/80/BW 3400 (F5.6) at a 250th. And that's all for that one.

SC Okay, Vance. Let me see if I have it here. For the LM want to use the 70 millimeter EC Hasselblad 80 millimeter lens at A 13 on the using 3400 black and white film mag R or S. Prepare to take into of the LM and the setting would be the LM/DC/80/BW 3400 (F5.6) at a 250th.

CAPCOM That's correct. Okay. Next. The next camera - stand by one. I've got noise here. Okay, the next camera for the LM will be 16 millimeter and these photos are considered to be priority 3. Okay. one, get the 16 millimeter dac and powerpack from A8. Get the 10 millimeter lens and remove the 10 millimeter lens and take the 18 millimeter lens from B3 and attach it to the camera and attach the power cable, transfer to the LM, set frame range at 12 frames per second and the same data line that I gave you before reads this way this time. LM/Dac/18/CEX, battery (F8 and 1/250th.) Okay, now looking at these two cameras in the LM it is recommended that you use the 16 millimeter for the first 2 and one-half minutes and then switch to the 70 millimeter. That's partly because the frames been - they have been optimized for closer longer range. Okay. Read back, please.

SC Okay, Vance. I guess this is what you wanted to use as far as the movie camera in the LM goes is our lunar sequence camera which is attached to the power pack. We use the 18 millimeter lens, set it at 12 frames per second (garble) F8, 250th of a second.

CAPCOM Roger. F8 and 250th.

SC Right F8 and 250th.

CAPCOM Okay. Would you believe we have a correction now to the last camera I gave you. Correct that 18 millimeter lens to 75 millimeter lens.

SC Okay. The 18 millimeter to 75 millimeter. lens. Okay.

CAPCOM Right. Okay. Next for the command module pictures. It may be a little hard to see the service module from the command module, but if you can see it, it will be through window 5, people down here think. Recommend for that the CN 70 millimeter. Those photos have priority 2. So this is 70 millimeter EL which has 80 millimeter attached and this is all in B3. Take off the 80 millimeter lens and attach the 250 millimeter lens.

END OF TAPE

CAPCOM And the 250 millimeter lens can be found in U4. Use CEX film from A13. Ring site from A7 and these pictures will F8 at a 250. And I think probably by now you probably already have these cameras configured and this may be redone on information, but here it is anyway. Over.

SC Okay, Vance you're right, we do have cameras almost configured like you said. For the Command Module, you think that the EL or the 250 lens CEX flim F8 at a 250 is the best set and you're saying now that where you think that you will see it is out the window 5, is that it?

CAPCOM That's right, Jim.

SC Okay, my procedure now after Service Module jet is going to be to PITCH up, in order to try to get the Service Module into the - to get the center window in view of the Service Module which we are going to have somebody there to take a photograph. Why do you think window 5 will be it?

CAPCOM Okay, stand by on that one. This is a question of geometry, and I will be right back.

PAO This is Apollo Control at 124 hours 55 minutes. Apollo 13 now 93 329 nautical miles from Earth, velocity 6148 feet per second. We're 12 hours 45 minutes away from the planned last midcourse correction. Tracking to date indicates that would be about a 3.4 feet per second DELTA-V. If it stays around that number, it will probably be done with the reaction control system, it would be a 25 second duration burn with reaction control system. Capcom Vance B Rand will pass up more information here shortly on the photography task as the Service Module seperates and we will stand by for that.

CAPCOM Aquarius, Houston, over.

SC Go ahead, Houston.

CAPCOM Jim, regarding window 5, I have a drawing here and when you're docked you have approximately a 60 degree angle between the Z axis of the two -

END OF TAPE

CAPCOM - you'd have approximately a 60 degree angle between the Z axes of the two spacecraft. It appears that peering out window 5 you would be looking at the rendezvous radar on top of the LM which would - if you pitched more or less to give you a view of the service module. That is, if you pitched, so - from - and I think that this has been run by quite a few folks here so offhand I can't see why any other window would be as good or perhaps even possible.

SC Okay. Understand. Yeah. You're right. When we look out window 5 we can see rendezvous radar. And we'll try window 5.

CAPCOM Rog. It presumes though that there has to be a pitch to be able to see it. You guys sound a lot more rested today.

SC Well, I just went back and sacked out for an hour or so and just got back up.

CAPCOM Very good.

CAPCOM And Jim, Houston. We really are going to get those checklists up to you.

SC Okay.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Jim, it's time for readings on the battery charging again. Request that BATT A voltage and the charger amps. Over.
SC Okay, standby, Vance.
SC Houston, Aquarius
CAPCOM Go ahead, Jim.
SC Okay, we have no more water in the potable tank; we tried to get some more out a few minutes ago, and there isn't any.
CAPCOM Okay, understand you ran out of water in the CM potable tank.
SC Affirmative.
PAO This is Apollo Control at 125 hours, 24 minutes. We have an update now on the lunar module consumables lifetime. These figures include powering up the LM at 136 hours, 15 minutes elapse time. Including that power up we have enough water for 30.7 more hours. The - enough oxygen for 140 - enough oxygen for 146 hours, and -
CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Jim, we you - we're you able to get those voltage - BATT A voltage and current readings?
SC Oh, yes, just a minute, Fred's - Fred's up there now.
CAPCOM Okay. And we're ready to read you the first checklist installment. This will - what we're going to read-up is going to be - a LM timeline; a CSM timeline; and checklist changes to conform with these. And, right now I have the first installment of the CSM timeline; ready to read up. Over.
SC Okay, Jack. I'm going to get - Vance, I'm going to get Jack on the line for that; and so standby.
CAPCOM Okay. And he'll need a lot of paper.

END OF TAPE

AQUARIUS Okay, Jack, I mean Vance, I'm going to get Jack on the line for that and so stand by.

CAPCOM Okay, and he'll need a lot of paper.

AQUARIUS Okay. Volts are 39.5 amps 1.24. Stand by.

CAPCOM Okay, we got it.

PAO Time remaining on the electrical power at 22 and 1/2 hours, which would bring us to an elapsed time of 100, would bring us to an elapsed time on the electrical power of 147 hours 30 minutes. The water remaining would bring us to elapsed time of 155 hours 42 minutes.

AQUARIUS On and ready to go.

CAPCOM Okay, Jack. Wait one, we want to get one into the hands of flight EECOM and it'll take about a minute or two. Sorry to wake you up for this but take about a minute and then we'll read it up to you.

PAO And we have about 137 hours worth of lithium hydroxide left. Partial pressure of carbon dioxide in the lunar module now, is at 3 tenths of a milimeter of mecury. The 146 hours of oxygen left in the lunar module would bring us to an elapsed time of 271 hours. We're at 17 hours 11 minutes away from entry into the earth's atmosphere. Jim Lovell reported a short time ago, that the portable water tank in the command module has gone dry. There is enough of a pad in lunar module water, though that the crew would not have to go thirsty.

AQUARIUS Okay, Vance, go ahead.

CAPCOM Hey, Jack, do you have any of the CM water, bagged water left? Over.

AQUARIUS Negative. I went up and tried to repressurize the surge tank and get another shot of water and was able to repressurize the surge tank okay but there was no water that came out of the water tank.

CAPCOM Yes, we understand that there isn't any more in the portable tank, but we understood that you had put some water from that tank into bags, and I wondered if any of the bags were left.

AQUARIUS Negative.

CAPCOM Okay.

CAPCOM Okay, Jack, ready to copy?

AQUARIUS Okay, Vance, ready to copy.

CAPCOM Okay. Start at EI minus 6 and 1/2 hours. You're going to get LM pads and CSM pads and I don't know if you want to copy them or not. This is something I can just read off to you, without your copying unless you 'specially want to.

AQUARIUS Okay.

CAPCOM Okay, LM pads SM jettison..

AQUARIUS Okay, go ahead, read which ones we're going to get.

CAPCOM Okay, I'll read them fast, first here

CAPCOM so you get a general idea. LM pad service module jet attitude, moon viewing, attitude, sun viewing attitude, and LM jet attitude. The CM pads are course align angles for LM attitudes during moon and sun sightings, course align angles for entry REFSMAT, and CMC angles on entry REFSMAT for LM jet, moon viewing and entry. Okay, that's general pad information. If you want I'll read it slowly so you can copy it down, otherwise I've read it.

END OF TAPE

CAPCOM - general pad information. If you want, I'll read it slowly so you can copy it all down otherwise I'll go ahead.

SC I got - I was trying to copy it as you were reading it, Vance. The LM pads, service module jettison attitude, moon viewing attitude, sun viewing attitude and LM jettison attitude. Is that correct?

CAPCOM That's correct. Okay, I'll read the CM pads now slowly. Course align angles for LM attitudes during moon and sun sightings. Okay, the next, course align angles for entry REFSMATT. Okay, the next, CMC angles on entry REFSMATT for 1 LM jet to moon viewing, 3 entry. Okay, I'll stand by until you read that back.

SC Okay. CSM pads will be course align angles for LM attitudes during moon and sun settings. Course align angles for entry REFSMATT. CMC angles are entry REFSMATT for 1 LM jettison, 2 moon viewing 3, entry.

CAPCOM Okay. That's correct.

CAPCOM Jack, I'm going to hold up one. The hordes of people who devised this procedure are going to be coming into the room in a minute and they'd like to hold up until everybody can listen in.

CAPCOM Get that, Jack?

SC Okay, Vance, we're ready to go.

CAPCOM We lost you there briefly while you were in an attitude where we couldn't receive you. Jack, we'd like to hold off for about 5 minutes. We have some more people coming in to listen to this and it took a lot of people to devise this procedure and a few people have been testing it out so we'd like to have them all on hand while we give you the rest.

SC Okay.

CAPCOM How's the temperature up there, Jack. You guys chopping wood to keep warm?

SC Deke, I think it's about 51, I think, or 50 in the LM and it's about 45 or little bit less in the command module.

CAPCOM Nice fall day, huh?

SC I tell you, we don't have to worry about chill-down.

SC Vance, while we are waiting, do you have there also when I can expect ground to uplink me?

END OF TAPE

SC - fence ground to uplink B.
CAPCOM We'll have that Jack, but stand by for that.
SC Okay.
CAPCOM Jack. Probably the thing to do is to give you all of the checklist and it will include things like this. Then we'll have a big question and answer session afterwards. If that's okay by you.
SC Okay. That sounds good.
SC Okay Vance. While we're waiting, just for your information the command module has been stowed per your checklist with the exception of the two Hasselblad cameras.
CAPCOM Rog. Got that Jack.
SC And the LM is pretty well stowed with the exception when we have yet to bring in the probe and the drogue.
CAPCOM Rog. Got that.
PAO That's Deke Sleyton talking to Jack Swigert.
CAPCOM Relative to your water situation Jack, we're going to have a pretty good hack on the LM here in the next few hours and we anticipate letting you fill your own tanks before we transfer over so we should be in reasonably good shape there.
SC Okay. We have a number of juice bags all cut and ready to go and we tried to get the water out of the command module about 12 - 20 minutes ago and found out that the command module's portable tank was empty. So we have no bags made up now so we're dependent on LM water and PLSS' water.
CAPCOM Rog. If you feel like trying the PLSS that's all excess, and you might want to try that at any time.
CAPCOM I'm sure it'll taste like PLSS but you might as well try it.
SC Okay.
SC Okay Deke. All the windows in the command module are heavily coated with water right now. So I don't know what kind of pictures we'll get out of them but I'm going to try and clean them off and do the best I can with the 250 millimeter lens in the Hasselblad.
CAPCOM Rog. Just so we have the top priority stuff in the LM. We figure you've got a much better chance of getting it through there.
CAPCOM Aquarius, Houston.
SC Are you ready to send it up Vance.

CAPCOM Jack, before we start reading the procedure, we'd like - we find that batt A is topped off and in great shape. Like to switch over and top off batt B some more. Give it 2 more hours of charging. Have about a 7 or 8 step procedure here to give you if you want to copy that. Switching before we start reporting the entry procedures.

SC Okay. Stand by and let me get out my other checklist.

SC Okay Vance. Ready to copy.

CAPCOM Okay. Panel 3. Switch battery charge to OFF.

END OF TAPE

CAPCOM - switch to OFF. Panel 5; MAIN BUS TIE, BATT AC to BATT AC. CB battery charger - BATT A charge to OPEN; CB battery charger BATT B charge - CLOSE. Next, panel 250; CB BATT B power entry post landing to CLOSE. Panel 5; MAIN BUS TIE BATT BC - OFF. Panel 3; battery charge to B; advise - well standby. Jack, advise that we have a backout procedure for this, but we'll read that up to you later, in about 2 hours. And, also, that this procedure is a DELTA to your - the first battery charging procedure that we gave you, in other words, it's a DELTA from where you are right now.

SC Okay, this is the procedure for charging BATT Baker. Panel 3; BATT charge, OFF; panel 5, MAIN BUS TIE BATT AB to AC; CB BATT charger BATT A charge, OPEN; CB BATT charger BATT B charge; CLOSE. Panel 250, CB BATT B power entry and post landing, CLOSE. Panel 5; MAIN BUS TIE BATT BC to OFF; Panel 3, BATT charge to B; this is a DELTA for the first battery charger procedure; you'll give me the backout procedure in several hours.

CAPCOM That's affirm.

SC Okay, I'll put it in work right now, and then come back and standby to copy the rest of - well, I've got the rest of everything.

CAPCOM Everything is right. You'd never believe how much this procedure's been massaged in the last day.

PAO This is Apollo Control at 126 hours. Apollo 13 is 89 401 nautical miles from Earth. Velocity is 6320 feet per second. Jack Swigert's in the process of discontinuing the charge on battery A in the command module. And then they will hook up to BATT - -, the command module battery B and will charge that for about 2 hours top it off.

SC Okay, Vance. I put the BATT Baker on CHARGE; I don't think it quite had stab -

END OF TAPE

SC baker on charge, I don't think it's quite as stabilized. It was reading 1.1 amps 39.6 volts when I left up there.

CAPCOM Okay. Got that.

SC Okay. I guess now is as good a time to start as any.

CAPCOM Just a second, Jack.

CAPCOM Aquarius, Houston.

SC Okay, Vance. your're kind of weak, but readable.

CAPCOM Jack, we're going to need readings on the bat volt and charger amps about every 10 or 15 minutes for awhile so is there somebody else who can be reading them out while you are copying them?

SC Yes. Jim will take a run up there. Fred-o is sleeping right now. We are trying to get some sleep here and Jim'll run up and take a look at voltage and current when you call.

CAPCOM Okay.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius

SC Vance, we've got to realize that we've got to establish a work-rest cycle up here so we can't just wait around here to read the procedures all the time up to the burn. We've got to to get them up here, look at them and then we've got to get the people to sleep. So take that into consideration when you get ready to send up the pads.

CAPCOM I know, Jim. We're very conscious of that. We should be ready to go in about 5 minutes. That's all I can say. Stand by.

SC Okay.

CAPCOM Aquarius, Houston.

SC Okay, Vance, we're ready to go.

CAPCOM Okay, we need a sorry - we need a readout. Volts and amps.

SC Okay. In work.

CAPCOM And, might as well bring the COMM up to a higher fidelity for this long period of checklist reading that requires panel 16, CB primary S-band power amp closed.

SC Primary S-band power amp closed now, how do you read?

CAPCOM Okay, and the next step panel 12, S-band function to voice and -

END OF TAPE

AQUARIUS How do you read.
CAPCOM Okay, next step, panel 12 S-band function to voice and ranging function to ranger.
AQUARIUS Okay, Vance. The S-band function is voice and the ranging switch was a ranger.
CAPCOM Okay, that makes it so we can hear you better Jack.
AQUARIUS Okay, can we, this is the first part of it, you're just going to read and I'm going to copy and we're going to have a question and answer period later. Can we get started?
CAPCOM Okay, the procedures coming back in again. Multi copies for distribution and Ken's back, he's a local expert on that now, so we'll turn you over to him and he'll read it off.
AQUARIUS Okay stand by, I'll give volts and amps.
PAO Ken Mattingly will read the procedures.
AQUARIUS Voltages 39.1 amps 1.75
CAPCOM Okay.
CAPCOM Hello Aquarius, Houston, how do you read?
AQUARIUS Okay, very good Ken.
CAPCOM Okay, let me take it from the top here. There might be some overlap, but to make sure we're all on the same signal. We're starting off with a set of time-line procedures that are going to give us, end up with the normal entry checklist. There will be some checklist changes into the book, but the bulk of what I have for you is the time lines. And it starts at six hours 30 minutes prior to EI and assumes that we're getting LM power to main B in the command module. I think you already have the numbers for the LM pads and the command module pads, I mean the types of pads we'll be giving you. And if you have a question on what they'll be doing or what they're for, I can go over those now or when we get through.
AQUARIUS Okay. Yes I'll make a little note there and we'll discuss this when we get everything copied.
CAPCOM Alright. And the first item then after you get ready to start this checklist is to install lithium hydroxide canisters and stow ordeal On panel 8 we want to turn the flood lights to fixed.
AQUARIUS Okay, wait a minute here, you're going too fast.
CAPCOM Okay, I'll tell you. I'll go line at a time and wait for your verification before I go on to the next one. I have panel 8 flood lights fixed.
AQUARIUS Okay, install LIOH canisters, stow ordeal. flood lights fixed.
CAPCOM Okay, that's the panel 8 flood lights. Now we're going to take panel 5 and put the flood light reostat at flood and the LEB that's panel 100 flood lights also going to fixed. And the purpose of this is to balance up BUSes A and B.

AQUARIUS Okay. Panel 5 flood lights, you want the reostat on. Panel 100 flood lights, you want fixed.

CAPCOM That's affirmative. Okay, on panel 8 circuit breakers EMS main A and main B that's 2 open.

AQUARIUS Okay, panel 8 EMS main A and main B open.

CAPCOM Okay on panel 250, circuit breaker, battery A power entry and post landing closed.

AQUARIUS Okay, panel 250, CB BAT A power entry and post landing closed.

CAPCOM Okay, the same for circuit breaker, battery B power entry and post landing.

AQUARIUS Okay, battery B power entry and post landing closed.

CAPCOM Okay, and add battery C power entry and post landing.

AQUARIUS Battery C power entry and post landing closed.

CAPCOM Okay, that's correct. On panel 5 circuit breaker BAT charge battery A charge, closed.

AQUARIUS Okay, panel 5 CB BAT charge BAT A close.

CAPCOM Okay and the same for circuit breaker for battery charge BAT B charge closed.

END OF TAPE

CAPCOM - battery charge, batt B charge CLOSED.
SC Okay, batt charger batt B CLOSED.
CAPCOM All right. Try to take main bus ties two of them on and up. That's probably a verify.
SC Main bus ties AC and BC ON, verify.
CAPCOM That's correct. Circuit breaker, battery relay bus, battery A and B, CLOSED.
SC Okay. CB batt relay bus batt A and batt relay bus batt B CLOSED.
CAPCOM That's affirmative.
CAPCOM Circuit breaker EPS sensor signal main A and main B CLOSED.
SC EPS sensor signal main A and main B CLOSED.
CAPCOM Okay. On panel 275. Circuit breaker main A battery C CLOSED.
SC Okay Ken. Wait on that one here. I'm just about to lose you here. Just - I'm going to change OMNIs.
CAPCOM Okay.
SC Okay. Could you give me that one again, please.
CAPCOM All right. On panel 275. Circuit breaker main A battery C CLOSED.
SC Okay. Main A batt B CLOSED on 275.
CAPCOM That's Main A battery C, Charley.
SC Main A batt C Charley.
CAPCOM That's affirmed. No - negative on the battery BRAVO.
SC Okay. Big enough on battery BRAVO. That's main A batt Charley CLOSED.
CAPCOM Okay. Good. On panel 276. Circuit breaker instrumentation power control, 3 and 4 OPEN.
SC Would you say that one again Ken?
CAPCOM All right. On panel 276. Circuit breakers instrumentation power control, 3 and 4 OPEN.
SC To panel 276. CB instrumentation power control, 3 and 4 OPEN.
CAPCOM That's affirmative.
CAPCOM Okay. Panel 5. Circuit breaker central instrumentation power main B CLOSED.
SC Okay. Panel 5. (Garble)
CAPCOM Okay I'm sorry Jack. Will you read that again, please?
SC Okay. On panel 5. CB central instrumentation power main B CLOSED.
CAPCOM Okay. That's correct.

CAPCOM Primary evaporate water control valve AUTO.
SC This is on 382?
CAPCOM That's affirmative.
SC Wh- Wh-
CAPCOM Okay Jack. We want to put the primary and the secondary evaporater water control valves to AUTO.
SC Okay.
CAPCOM And Jack. Can you give us a readout on batt B on the charger card?
SC Okay Ken. That was the primary and secondary H2 0 control valves to AUTO on 382.
CAPCOM That's affirmative and did you copy about the readout on the battery (garble)
SC Aw yes. Jim's on his way up.
CAPCOM Okay. Thank you. All right. The next step after your water control valves is perform the CSM RCS preheat. Will do that on page 1-5 steps 35 and 37.
SC Okay Ken. We're having a problem with the COMM. You read now?
CAPCOM Yes sir. Loud and clear.
SC Okay. Perform CM - CSM RCS preheat and could you say again all after?
CAPCOM Okay. I'm referring to the entry checklist page E 1-5, steps 35 and 37.
SC Okay. Perform CSM RCS preheat per entry checklist page - -

END OF TAPE

SC Okay, perform CSM RCS preheat per entry checklist page 1-5, steps 35 and 37.

CAPCOM That's affirmative. Now, back to panel 5; circuit breaker caution and warning MAIN B; CLOSED.

SC CB caution and warning MAIN B; CLOSED.

CAPCOM That's affirm. On panel 2; caution and warning power to 1.

SC Panel 2, caution and warning power to 1.

CAPCOM That was to power to number 1, Jack.

SC Caution and warning power to 1.

CAPCOM Okay. On panel 5; circuit breaker EPS sensor unit, DC BUS A and B, CLOSED.

SC Okay, Ken. The COMM from you is awful weak — awful weak, I — I can't — CB EPS sensor unit. Say again, after that.

CAPCOM All right Jack. That's CB EPS sensor unit, DC that's Delta Charlie BUS A and B, CLOSED.

SC A CB EPS sensor unit, DC BUS A and B, CLOSE. And I'll give you the volts and amps.

CAPCOM Okay, that's correct. Go ahead.

SC Okay, volts are 39.1; amps 1.5.

CAPCOM Okay. On panel 3; MAIN BUS A and B go to RESET and leave it in the center.

SC Okay, panel 3 - standby, got to change OMNI's.

SC Okay. MAIN BUS A and B, RESET and CENTER.

CAPCOM That's affirmative. Okay, now we're at EI minus 5 plus 05. And, as far as you're concerned Jack, the command module is using this for information only. This will be the LM doing an Earth terminator AGS alinement; and at the time of 5 plus 05 is the time they'll be going ahead and releasing their ball. And, this will be covered in the LM checklist it'll be uplinked after this one. At EI minus 5 we perform midcourse number 7. Over.

SC Okay, at EI minus 505; the LM is making an Earth terminator align; and at EI minus 500 we perform MCC 7.

CAPCOM That's correct. At the completion of mid-course 7 the LM will maneuver to a separation attitude. And this attitude will be sent up on one of the pads that you're going to get before all the sequence starts. And it'll be flown to the LM ball angles on that pad.

SC Okay, understand.

CAPCOM All right, at EI minus 4 plus 40 - we want to perform page 1-6, step 39 of the entry checklist.

SC Ah, Ken, I - I didn't get it. We had to change OMNI's again. Could you say it - the EI minus 4 dash - or 440 we do something.

CAPCOM Okay, and at that time you'll want to perform step 39 of page E1-6. Over.

SC Okay, perform step 39 of entry checklist page E1-6.

CAPCOM That's correct. Okay, the next in the command module RCS activation. And, that's step 41 of page E1-6.

SC Okay, the next is perform CSM - or CM RCS activation for step 4-1 on page E- - E1-6.

CAPCOM That's correct. All right, Jack, the next is at EI minus 4 plus 30 -

END OF TAPE

CAPCOM - minus 4 plus 30. We want to verify that the Lm is configured for command module RCS hotfire.
SC Okay. verify LM to configure for RCS hotfire and at EI-430.
CAPCOM That's correct. Now panel 5 circuit breaker G&N IMU heater main B closed.
SC Okay. Panel 5 CB G&N IMU heater main A and main B closed.
CAPCOM Negative, Jack. That's main B only.
SC Okay. Main B only.
CAPCOM I'm sorry, I lost you that time. Say it again.
SC Okay. Let's repeat it. Stand by. Cut out. We really got a strange attitude so this is why we are having the comm problem. Panel 5CB G&N IMU heater main B closed.
CAPCOM That's affirmative. Hot panel 1 rotation control power normal, that's two of them, to AC DC.
SC Okay, panel 1 RAC normal, AC DC, two controllers.
CAPCOM That's correct. On panel 7 SCS logic power 2/3 ON.
SC SCS logic power 2/3 ON, panel 7.
CAPCOM Back to panel 2. RCS command ON.
SC Panel 2, RCS command on.
CAPCOM That's correct. Now the command module RCS check for step 4 on page E 2-1.
SC Okay. perform the command module RCS check per step 4, page 2-1.
CAPCOM That's correct. Okay, at this point we want to lock the rotation hand controllers.
SC Okay, after that lock both rotation hand controllers.
CAPCOM That's affirm. Panel 8 sequential PYRO ARM 2 to ON.
SC Okay. Panel 8 set fire alarm 2 to ARM. Do I get a MSFN GO for that?
SC That's negative, Jack. We haven't powered up any of the downlink at this time. Y ou'll be doing this and the command module RCS pressurization both by yourself.
SC Okay.
CAPCOM Okay. Now, the next event is going to be the separation of the service modules and these are some Lm steps but so that you will know what is going on, I'll read them to you. The LM will do a LM plus X of one-half foot

CAPCOM per second. Then you'll be hitting the CMSM sep on and up on their command. As soon as we are free of the service module, the LM will do another LM minus X for .58 per second. This is called the push-pull maneuver. I think it was described this afternoon.

SC Yes, Ken, I heard about it.

CAPCOM Okay. I just wanted you to know that's the sequence you're in. Okay, at the completion of that, we'll go back to panel 8 and it's sequential PYRO ARM, both of them, to SAFE.

SC Okay. panel 8 set PYRO ARM to SAFE.

CAPCOM Okay. and following this, we take sequential logic 2 to OFF.

SC Logic 2 to OFF.

CAPCOM I'm sorry, Jack, I'll have to ask you to repeat that.

SC Okay. Panel 8 set logic 2 to OFF. Are they on now, Ken. I don't remember - I guess that's what I want -

END OF TAPE

AQUARIUS two are off. Are they on now Ken? I don't remember turning, I guess they were part of the other sequences when we turned them off.

CAPCOM That's afirm. The reason we're turning the logic off Jack is a power savings. So we'll be turning them off and I'll be getting them back on when we go to get off of the LM and then turn them back off then we'll be turning them back on prior to entry. Just so you know what's coming.

AQUARIUS Okay, real fine.

CAPCOM Okay. Then following that the LM will pitch up to acquire the moon proximity, excuse me, they're going to pitch up and acquire the service module and photograph and they'll be using the ACA for rotation from now on. And you may see the LM out of window number 5 at the same time they pitch up to acquire.

AQUARIUS Okay, the LM pitches up acquires the service module and photograph it and I should expect to find my (garbled) service module out of window number 5.

CAPCOM That's affirmative. Okay, now we're down to EI minus 3 hours, the next time-event and the LM starts a maneuver to what we call the moon view attitude. This maneuver is designed to place the command module optics pointing 00 at the moon and it will be flown to on the LM ball angle.

AQUARIUS Okay, the LM maneuvers to the moon viewing attitude which would place the moon in the center of the command module optics with them at 00.

CAPCOM That's affirmative. Okay, now we're going to panel 5. And it's circuit breaker G&N computer main B closed.

AQUARIUS Okay, panel 5 CB G&N computer main B closed

CAPCOM That's affirmative. Now you're going to come up with a 37 enter 0 enter most likely on the computer. And what we want to do is to put the computer to stand by and you come up with a 3706 you'll have to do an enter in order to get the code 62. If its got 62 on it you can do a procede until the disky blanks. You might remember that the AC is still off at this time so you won't be getting the stand by status light, and you're cue to the computer is indeed in stand by is when the disky goes blank.

AQUARIUS Okay, you're saying that I will probably get a program 06 with a VERB 37 enter flashing..

CAPCOM I expect that you..

AQUARIUS 06

CAPCOM I expect you're

AQUARIUS Say again Ken.

CAPCOM Yes. We think that you're going to come up with a 3706 already on the disky. If you do do an enter and that should take you to the code 00062 which is the request for stand by. And when you get that, then procede until the disky blanks. If you come up with something else

CAPCOM that's where we want to end up anyhow. With either, when you get the code 62 when it comes up, just do a procede on it.

AQUARIUS Okay. Is there anything else I could get?

CAPCOM I don't believe so, Jack, that's one that when you get to that step if you do get something else we will be standing by to see what you see. The whole scheme is to go to stand by.

AQUARIUS Will you be gettint it on down-link.

CAPCOM No sir, we don't have that powered yet.

AQUARIUS Okay, I'll yell to Jim and Jim will give you a call.

CAPCOM Okay. The basic thing, Jack, is just to get the computer on stand by to save power.

AQUARIUS Okay.

CAPCOM And we need another battery B readout.

AQUARIUS Okay, he is on his way. Go ahead.

CAPCOM Okay. Okay we're at EI minus 2 plus 30 we're going to panel 5 circuit breaker essential instrumentation main A closed.

AQUARIUS Okay, CB essential instrumentation main A closed.

CAPCOM That's correct. Now circuit breaker G&N IMU heater main A closed.

AQUARIUS CB G&N IMU heater, main A closed.

CAPCOM That's correct. CB LM power 1 and 2

END OF TAPE

CAPCOM Correct.
CAPCOM CB LM powers 1 and 2 OPEN.
SC CB LM power 1 and 2 OPEN.
CAPCOM That's correct.
CAPCOM CB G&N computer main A CLOSED.
SC CB G&N computer main A CLOSED.
CAPCOM Okay Jack. And that's correct. In fact I got it out of sequence. Would you put that computer main A ahead of LM power?
SC Okay Ken. That's CB G&N computer main A CLOSED goes before CB LM power 1 and 2 OPEN.
CAPCOM That's correct. Jack, what we're doing is we've got the LM powering main B and we've had all these particular loads on it and we're getting ready to secure LM power so we wanted to make sure that essential things like the computer, the platform and all have dioded power supplies before we remove the LM power.
SC Okay. Sounds good. Volts 39.1 amps 1.3.
CAPCOM Okay. Thank you. All right. Now panel 275. Circuit breaker main B battery bus B CLOSED.
SC Panel 275 CB main B batt bus B CLOSED.
CAPCOM That's correct. Circuit breaker inverter power 1, 2 and 3 CLOSED.
SC CB inverter power 1, 2 and 3 CLOSED.
CAPCOM That's correct. On panel 5. Circuit breaker battery relay bus battery A and B CLOSED.
SC CB batt relay bus bat A and B CLOSED.
CAPCOM That's correct. Circuit breaker inverter control 1, 2, and 3 CLOSED.
SC CB inverter control 1, 2 and 3 CLOSED.
CAPCOM That's correct.
CAPCOM On panel 3. AC inverter 1 main A.
SC Okay. Panel 3 AC inverter to main A.
CAPCOM That's correct. Now AC inverter 1 AC plus 1 ON.
SC Okay. AC inverter 1 to AC bus 1 to ON.
CAPCOM That's correct. And we're going to also put AC inverter 1 AC bus 2 ON.
SC Okay. AC inverter 1 to AC bus 2 ON.
CAPCOM That's correct. Back to panel 5. Circuit breaker EPS sensor signal AC 1 and 2 CLOSED.
SC See if I can't (garble) down. You got cut out.
CAPCOM Roger.
SC Okay. Could you repeat that please?

CAPCOM Okay. On panel 5, circuit breakers EPS sensor signal AC 1 and 2 CLOSED.

SC Okay. CB EPS sensor signal AC 1 and AC 2 CLOSED.

CAPCOM That's correct. Circuit breaker EPS sensor unit AC 1 and 2 CLOSED.

SC Okay. CBS - CB EPS sensor unit AC 1 and AC 2 CLOSED.

CAPCOM That's correct. And circuit breaker CAUTION and WARNING main A CLOSED.

SC CB CAUTION and WARNING main A CLOSED.

CAPCOM That's correct. On panel 3. AC inverter AC bus 1 and 2 RESET and back to the center.

SC AC invert bus 1 and 2 RESET then center.

CAPCOM That's correct. On panel 225. Circuit breaker flight bus main A and main B CLOSED.

END OF TAPE

CAPCOM - the circuit breaker flight BUS MAIN A and MAIN B. CLOSED.
SC Okay, panel - Okay, CB flight BUS MAIN A and MAIN B, CLOSE.
CAPCOM That's correct. CB CTE MAIN A and MAIN B, CLOSED.
SC CB CTE MAIN A and MAIN B, CLOSE.
CAPCOM That's correct. On panel 4; tele COMM group 1, A C 1
SC Tele COMM group 1 to AC 1.
CAPCOM And tele COMM group 2 to AC2.
SC Tele COMM group 2 to AC2.
CAPCOM That's correct. On panel 3; S-Band normal transponder to PRIMARY.
SC S-BAND normal transponder to PRIMARY.
CAPCOM That's correct. We want to take power SCE to NORMAL.
SC Power SCE to NORMAL.
CAPCOM All right, and power PMP to NORMAL.
SC Power PMP to NORMAL.
CAPCOM That's correct, and uptelemetry command reset to RESET and then NORMAL.
SC Uptelemetry command reset to RESET, then NORMAL.
CAPCOM Okay. On panel 2; uptelemetry CMC to EXCEPT.
SC Uptelemetry CMC to EXCEPT.
CAPCOM On panel 275; circuit breaker flight post landing MAIN A and MAIN B, CLOSED.
SC A panel 275 CB flight and post landing MAIN A and MAIN B, CLOSE.
CAPCOM that's correct. And configure for COMM on panel 6, 9 and 10.
SC Okay. Okay, are you with me?
CAPCOM All right, I assume you got that. Panel 5 circuit breaker IMU MAIN A and MAIN B, CLOSED.
SC CB IMU MAIN A and the MAIN B, CLOSE.
CAPCOM That's correct. Circuit breaker optics MAIN A and MAIN B, CLOSED.
SC Okay, CB optics MAIN A and the MAIN B, CLOSE.
CAPCOM That's correct. CB G&N power AC1 and AC2, CLOSED.
SC CB G&N power AC1 and AC2, CLOSE.
CAPCOM That's correct, and the G&N power switch to A C 2
SC Okay, G&N power switch to AC2.
CAPCOM That's correct. Now we want to perform the CMC power up per the CSM G&C checklist. G2 dash 2.
SC Perform CMC power up per the G&C checklist, page 2 dash 2.

CAPCOM That's correct. Perform the EMS check step 32 of the entry book page 1 dash 4.

SC Okay, perform the EMS check per step 32 per the entry checklist page 1 dash 4.

CAPCOM That's correct.

CAPCOM Okay, now the ground is going to give you a P27 update at EI minus 2 plus 15. That's a - that's a time that you need to be configured to except uptelemetry. And, what they're going to give you on a P27 update will be a - a clock increment, a state vector, they'll give you a VERB 66, they'll give you two REFSMATT's, there'll be an actual and a preferred, and the entry target load. Now, if you'd like to copy those I take it a little slower.

SC No, I got them, they're going to give me a clock Delta -

END OF TAPE

SC I've got them. They are going to give me a clock DELTA, state vector, VERB 66, two REFSMMATs and an entry target load.

CAPCOM That's correct. Okay, and then we'll do -

SC There isn't much else they could give me, is there, Ken?

CAPCOM No, not very much. How about IMU power up according to the GNC checklist 2-1.

SC Okay. Perform IMU power up for GNC checklist page 2-1.

CAPCOM That's correct. Ken, while you are there, you can do the optics power up on G2-3.

SC Perform the optics power up per page 2-3.

CAPCOM That's correct and on panel 229, circuit breaker timers, main A closed,

SC Okay. Panel 229, CB timer Main A closed.

CAPCOM That's correct. And the next thing you will do will be to set the mission timer and what we've done is to only turn on the mission timer on MDC. And you'll probably have to wait here until they get through with the uplink so you can have the computer.

SC Okay. Set it from the CSC, huh?

CAPCOM That's affirm. Okay. Now, we are getting ready to start the alignment sequence and are you familiar with the general sequence of events we are going to use, Jack?

SC How do you mean. We are going to make an alignment on the moon and on the sun, other than that - I didn't get - I wasn't on the headset when the general information was passed up. If there was anymore than that, I didn't get it.

CAPCOM Okay, basically, that is correct. Let me just run through it hand-weighing type for a minute and then I'll read you the steps. I think it will make more sense. Now the scheme is that the LM can fly to set up all angles that will point your optics at the moon. Now at any time in any attitude that we happen to be at, if you can look in the telescope and recognize star patterns sufficient that you believe that you can make an alignment all on your own, that's the place we'd like to break off and let you go ahead and take over with your own alignment. However, we are giving you a procedure which will give you things we know we can see in the telescope without worrying about any reflections or anything of that nature and it's not intended that this procedure has to be followed past the point where you know

CAPCOM you've got good definition of star patterns in your telescope. If you need to go on, we'll maneuver, take a look at the moon, we'll take a mark there and then we'll maneuver with the LM FDAI angles again and take a look at the sun, and get yourself another mark on the sun and that will complete the alignment. Now, the alignment scheme is that we are going to give you a set of angles that you can course align the ball to when the LM is pointing you at the moon. Now, this set of angles will agree with the REFSMMAT that you have in as a nominal REFSMMAT in your CMC. You can course align to that, set a drift flag and REFSMMAT flag and you'll have a good platform and we'll be within a couple of degrees of a good alignment. And, if we have to, we could break off at this point, then go ahead with the entry; however, in an attempt to get a good platform we are going to have you then do a P52 option 1 and what you are going to find in the option 1 slots is the entry REFSMMAT. You'll come up with the NOUN 22 values and we intend to go ahead and course align the ball to the entry REFSMMAT attitude and then we'll go ahead and take marks through a normal P52 sequence. So that's the general scheme that we are going to use. If you think you have a handle on that, I will go ahead and read you the steps.

SC Okay. Well, let me ask a question. The LM maneuvers to a set moon viewing angles. Okay, at this time I am going to do a P-52, is that right? With the planet option?

CAPCOM The first thing we are going to do is to course align the platform and get it inertial based on the REFSMMAT that you have in the -

END OF TAPE

CAPCOM - platform and get his inertial based on the REFSMMAT that you have in the present slot inside the CMC. Will then go and do a P-52, option 4. Correction option 1.

SC Okay. That's after the LM gets established at the attitude. Jim says I'm here at the moon viewing attitude, I do a VERB 41 NOUN 20 to the set of angles that you're going to give me at the pass.

CAPCOM That's affirmative.

SC (garble) of the P-52.

CAPCOM That's correct.

SC Okay. Then I enter the P-52 and that's - option 3. Right?

CAPCOM The P-52 will be done as an option 1. The only reason you have the other REFSMMAT inside the computer is that in order to set the REFSMMAT flag you need some relative orientation.

SC Okay. I see. I do a P-52 option 1 and when do I set the REFSMMAT flag and the drift flag?

CAPCOM That will before entering P-52. I am going to give you this procedure in detail.

SC Okay. All right. Let's go at it. Maybe it'll all fall out and I won't have any questions. Go ahead.

CAPCOM Okay. I'm ready to start reading again. We start with a VERB 41 NOUN 20.

SC Okay. When the LM is at the moon viewing attitude, I do a VERB 41 NOUN 20 ENTER.

CAPCOM That's right. He'll put in the attitudes that you'll get from one of the pads and this will be for the course align angles when the LM is at the moon viewing attitude. Then when they're all squared away, I tell you they have the right attitude, we then pick up again with a VERB 40 NOUN 20 ENTER.

SC Okay. VERB 40 NOUN 20 ENTER when moon is - the LM is satisfied that they're at the moon viewing attitude.

CAPCOM That's correct. Now we're going to set the REFSMMAT and drift flags according to the G&C checklist page G 7-1 steps 3 and 4.

SC Okay. Set the REFSMMAT flag for G&C 7-1 steps 3 and 4.

CAPCOM That's correct. Now VERB 37 ENTER 52 ENTER option 1.

SC VERB 37 ENTER 52 ENTER option 1.

CAPCOM That's correct. And we do the course align.

SC Okay. Perform the course align.

SC - that box in there.
CAPCOM Okay. Now when it gets back to the MARK team we want to take a MARK on the moon.
SC Okay. MARK on the moon with the (garble) in the center. Is that right?
CAPCOM That's affirmative. Okay. When that's complete, the LM will maneuver to the sun viewing angle for attitude.
CAPCOM And when you get there, you take a MARK on the sun using the sun filter and the telescope and again we're marking on the center.
SC Okay. Now, let me ask you a question. Is the first mark on the moon made with the - are all these made with the telescope and not the sextant?
CAPCOM If - I'm not sure right off hand what the angular size of the moon is, Jack. If you can get it in the sextant that's the best thing to do but you may have to go into the telescope in order to find the center. Either one's acceptable.
SC Okay. If I can define the center through the sextant, do it that way. And if I can't use the telescope.
CAPCOM That's affirmed. We know you're going to use the telescope on the sun. Okay. You ready to press on?
SC I'm ready.
CAPCOM Okay. Just reminded we owe somebody a batt B ullage.
SC Okay. Ullage, volts and amps coming up.
CAPCOM All right. Thank you. And this left us in P052 with two MARKS and we'll go ahead and torque the NOUN 93's.
SC Okay. (garble) torque the NOUN 93's. After the 2 MARKS.
CAPCOM Okay. So that gives us a good platform. Now the LM will maneuver to the jettison attitude and the only thing of significance here is that you want to watch to make sure that the path they choose to go to the jettison attitude avoids gimbal lock on your own platform.
SC Okay. The LM maneuvers to the jettison attitude and I just monitor the maneuver and yell at Jim if he gets near a gimbal lock.
CAPCOM That's affirmed. Okay, and then the LM will go to a MAX DEADBAND ATTITUDE HOLD and the jettison attitude.
SC Okay. The LM goes to MAX DEADBAND ATTITUDE HOLD.

CAPCOM Okay. Now we're ready to go back to work. The next thing we'll do is to continue to power up procedures. Do you have any further questions on that alignment Jack?

SC No. No. I think - I think it's all self explanatory now.

CAPCOM Okay. The one thing that everybody would like for you to understand is we certainly don't insist on using the moon and the earth if you find you have good stars, why use them. However, this alignment is more than adequate to give us a good guided entry.

SC Okay. If I get a set of good stars, do I start right out to a basic P-51 attitude - 52 option 1?

CAPCOM That's affirmative.

SC Okay.

CAPCOM Okay. Now we're ready to go to work on panel 275. And it starts with a circuit breaker main A -

SC Wait - wait just a minute. Wait just a minute. I owe you some volts and amps.

CAPCOM Okay. All right.

SC Okay. Volts are 39.4 amps 1.25.

CAPCOM Okay. I thought maybe your meter was stuck before.

SC No (laughter).

CAPCOM All right. You ready to go back to 275? Have a circuit breaker main A. Batt bus A CLOSED.

SC CB main A batt bus A CLOSED.

CAPCOM That's correct. And circuit breaker main B batt C CLOSED.

SC CB main baker batt Charley CLOSED.

CAPCOM Okay. That's correct. Now we're up to EI minus 1 plus 30. And at this time, we're going to proceed with the closeout and hatch installation.

SC Okay. Closeout the hatch installation at EI minus 1 plus 30.

CAPCOM That's right Jack and we're going to close the LM hatch and we'll make the dump valve in the LM hatch CLOSED.

SC Understand you're going to close the dump valve down on the LM hatch right?

CAPCOM That's correct.

SC Okay. This is a change from what we had understood previously.

CAPCOM That's correct.

SC I'm (garble) to see it but that's good.

CAPCOM Okay. That's one vote on your side. Okay. And we're going to go ahead and do the - use the D cal to perform the hatch installation and we'll start on

CAPCOM - the hatch integrity check.
SC Okay. For the D cal perform the hatch installation and start on the hatch integrity check.
CAPCOM That's correct.
SC Okay Ken. One thing I think that - I don't know whether anybody - the D cal don't take into account the fact that we still have the umbilicals connected at what point in time should they be removed?
CAPCOM Okay Jack. That doesn't matter. We're going to be separating the tunnel upstream of those umbilicals and you can leave them right there.
SC Okay. Does it make any difference if we disengage - the LM - we have pulled the circuit breakers LM power 1 and 2 so if we choose to disconnect these umbilicals there's no alarm. Right?
CAPCOM That's right. No sweat.
CAPCOM Joh Ahren just saying that they may be hot. He's checking on that so how about holding a decision on that and let me come back to you?
SC Okay.
CAPCOM Okay. And let me tell you what we're going to do since we told you a different story this afternoon on this tunnel. We're actually going to vent the tunnel down so that we end up with about one and a half to two psi absolute in the tunnel. And this will give us a DELTA P of 3. So we'll do our hatch integrity check at the same time we're venting the tunnel now.
SC Okay. It sounds good.
CAPCOM Okay. Now let me give you some plumbing switches here. Let's take the search tank oxygen valve to ON.
SC Search tank 02 to ON.
CAPCOM All right. Take the main regs 2 OPEN.
SC Main REGs 2 to OPEN.
CAPCOM Okay. And the water and GLYCOL tank pressure, the pressure valve and the relief valves to BOTH.

END OF TAPE

AQUARIUS Okay, water and glycol pressure and relief valve to bolt.

CAPCOM That's correct. And emergency cabin pressure valve to bolt.

AQUARIUS Emercengy cabin pressure to bolt.

CAPCOM That's correct and the suit to man to rigs bolt.

AQUARIUS Suit to man rigs to bolt.

CAPCOM That's correct. Okay, now we're going to panel 5. Circuit breaker ECS transducers, pressure group 1 and 2 main A and main B, that's four circuit breakers closed.

AQUARIUS ECS transducers group 1 and 2 main A and main B four to close.

CAPCOM Okay, now circuit breaker ECS transducer temperature main A and main B that's two of them, closed.

AQUARIUS CB ECS transducer temperature main A and main B closed.

CAPCOM That's correct. On panel 4, primary ECS glycol pumps 1 to AC 1.

AQUARIUS Primary ECS primary pumps to 1 AC 1.

CAPCOM That's correct. Okay, then we'll finish going back to the tunnel vent and verify the LM C and Delta P and make sure its been holding pressure. And we'll come back again and rehash all of the hatch integrity check and tunnel procedures with you. The next thing I want to read off is the EI minus 1 plus 20. We'll go to panel 7 B mag number 1 power to warm up.

AQUARIUS B mag number 1 power to warm up.

CAPCOM That's correct. Then at EI minus 1 plus 10 we'll perform SCS power up per check list page G2-4.

AQUARIUS Okay perform SCS power up per CNC checklist page 2-4.

CAPCOM That's correct. Okay, on panel 4 suit compressor number 2 to AC 1.

AQUARIUS Suit compressor 2 to AC 1.

CAPCOM That's correct. Spacecraft control to SCS.

AQUARIUS Spacecraft control to SCS.

CAPCOM Okay. and your manual attitude switches as you desire. We're coming up on jettison of the LM so that's just like seperation.

AQUARIUS Okay.

CAPCOM Okay, and we'll do a GDC align.

AQUARIUS Okay, perform a GDC align.

CAPCOM Okay on panel 8, rotation control power direct 1 and 2 main A/main B.

AQUARIUS Okay, these are circuit breakers? Rotation control power direct 1 and 2 main A and main B closed

CAPCOM Okay, Jack, I wasn't thinking switch. Let me verify that's a circuit breaker 2. I think we have to get both of them.

AQUARIUS Okay, there's those four circuit breakers over there Ken, when you said panel 8 that's what I thought you were talking about. I don't think the circuit breakers are out right now but why don't we just put verify the circuit breakers and put the switches to main A main B.

CAPCOM Okay, that's correct Jack. Okay, at EI minus one hour we're going to be doing the LM jettison, so just prior to that we'll do a P47.

AQUARIUS Okay say in about one minute to LM jettison, huh?

CAPCOM Yes, just something that's comfortable for you.

AQUARIUS Okay.

CAPCOM Alright, after we've done that, we want to get panel 8 sequential pyro arm two of them on.

AQUARIUS Okay, I get a go for (garbled)

CAPCOM Okay, John says we can watch it.

AQUARIUS Okay.

CAPCOM Alright the next thing is CSM LM final SEP two of them on up.

AQUARIUS CSM LM final SEP two on.

CAPCOM That's correct. Now we're going back to panel 8 and it's sequential pyro alarm two of them to safe.

AQUARIUS Okay, that's pyro alarm two to safe.

CAPCOM That's correct and go back to P00.

AQUARIUS Okay, go to P00.

CAPCOM Alright, and now it's time to configure for single ring.

AQUARIUS Okay, configure for single ring RCS.

CAPCOM That's right and since you're still an hour from EI I guess it wouldn't hurt to use metal lead balls or something like that rather than adapt or at least not till you get closer down. We'll have the DAP lights for you later.

AQUARIUS Okay.

CAPCOM Okay and as soon as you've gotten yourself all set up with a good control mode, you want to maneuver to the reentry attitude.

AQUARIUS Maneuver to entry attitude per to DAP

CAPCOM That's correct. And we show EI minus 55 and which really means when you get to the entry attitude we have a sextant star check for you. And that will be on the pad.

AQUARIUS Okay, perform a sextant star check.

CAPCOM Okay, and I want to remind you to part the optics at 93 of shaft.

AQUARIUS Okay, say again why Ken, I didn't understand that.

CAPCOM Okay, this is just a precaution Jack. If we part the optics with a 90 degree shaft angle that will

CAPCOM align up the slits so it gives you the best air flow over that part of the heat shield and avoids a hot spot. If you don't remember it, I don't think it makes much difference. Just good procedure.

AQUARIUS Okay.

CAPCOM Okay, and after you've got it parked where ever you want it, we'll turn the optic power off and stow the optics.

AQUARIUS Okay, optics power off, stow the optics

CAPCOM Okay, that's good. Okay, the next thing we'll do is initialize the EMF and that's on entry checklist page 2-1 step number 2.

AQUARIUS Okay, perform EMF initialization on entry checklist on page 2-1 step 2.

CAPCOM Okay, that's correct. Now we're coming up on EI minus 45 minutes, and we'll give you an entry pad and a final state vector.

AQUARIUS Okay, at minus 45 entry pad and final state vector for MSFN.

CAPCOM Okay, now we're going to perform what we call the moon check. Rather than go into detail, if you already know what we're doing, just say so, otherwise I'll describe the use of the moon attitude sensor.

AQUARIUS I think you better describe it.

CAPCOM Okay, Jack. You remember everybody in the past has commented on seeing moon set just a couple minutes prior to EI, and you're horizon will probably be dark at the time that you get there you're having an early morning entry and coming in from the west you'll still be looking at a dark horizon. So, just as a back up technique just like you would track the horizon, we're going to give you an attitude which will be on the pad so that you can look directly at the moon. This is an enertial attitude. It won't be changing and you'll put the 36 degree window line on the moon and just sit there and watch it and just prior to E1 the earth will come up and you will then have a good horizon check. And I have some times, and I'll give you that later. And if you just look at this thing now, at that point you can set the GDC or whatever you desire. And you will have a known attitude reference. It's just like a horizon check.

AQUARIUS Okay, I maneuver to the moon check attitude at which time I put the 36 window line on the moon and just prior

END OF TAPE

SC - I maneuver to the Moon check attitude, at which time I put the 36th window aline on the Moon and just prior to TEI the Earth will (garble).

CAPCOM That's correct. And that corresponds to the same inertial attitude that you'd have on the back of your entry card where it shows the horizon attitude several minutes prior to EI, it's the same thing.

SC Yes, S-BAND one at 17 minutes prior. Okay.

CAPCOM Okay, and we're just getting it in a little closer. Okay, the next item on the check -

SC (Garble).

CAPCOM - checklist here is an EI minus 40; we're going to panel 7; and it's BMAG number 2 power to WARMUP.

SC Okay, panel 7, BMAG number 2 power to WARMUP.

CAPCOM That's correct. Now, I'd like to verify the surge tank and repress packages are ON.

PAO This is Apollo Control at 127 hours, 31 minutes. We've completed the shift handover in Mission Control. A change of shift briefing is scheduled to begin in about 15 minutes at 9 P.M. in the main News Center Auditorium, in Building 1 -

CAPCOM - control system; waste water, urine dumped heater, two of them, CLOSED.

SC Panel 5, CB ECS (garble) fuel, urine dump heaters, 2 to CLOSE.

CAPCOM That's correct. Suit compressor number 2 to OFF.

SC Suit compressor 2 to OFF.

CAPCOM That's right, Jack, and what this - what we're planning to do in order to conserve power is we're going to run the suit compressor from an hour to this point at the minus 40. And we'll be watching the PCO2, if that thing's working we'll turn it off at the earliest time that we have a good cabin, and then we'll just leave it off. And in the event that the PCO2 gage isn't working properly or something like that - well, we'll just go ahead and run it for this time frame.

SC Okay, that sounds good.

CAPCOM All right, now, we're at EI minus 30. Sequencial logic, that's two of them to ON.

SC EI minus 30; SEQ logic two ON.

CAPCOM Okay, in panel 7 the BMAG number 2 power to ON.

SC Okay, we - you only gave that 10 minutes for the warmup, huh?

CAPCOM That's okay.

SC Okay.

CAPCOM All right, and the FDAI power to BOTH.

SC FDAI power to BOTH.

CAPCOM Okay. And we want to activate the primary evaporator.

SC Okay, activate the primary evaporator. All this time, Ken, what we've been getting is our cooling. Right now I think we have the radiators at PULL to BYPASS.

CAPCOM That's correct. We started out that way, and we turned the glycol pumps on, and we're just circulating it internally. And, we're counting on the command module being a heat sink, it's pretty cold soaked, and it looks like this is good enough. You got some relatively low heat loads -

SC Okay.

CAPCOM - and we'll keep watching the TEMPS, and if we need it, why we'll start the evaporatory early.

SC Okay, that sounds good.

CAPCOM Do you believe it's cold up there?

SC Yes, and we used to call the command module the bedroom, and it's now the refrigerator.

CAPCOM Okay, just don't call it the refer.

CAPCOM Okay, at about EI minus 19 we get back into the standard entry checklist on page 2 dash 2, where it starts with P61.

SC Okay, at EI minus 19 we get back into the entry checklist at page 2 dash 2; where we start entering P61.

CAPCOM Okay, Jack. Now that's the - those are the timeline note I had for you. I hate to tell you this, but I also have a couple of corrections to make to the entry checklist. They aren't corrections, they just are pieces of the entry checklist which will correspond to what I've writ — already read to you. And I'm ready to go on that whenever you are. And, Vance tells me you can get into the descent water for drinking now.

SC We can get into the descent water for drinking, huh?

CAPCOM Un-huh.

SC Sounds good.

CAPCOM Hey, go to it.

SC Jim would like to know whether the descent water will be good until LM jettison?

CAPCOM Okay, Jack. Looks like we're going to go on the ascent tanks at 128:30. And it looks like -

SC (Garble) S-BAND -

CAPCOM - you have plenty of water. I'm sorry we cut each other out, say again.

SC Okay, yes, I was going to say, understand we're going to go on the ascent tanks at 128:30.

CAPCOM That's right, based on the current rate that's what they predict and you can go ahead and drink the water. No sweat.

SC Okay, real fine.

SC And I've got the entry checklist down, and I'm ready to copy just give me the page.

CAPCOM Okay. Jack, you're starting to sound like an LMP.

SC I think I'm probably the only CMP that's ever witnessed an - a LM burn from inside the LM in - in spaceflights.

CAPCOM (Laughter) I hope it stays that way. Okay, Jack we're starting on page 1 dash 1.

SC Okay, go ahead.

CAPCOM Okay, down in the middle of the page on line 9, we're just going to strike out the activate the vhf for COMM check, and line 10 verify the DSE. We're going to leave the DSE off, and that's to save power as is the VHF activation.

SC Okay.

CAPCOM Okay, on page 1 dash 2. At minus 2 hours there's a title logic sequence check; and we're deleting that entire sequence; that's included in what I read up to you.

SC Okay, delete the logic sequence check at minus 2 hours there.

CAPCOM That's correct. And delete lines 23, 24, and 25; that means a maneuver to super CIRC entry attitude, everything below that is deleted.

SC Okay, delete lines 23 through 28.

CAPCOM That's correct, you got ahead of me. All right on line 29 on page 1 dash 3 we're going to put in a time of minus 00:55, that's the time we gave you for the boresight check.

SC Okay -

CAPCOM It's a sextant check, really.

SC I got that.

CAPCOM Okay, on the top of page 1 dash 4; where it said 1 hour and 15 minutes next to line 32, we're going to change that to minus 2 hours and 30 minutes.

SC Okay, minus 2:30 opposite item 32.

CAPCOM Okay, down at the bottom of the EMS entry check, right there where we are, the bottom line now reads: EMS mode to STANDBY. Well, just above that like to remind you to put our mark, do not initialize the range to go. This is because you're going to come into the EMS entry check, you're going to run through all these things, then we're going to remove power from the EMS. And, just didn't want you to get ahead of yourself and initialize the entry parameters cause you'll lose them when we power up.

SC Okay.

CAPCOM And, after we go EMS mode to STANDBY, like for you to add circuit breaker EMS 2 to OPEN.

SC Okay, CB EMS 2 to OPEN.

CAPCOM That's correct.

CAPCOM And we want to delete this setup camera

CAPCOM - that's listed on the bottom of the page; we're deleting that for power reasons. That's line 33 Alfa.

SC Okay, we're way ahead of you. We already got it stowed.

CAPCOM Okay. On the top of the next page where it says secondary water evap; just keep in mind we don't plan to use the secondary evaporators unless the primary fails. On line 35 on page 1 dash 5; next to command module RCS preheat, the time is now minus 6:30.

SC Okay, minus 6:30 and the voltage reading 3.9 still is good, right?

CAPCOM Okay, very good. Under final stowage the first thing that's listed on line 36 page 1 dash 5 is optics. And, if you want to get started on your stowage we'd like to leave the optics out, because we'll have the star check coming up quite a bit after this. The rest of that stuff can be taken care of at your convenience.

SC Okay.

CAPCOM All right, still on page 1 dash 5, line 37; the time is now minus 6:10 -

END OF TAPE

SC Got that?
CAPCOM And this is one time it looks like we might actually do the preheat so that's the reason we want to make sure that we know that not more than 20 minutes of time on the preheat.
CAPCOM We may not be able to watch it at that time because you are powered up.
SC Okay. Either 20 minutes or till 3.9 volts DC.
CAPCOM That's correct Jack. And now lets go to page 1-6. And about 1/3 of the way down shows panel 275 CB main batt C CLOSED. We want to strike off that line, the next two lines and we're going to strike out main A batt C CLOSED. Main B batt C CLOSED, and DC indicator main B.
SC Okay. After that step on panel 275, strike out CB main A batt C; CB main batt C; and DC indicators to main B.
CAPCOM That's correct. Now under panel 8, it tells you to close all circuit breakers except and I have 4 additions. The first one is CB service module; RCS heaters; QUAD Charley main B OPEN.
SC Service module RCS heaters, QUAD Charley, main Baker OPEN.
CAPCOM Okay. And the same thing for service module RCS heaters QUAD DELTA main A OPEN.
SC Service module RCS heaters QUAD DELTA main A OPEN.
CAPCOM That's correct. And circuit breaker EMS. That's 2 of them, OPEN.
SC CB EMS 2 to OPEN.
CAPCOM All right. And the last is a circuit breakers for SPS gaging, four of them OPEN.
SC SPS gaging, four at OPEN.
CAPCOM Okay. And how about a readout on the battery and a charger?
SC Okay. (garble)
CAPCOM That's affirmed. Well, lets go back to page 1-6, line 41. Lets put in a time minus 440.
SC Minus 440.
CAPCOM That's correct. On page 2-1. Line number 2, put in a time of minus 55 minutes.
SC Okay. Minus 55 minutes.
CAPCOM Okay. And the first thing you want to do under EMS initialization is circuit breakers EMS, thats two of them, to CLOSE.

SC - CB EMS 2 to CLOSE.

CAPCOM That's correct. All right. Line 4 or step 4 where it shows CM RCS check. That occurs at minus 430.

SC Okay. Minus 430.

CAPCOM All right. Under CM RCS checks, the fourth line down says manual attitude 3 to minimal impulse. We'll have to use excel command and the reason for that Jack is we don't have the SCS powered up so there's no impulse generator.

SC okay. Manual attitude, 3 to self command.

CAPCOM That's correct. And on the same page 2-1, strike out the last 3 lines starting with RCS transfer to service module.

SC Right. The last three lines are scratched out. We ain't got one of those pages.

CAPCOM That's correct. Okay, lets flip to page 2-2 and strike out the first 2 lines.

SC Okay. Now wait a second I need to give you volts and amps again.

CAPCOM All right. Go ahead.

SC Okay. It's 39.6 1.12.

CAPCOM Sounds like you're getting there.

CAPCOM Okay. I believe we scratched out the first 2 lines on 2-2. Now we're right below that it says separation checklist. So we're going to just delete that whole thing that included in the notes I gave you.

SC Okay. Its clear to delete notations.

CAPCOM All right. Line number 7. It says maneuver to horizon check attitude. We're going to call this the moon check attitude and this is the one we discussed Jack. The angle of 265 is not correct. I'll have one of those for you first thing in the morning.

SC Okay.

CAPCOM Okay. And at the bottom of the page, step number 1. That will be after EI minus 19 minutes and we're off and running through a normal sequence of events.

SC Okay. That sounds good.

SC Ken. I guess you've read this thing. Is it a comfortable timeline? Any areas where you had problems with?

CAPCOM Jack, it is very comfortable. We run it several times now and fact is it's being run right now again. And we run it both here at Houston and the Cape. The only place where you might find that you need to stay ahead of things is during the platform alignment period when

CAPCOM you're getting ready to close out the LM and then once you get into the command module and jettison the LM why you're back on a very comfortable time. And, of course, we'll be watching and anything we can do, like keeping track of time for you, we'll remind you of that as we go along.

SC Hey, that would be good - that would be good, Ken.

CAPCOM Okay. Let me emphasize, Jack, that 2-1/2 hours is the earliest time we can start in on that power up and stuff. Everything else you can do the way you normally would where you get as far ahead of the game as you can. But the 2-1/2 hour time is based on saving command module consumables. And if you do that while we're fat, we've got plenty of time to give you some fans on the water even. So that's the one point you don't want to start early on. I do have a couple of more lines to run through on the entry checklist and two pages in the G&C. And I think that will clean us up.

SC Okay, Ken, and G&C checklist now?

CAPCOM Let me finish a couple more things in the entry book. You still got that?

SC Yes. Go ahead.

CAPCOM Okay. On - these are just clean-up items, Jack. On page 2-3, it lists how you separate from the CM/SM sep and all that so obviously we're on step 5 and 43 minutes down - that's all deleted. And that gets deleted all the way over onto page 2-4 up to the line where it says 50 minutes. And at that point, we pick backup and everything. from 15 minutes down is valid.

SC Okay. Delete item 5 down to the point where it says minus 15 minutes.

CAPCOM That's correct, Jack. Okay, on page 2-5. The top line where we had horizon check, that's now the moon set check and the time is approximately 57:37. And that's minus 223. And that angle that's listed in the book there - 177 - that's really a horizon time. In two minutes we'll have you - you can look that up on the back of your entry cue card and I'll look that number up again for you tonight.

SC Okay.

CAPCOM Okay. Another thing is to remember when we begin blackout, which is around 05 g and you can write this in your checklist wherever it's convenient, once we've lost comm we're going to go ahead and power down the SCE power off and the PMP power off. And we just want to do that after you lose comm, which comes up aroun TI. Any time after that, go ahead and secure the PMP and the SCE power.

SC Okay. When comm is locked, SCE power off, PMP power off.

CAPCOM That's correct, Jack, and that completes the entry checklist. Let's look at the G&C book.

SC Okay. Ready to copy.

CAPCOM Okay. Let's go to page 2-1.

SC Okay. Go ahead.

CAPCOM Okay, Jack. The second line under IMU power up, says FDAI power to both and we're going to make that a 1. The reason we're doing that is again to conserve power. There's no reason to drive the second FDAI before we get that information to put on it

SC Okay. FDAI power to 1.

CAPCOM All right. That's correct. On page 2-2.

SC Go ahead.

CAPCOM Okay. Under CMC power up, line — step 2 says flashing 3700 enter. The time we're going to use this, Jack, is going to be when you've just brought the computer up and it has a state vector in it that's way back many, many hours ago. So we want to do a VERB 96 enter to stop the integration to keep it from just sitting there ambling along. And when the ground gives you a new state vector, why then we can go through P00 and we'll be back in business.

SC Okay. You want me to go to VERB 37 enter 000 enter and then do VERB 96?

CAPCOM When you come up, I guess you're going to - once you get the CMC powered up, you're probably going to be going - you're going to come up in a flashing 37 and if you'll just do a VERB 96 enter right there, that will take care of it.

SC Okay.

END OF TAPE

CAPCOM - 37 and if you will just do a VERB 96 ENTER right there, that will take care of it.

SC Okay.

CAPCOM All right. And the last one I have for you is on page 2-4.

SC Okay. Go ahead.

CAPCOM Okay. Under the SCS power up, the first line says AUTO RCS select 16 OFF. Okay. You can just delete that part. On the fifth line it says circuit breaker SCS logic power, that's really logic bus, four of them to closed. The DELTA V CG is not important since we are not burning the engine. The signal condition driver bias power lists 2 to AC-1. We are going to make that just 1 of them, make it signal condition driver bias power 1 to AC 1. The B mag power which is the 3rd line from the bottom says B mag power 2 ON, we are going to make that just 1. We'll bring up number 1 and we'll make FDI power number 1 and the last line AUTO RCS select 16 and able, you can strike that off and replace it with B mag mode 3 of them to rate 1. You want to try reading that back?

SC Okay. Delete RCS select 26 OFF. Change CB logic power to logic thrust power, CBS CS logic thrust 4 to closed, delete DELTA V CG, coming down here signal conditioner driver power 1, AC 1, C mag power 1 to ON, and it's the number 1 B mag, ACA power to 1, d mag mode 33 to rate 1, deleting the AUTO RCS select 16 to ENABLE.

CAPCOM That's correct. You've got them all Jack. Thank you.

SC Thank you. This does it, huh?

CAPCOM Yes, Sir. Let's see. Just let me check on this hatch and integrity check, maybe I can tell you something about that. And I do have an answer to your LM power question about the umbilicals. The umbilicals will be unpowered according to the LM procedures, so if you'd like to disconnect them, you can.

SC Okay. I think we will

CAPCOM All right, Sir. Okay, Jack, they'd like us to stand by for just a second.

CAPCOM Jack, would you get the battery charger off, please.

SC Okay.

CAPCOM and we'll finish the rest of that procedure later.

SC You mean there's more? Okay. battery charger is going off.

CAPCOM Right.

SC Okay, Vance, Okay. I don't think you've given me the back out procedure, have you, for the battery chargers?

CAPCOM That's negative. Wait. All we want to do, Jack, is say battery charge off at the moment. We'll complete that procedure as soon as you are through with Ken completely.

SC Okay, Vance, the battery chargers OFF and I'm ready to continue with Ken.

CAPCOM Okay, Jack, and we'll get the back out to you after that.

CAPCOM Okay, Jack. It looks like we've closed up the loose ends here. Amazingly enough, out of all that stuff, it looks like we generated only one question on the floor and we'll research that one. We'll even let you guess what it might have been. If you have any questions, after you mull it over, why, we're always available. Just ask just what you're thinking about.

SC Okay. That's what we're going to do. We're going to wait until the LM people get theirs and we're going to discuss it for these things here, and we're going to make sure that we don't have any interface problems. If we have any more questions, we'll be coming back at you.

CAPCOM Okay, we did run the thing integrated so we think that we've got all the little surprises ironed out for you.

SC I hope so because tomorrow is examination time.

CAPCOM Roger.

SC Ken, this is Jim.

CAPCOM Yes sir.

SC Appreciate the work that you've done, and Jack says that it's going to be hard to beat his record about saving SM RCS fuel all the way there and back.

CAPCOM I can't do much about that. Some people will do anything to set a record.

CAPCOM Hey, Jim, you even did good on Service Module fuel this time.

SC Yes, we're coming back with a full load almost of both RCS and SCS. That's pretty much of a record. Okay, did you want to put Fred-0 on or somebody to copy the LM data out?

CAPCOM Hey, Jack, don't wake him up yet. Standby one.

SC He's awake.

CAPCOM Hey, Jack, we'll give you this Battery charging backout procedure and then Deke says you ought to

CAPCOM - get some sleep. You're going to need it tomorrow.

SC Okay. I'm ready to copy the back out procedures.

CAPCOM Okay. Panel 3, Battery Charge - OFF. You've already done that, Jack. Next AC inverter, inverter to OFF. Panel 5, Main Bus Tie Batt B/C to Batt B/C. Yes, it's the UP position. Panel 250, Circuit Breaker, Batt A Power entry/Post landing to OPEN. Circuit Breaker, Batt B Power entry/Post Landing - OPEN. Panel 5, CB Battery Charger Batt B Charge - OPEN. Okay, I let you read that back, Jack.

SC Okay, Batt Charge - OFF. AC inverter to - OFF. Main Bus Tie, Batt B/C to ON - Up. Panel 250, CB Batt A Power entry/Post landing - Open. CB, Batt B, Power entry/Post landing - OPEN. Panel 5, CB Batt Charger Batt B - Charged - OPEN.

CAPCOM Okay. That's correct. That gets you back to the place where you can back out of the big battery charging procedure, which you have. I think you have the back out procedure for that, but I'd like to check with you.

SC Okay, standby here.

CAPCOM Okay, Jack. Do you have that back out procedure in your hands.

SC Yes, I do, Vance.

CAPCOM Okay, just to verify. It starts out Panel 3, Battery Charge Switch - OFF. AC inverter 2 - OFF. Panel 5, Main Bus Tie, Batt A/C - ON/UP, etc.

SC Roger. Continue, CB Batt A Power entry/ Post landing - OPEN. Inverter Power 2, Main B - OPEN, and then you reverse the steps that you had for entering the procedures.

CAPCOM Yes. That's fine. Okay, and we have one other comment regarding this systems checklist, and standby one and that'll wrap it up for us. A new item came in, Jack. We need to switch to Ascent water, and I have a three step procedure for you, if you're ready to copy.

SC Okay. Jim will copy that.

CAPCOM Okay. Descent water valve - CLOSE. Ascent water valve to CLOSE. Water tank select valve to Ascent.

SC Okay, Vance. Descent water valve - CLOSE, Ascent water valve - CLOSE, and Water select tank to Ascent. Is that correct?

CAPCOM Water tank select - ASCENT. That's correct, Jim.

SC And we'll proceed with that right now, and how about us still drinking descent water?

CAPCOM Jim, we understand that you should be able to continue drinking it.

SC Okay, we switched to ascent water, but we'll probably have to have the descent water valve back opened up again to drink water.

CAPCOM That's affirmative. That's the one thing you'll have to do is whenever you want a drink -

END OF TAPE

CAPCOM That's affirm. That's the one thing that you'll have to do is whenever you want to drink out of the descent tank is open the descent valve. The descent water valve momentarily will have to be opened.

SC Okay. We are now on ascent water.

CAPCOM Okay. I need Jack again, please.

SC Okay, Vance. I'm here and you have something with the systems checklist.

CAPCOM That's right. Referred to S2-6. This - really what we're talking about, Jack is the hatch integrity check decal. I think that it'll be easiest if you'll open to S2-6 and I'll explain it to you.

SC Okay, Vance. I'm ready to copy.

CAPCOM Okay. This just involves changes. Look down to the third line where it says tunnel vent valve - tunnel vent for 30 seconds. Cross out 30 seconds and cross out the 2 lines below that. In other words, LM CSM DELTA-P, Check DELTA-P and cycle to tunnel vent.

SC Okay. You want me to delete for 30 seconds.

CAPCOM That's affirmative, and the 2 lines below 30 seconds. Actually a part of the fourth line there, which is 8 1/2 minutes, too.

SC Standby. Can you read okay?

CAPCOM Yes. I hear you now. Okay, delete the 2 lines below that or the 2 1/2 lines below that also.

CAPCOM That's affirm, and now we have an addition to put in place of what we deleted. Standby one. The Comm is bad. How do you read?

SC Now it's loud and clear.

CAPCOM Okay. We want you to vent - tunnel vent until, and add the following, until LM/CM DELTA-P is equal to 3.0 psid.

SC Okay, until LM/CM DELTA-P equals 3.0.

CAPCOM Okay, and that means that you'll have a pressure of 1.5 to 2 in the tunnel absolute. That's a note.

SC Okay.

CAPCOM Jack, we've got something that we want to end up with ultimately is 1 1/2 to 2 in that tunnel depending on the gauge reading, but that should be about 3.

SC Okay, Deke.

CAPCOM Okay, then Jack, continuing on, every-thing is okay until you get down to on the next page, you get through verify 02 flow indicator no increase. We would like to delete everything below that until the last step which is tunnel lights OFF. So starting with the 4 undocking only, delete all lines through tunnel vent valve - tunnel vent.

SC Okay, delete the section that says before undocking only down until where it says tunnel vent valve to tunnel vent.

CAPCOM Yes, through that.

SC Well, through that. Leave tunnel lights off is the only step remaining.

CAPCOM Roger, and just - that's a verify.

SC Okay. Got that.

CAPCOM Okay, really what this does for you then is it gives you a pressure - a tunnel pressure integrity or a hatch pressure integrity check with a DELTA-P of 3 psi between the tunnel and the cabin. And, then you never go on to the steps of venting that on out. You just leave it in there for the time that you separate from the LM. That gives you a shotgun DELTA-V effect.

SC Okay. Copy that.

CAPCOM Okay, I think that's all, but we're polling the house here to see if there's another comment for you. Standby.

CAPCOM Aquarius, Houston.

SC Go ahead, Vance.

CAPCOM Jack, that's it. Unless you have any more questions, why, everyone is hoping you'll hit the sack and get some rest.

SC Okay. You want that Battery backout procedure now. To that - to complete the remaining step?

CAPCOM That's affirm, Jack. We request that you go ahead and finish out the backout completely until you get to square 1. Over.

SC Okay.

SC Houston, Aquarius.

CAPCOM Go ahead, Jim.

SC Do you have any more updates for us?

CAPCOM We've still got a LM update, but we strongly recommend that you and Jack work as hard as you can sleeping for about the next 5 hours. Fred can handle it.

SC Okay, that's what we'll do. We'll put Fred on watch here, and Jack and I will take it easy and if Fred copies the LM update, well, then we'll all start from fresh in the morning.

CAPCOM You bet.

CAPCOM Aquarius, Houston. Over.

SC Go ahead, Vance.

CAPCOM Okay, Fred, two or three things. First, thing is we need a docking angle checked as soon as you can conveniently get it. Second point, please drink all the

CAPCOM - descent stage water you want. That wasn't clear before, and the third point, if you have a piece of paper, standby to get writer's cramps. We have something to give you here.

SC Okay. You want a general look at the docking tunnel index.

CAPCOM Why don't you go ahead and look at that - look at that first, yes.

SC Okay.

PAO This is Apollo Control at 128 hours

SC Jim says the docking tunnel index a plus 2.1 degrees.

CAPCOM Okay. Plus 2.1 degrees, docking tunnel index.

SC Okay. He corrects himself. He says make that sign a minus. Minus 2.1 degrees.

CAPCOM Okay, we just changed, plus to minus.

SC Okay, and your second item was we could drink all of that descent water that's left - looks like about 5 percent, and I'll get a book here and be ready to start writing.

CAPCOM Okay. Get - this won't be as long as the one T. K. read up, but you'll need several pages, probably.

SC Okay, I've got lots of pages here of Ken's photo log. I'm set to go.

CAPCOM Okay, Fred-O. Okay, this is entry LM prep. Starts EI minus 6 hours. At that time you power up the AGS. I think I'll give you a line at a time and when I hear you say okay on that I'll go to the next. Does that sound reasonable?

SC Okay. I'll go hot mike briefly.

CAPCOM Okay. Batt 5 -

SC Hey, how do you read now?

CAPCOM Okay. I read you okay, Fred. Okay, Battery 5 - Battery 5 normal feed on, is the first step.

SC OK. Bat 5. Go ahead.

CAPCOM Okay, use modified LM DPS RCS 30 minute activation checklist.

SC Okay.

CAPCOM EI minus 5 hours. Mid-course 7 -

END OF TAPE

SC Okay.
CAPCOM EI minus 5 hours, midcourse 7 if required. Next, LM preentry procedure, and Fred, the time on LM preentry procedure is just -
SC Okay. Go ahead.
CAPCOM Okay. The time on the LM preentry procedure is just as soon as you're finished midcourse 7, or 5 hours -
SC Go ahead Vance.
CAPCOM Okay.
SC Okay. I've got this TEI minus 5 hours, MCC 7 if required and now you're going to start me a new procedure called LM preentry procedure. Go ahead.
CAPCOM Roger. Maneuver to SM SEP attitude. Configure for CSM hot fire.
SC Okay.
CAPCOM Under that Deadband Max, and attitude control 3 to pulse.
SC Okay.
CAPCOM Perform CSM hot fire. Maneuver back to SM SEP attitude.
SC Okay.
CAPCOM And under that attitude control, pitch and roll, pulse, yaw mode control. Okay next, EI minus 4 hours, 30 minutes. Configure for CM SM SEP.
SC Okay, hold on a minute.
CAPCOM Okay.
SC That was EI minus 4 1/2?
CAPCOM That's correct.
SC Okay, at EI minus 4 1/2 hours configure for SM SEP.
CAPCOM That's affirm, and under that, balance couple on.
SC Okay.
CAPCOM EGS 404 plus 0, 405 plus 0, 406 plus 0, and 470 readout.
SC Okay. Got it.
CAPCOM Translate plus X at point 5 feet per second.
SC Okay.
CAPCOM Then CM SM SEP. After SEP null 470 -
SC Okay, stand by (Garbled)
CAPCOM Okay.
SC Okay. Go ahead.
CAPCOM After SEP null 470 to 0.
SC Okay.
CAPCOM Attitude control three of them to pulse.
SC Okay.
CAPCOM Pitch to acquire service module for photos.
SC Okay.

CAPCOM Okay. Note, use ACA for control.
SC Okay. We can use the ACA now for control.
CAPCOM Roger. EI minus 3 hours, maneuver and AT hold for moon view attitude -
SC Wait a minute. Was that maneuver in AT hold for moon view. Is that right?
CAPCOM - for - That's affirm. - for moon view attitude, until CM platform release.
SC Okay. It says maneuver and AT hold for moon view attitude until CM platform release.
CAPCOM That's affirm. Better worded, it would have been maneuver and hold an attitude for moon view et cetera.
SC Okay. That's mainly for, Jack, to be able to get at the optics, you mean.
CAPCOM Yes. That's correct. Okay Fred, could you give us a readback on everything up to this point?
SC Okay, I'll go back to normal voice. This might- or is this pretty clear?
CAPCOM It's clear.
SC Okay. The events are titled entry, LM SEP, EI minus 6 hours. Earth bat 5 normal feed on, backup used modified LM dip, (Garbled) 30 minute activation check list. Next is TEI minus 5 hours, MCC 7 if required. Now, we have a LM preentry procedure. First, we maneuver to service module SEP attitude. Second, configure for CSM hot fire. Under that Deadband Max, and attitude control 3 to pulse. Thirdly, perform CSM hot fire. Fourth, we - the LM maneuvers back to SM SEP attitude, with attitude control pitch and roll the pulse, attitude control yaw to mode control. Now, have you got that so far, Vance?
CAPCOM That's correct so far Fred.
SC Okay, at EI minus 4 1/2 hours, configure for SM SEP. First, balance couple on. Secondly, 0 to counters in EGS, 404, 405, 406, plus 0, readout 470. Thirdly, translate plus X to point 5 foot per second. Fourth, CM SM SEP. Fifth, after SEP null 470 to 0. Sixth, attitude control 3 to pulse. Seventh, pitch to aquire service module for photos. And a note, use the ACA for control. Last. we had - you gave me was TEI minus 3 hours. Maneuver in AT hold for moon view until the CM platform release.
CAPCOM Okay Fred. Only - Only a minor point that we just picked up. At the very top EI minus 6 hours, the title is power up, above Bat 5 normal feed on.
SC Okay, the title above Bat 5 normal feed on is power up.
CAPCOM Okay, and on the last it was maneuver in AT hold from moon view attitude until CM platform release.

CAPCOM I think that's what you read. Okay, ready to go on? EI minus - Are you there?
SC Okay. Okay next is EI minus what, Vance?
CAPCOM It's EI minus 2 1/2 hours, Fred.
SC Okay. EI minus 2 1/2.
CAPCOM Okay. The title, power removal from CM-LM umbilical.
SC Okay, power removal from CM-LM umbilical.
CAPCOM That's correct. Next, assume -, this assumes all descent batteries on line.
SC Okay, I'll put that as a note.
CAPCOM And ascent batteries 5 and 6 on normal B.
SC Okay. This assumes all descent bats on line and ascent bats 5 and 6 on normal B. Go ahead.
CAPCOM Roger. Next, CSM CB LM power 1 main B to open.

END OF TAPE

SC Okay. CSM CB LM power 1 main B open.
CAPCOM Next, CB LM power 2 main B open.
SC Okay. CSM CB LM power 2 main B open.
CAPCOM CB EPS sensor signal main B to open
SC Okay. CB EPS sensor signal main B open.
CAPCOM Okay. Next, the LM. CB EPS panels 11 and 16 cross tie balance loads to close.
SC Okay. On the LM side now. CB EPS 11 panels 11 and 16 cross tie balance loads close.
CAPCOM That's correct. Next, CB PES panel 16 bat feed tie - two of them - open.
SC Okay. LM CB EPS panel 16 bat feed tie, two open.
CAPCOM Okay. CB EPS 16, ascent ECA control to close.
SC Okay. CB EPS panel 16 ascent ECA control close.
CAPCOM Correct. Battery 1, high volts - high voltage to off reset.
SC Okay. Battery 1 high volts off reset.
CAPCOM Battery 5 off reset.
SC Okay. Battery 5 high volts - or it should be battery 5 normal feed of reset.
CAPCOM Roger. And - stand by.
SC Or did you mean battery 2?
SC Yes. I think that's what he meant.
CAPCOM Okay. We mean battery 5 to off reset.
SC Okay.
CAPCOM That's a normal feed.
SC Battery 5 normal feed to off reset. Got you.
CAPCOM Okay. Bat 2 low voltage, off reset then on.
SC Okay. Battery 2 low volts off reset then on.
CAPCOM Next. Bat 2 high volts, off reset then on.
SC Okay. (garbled)
CAPCOM Roger. I didn't catch your readback, Fred.
SC Okay. The last item was item 9 and that was bat 2 low volts off reset then on.
CAPCOM Roger. After that, I gave another one. Bat 2 high volts off reset then on.
SC Okay. Bat 2 high volts off reset then on.

CAPCOM Correct Bat 1 high volts on.
SC Okay. Bat 1 high volts on.
CAPCOM Bat 5 normal feed on.
SC Okay. Bat 5 normal feed on.
CAPCOM CB EPS 16 bat feed tie - two of them closed.
SC Okay. CB EPS 16 bat feed tie two closed.
CAPCOM Roger.
CAPCOM Next. The LMP chould transfer to the CM.
SC Okay. I'll underline that one. LMP transfer to CM.
CAPCOM Don't let him forget you.
CAPCOM Okay. And just before LMP transfer to CM, we'd like you to add another step, Fred.
SC Okay.
CAPCOM That is, CB EPS ascent ECA control open.
SC Okay. You want CB - CB EPS that's on 16, I assume, ascent ECA control open.
CAPCOM Affirm.
CAPCOM Okay. This is EI minus 1 hour 45 minutes next.
SC Okay. Go ahead.
CAPCOM Okay. Maneuver to CM LM jet attitude. And you'll have a pad for that attitude.
SC Okay. Maneuver to CM LM jet attitude.
CAPCOM That's afffirm. As a matter of fact, Jack has a listing of your pads there, Fred, also. You can review them after this is over.
SC Okay.
CAPCOM EI minus 1 hour 35 minutes. Configure -
SC EI minus 1 hour 30.
CAPCOM That's correct. Configure for jettison.
SC Okay.
CAPCOM Under that, verify CM free.
SC Verify CM free.
CAPCOM Okay. Next, the comm configuration. S-band, TM prime -
SC Hold on. Say again now.
CAPCOM Okay. Next comm configuration.
SC This is for the command module?
CAPCOM Negative. The step above for CM free was command module, but the comm is for LM again.

END OF TAPE

SC Okay. Go ahead.
CAPCOM Okay. S-band, PM, primary, primary again, off, PCM, range, off, and high.
SC Okay. Our S-band configures, PM, prim, prim off, PCM, range, off, high.
CAPCOM That's correct. Stand by one.
SC Do you have any drothers about which OMNI?
CAPCOM Yes, select best OMNI.
SC Select, did you say, amp or best?
CAPCOM Best. Best in the west.
SC Okay. I'm wondering if that's still going to be best after it leaves. But okay. Best OMNI at the time.
CAPCOM That's affirm. Okay we've covered COMM Fred. Your next ECS.
SC Okay. Go ahead.
CAPCOM Okay. Under ECS forward dump valve close.
SC Dump forward, valve close.
CAPCOM Suit circuit release AUTO.
SC Suit circuit release to AUTO.
CAPCOM Cap and gas return EGRESS.
SC Cap gas return EGRESS.
CAPCOM Suit gas diverter, EGRESS.
SC Gas diverter, EGRESS.
CAPCOM Suit isolation valves, 2 of them disconnect.
SC Okay. Iso valves, 2 to suit disconnect.
CAPCOM Rog. Pressure RES A and B, closed.
SC REGS A and B to closed.
CAPCOM Cabin repress valve, closed.
SC Repress valve, closed.
CAPCOM Suit fan, off.
SC How many more after that?
CAPCOM Two after this, Fredo.
SC Okay. Stand by.
CAPCOM Maybe you need a scroll yet.
SC Yeah.
SC We're asking why all these steps just to get rid of a LM that's going to burn up in a half hour. Seems ridiculous.
SC (garbled)
CAPCOM Okay. Last one was suit fan, off. Jim, Deke said he thought you were asleep.
SC Okay. All these steps woke me up.
CAPCOM Okay. We'll try to be quieter. Except I don't know how. Okay, Fredo -
SC - my audio breaker on.
CAPCOM Did you get suit fan off?
SC Yep. Suit fan off.
CAPCOM Okay. Circuit breakers, panel - circuit

CAPCOM breaker panel 16 rather, ECS cabin repress to open.
SC Okay. CB panel 16 ECS cabin repress open.
CAPCOM Rog. Overhead dump valve, closed. Maybe Jim has a point there though.
SC Yep. Overhead dump valve closed and it is all ready.
CAPCOM Right.
CAPCOM Okay. That's all for the ECS. Next attitude control 3 to mode control.
SC Okay. Stand by 1.
CAPCOM Stand by 1, Fred. We'd like to change the position of that attitude control 3 mode control to be just under CM free. That's a more convenient time.
SC Yes, I agree. Okay. It'll be my item B. Have to verify CM free is ATT control is free to mode control.
CAPCOM And along with that deadband max.
SC Okay. 3 to mode control. COMMA deadband to MAX.
CAPCOM Next verify -
SC - I may not sound to clear because I'm holding a flashlight between my teeth.
CAPCOM Rog. Okay now -
SC I'm up with you. Go ahead, Vance.
CAPCOM Okay, now again down at the bottom beneath ECS verify transfer list.
SC Okay. Verify transfer list.
CAPCOM IVT to CM and close hatch.
SC What was the first part of that?
CAPCOM Transfer yourself to the CM. Or rather IVT that's the commander to the CM and close hatch.
SC Okay.
SC Actually it's commander transfer to CM and you mean close hatches. Plural, right?
CAPCOM That's correct.
SC Okay.
CAPCOM Okay. That's all for the timeline, Fred. Now the contingency checklist, if it's handy.
SC Okay. Which page?
CAPCOM Turn to 30 minute activation page 24.
SC Okay. I'm there.
CAPCOM Okay. Now, at this point you have this section marked up already so what I give you now represents additional deltas to your previously marked up checklist.
SC And I've already got a different colored pen, so it'll show nicely. Go ahead.
CAPCOM Okay.

END OF TAPE

SC Go ahead.
CAPCOM Okay. Okay. Go down to item 4.
SC Roger.
CAPCOM Verify AGS status switch OFF. That's an addition.
SC Do you mean under IVT to the LM number 4 RCS system AB 2 quads 4 AUTO? That 4?
CAPCOM That's affirm. Yes. It's the only 4 on that page 24 and it's a - presently has after it RCS system AB to quads 4 to AUTO. Under that put verify AGS status switch to OFF.
SC Okay. Verify AGS status switch to off.
CAPCOM Okay. At the bottom of the page, okay - you already have that. Mode control both off. Okay. Next page 26, circuit breakers.
SC Okay. Go ahead.
CAPCOM Okay. First row is okay as is. Second row, under flight displays, GSSTA should be closed.
SC Okay.
CAPCOM Under ac bus A, close GASTA.
SC Okay. GASTA flight displays and ac bus A will be closed.
CAPCOM Roger. That's all on the second line. Now the third line, under stability and control. ATCA PNGS to close.
SC Okay. ATCA PNGS to close.
CAPCOM That's all on that line. Fourth line, near the right side, LGC standby to close. And - -
SC Wait a minute. You mean LGC DSKY.
CAPCOM LGC DSKY. I'm sorry.
SC Okay.
CAPCOM And IMU operate closed.
SC Okay. IMU operate closed.
SC Okay, Vance. IMU operate closed.
CAPCOM That's correct.
CAPCOM Okay. Fourth row is okay as is. Now we would like to add a late arrival to row two.
SC Go ahead.
CAPCOM Under flight displays, mission timer closed.
SC Okay. Flight displays, mission timer closed. We can look at the (garbled) right to the end.
CAPCOM Yes. That's right. Okay. That's all for that page, Fred. That should add up to 6 circuit breakers all closed on that page.
SC Vance, Jim.
CAPCOM Go ahead, Jim.
SC Have we looked seriously at all at

SC just the essential things required to make a safe left jettison? We're at - I don't think we have the time to really do any engineering data and people might want to look at it as the thing goes into the atmosphere.

CAPCOM Well, Jim. I think that that was what everybody aimed for and people down here feel that's it's the essential. That it's what you need.

SC Well, we'll do everything you think is essential, but I just don't want to be slow on switches at the last minute. What we're really thinking about getting that command module in good shape.

CAPCOM Hey, Jim, this is Tom. The only reason we're bringing up the PNGS is to have another reference system just to have control of the LM as you jettison. Over.

SC Okay. Okay, Tom. It's - I thought the value of that hold was insufficient for this when we first thought about this.

CAPCOM Yes. I agree. But they decided just in case we have any blitz with the AGS, we want to make sure we get that LM off in good shape. And I agree with you on keeping out all the garbage on it.

SC Okay, Tom.

CAPCOM Hey, would you like to have - -

SC Good night.

CAPCOM Would you like to have us play you some guitar music to put you to sleep?

SC Oh, you know how to get to a guy.

CAPCOM We'll even have a 12 string guitar for you, Jimbo.

SC Okay.

CAPCOM Okay, Fred. Page 28.

SC Okay. I'm looking at panel 16 now.

CAPCOM No changes

SC Is that all panels?

CAPCOM No changes to panel 16.

SC Okay. I'm on 28 now.

CAPCOM Right. Okay. At the top of the page, under step 4, just above vhf test band activation, put in delete power amp and LGC. These are caution lights.

SC Okay. You mean delete pre-amp.

CAPCOM I'm sorry. Pre-amp and LGC.

SC Okay.

CAPCOM Okay. Under vhf S-band activation and checkout, step 2, we have changes to the comm as follows.

SC Go ahead.

CAPCOM Okay. Scratch the down and down voice. That leaves - that'll give you voice.

SC Okay. That's the way we had it last time.

CAPCOM Okay. And we'd like to insert ranging.
SC Okay. Instead of off reset put ranging.
CAPCOM That's correct.
SC Okay.
CAPCOM Okay. Under PNGS turn on, add in steps 1 and 2 again, which are no attitude light off, VERB 96 enter and set event timer.
SC Okay. Steps 1 and 2 back in.
CAPCOM That's affirm. And underneath set event timer, add the following. VERB 25, NOUN 07 enter, 1257 enter.
SC Okay. Go ahead, Vance.
CAPCOM Okay. If you got the 1257 enter then 252 enter and enter.
SC Okay. After event - set event timer VERB 25 NOUN 07 enter, 1257 enter 252 enter - enter.
CAPCOM Roger. And this activates your upfiring jets.
SC Say the last again, Vance.
CAPCOM Roger. What this does, Fred, is activates upfiring jets.
SC Oh. Okay.
CAPCOM They're all - actually, all vertical jets.
SC Okay. I got it.
CAPCOM Okay. Next, same page, under DAP, set gimbal drive. Go to step 2. Okay. Add in after NOUN 46 32021.
SC Okay. 32021.
CAPCOM Okay. Proceeding on down below the NOUN 47, to the proceed, insert VERB 34 enter, after the proceed. That would come before the NOUN 48.
SC Okay. (garbled) and then do a VERB 34.
CAPCOM Roger. Okay. We have some noise here, Fred. Stand by a minute.
SC I switched OMNI's. How's that?
CAPCOM Hey, that helped. Okay. No changes now on 29, 30 and 31. Next page is 32.
SC Okay. I'm on 32.
CAPCOM Okay. At the very first step above guidance control AGS, put in VERB 76 enter.
SC Okay - -

END OF TAPE

CAPCOM - EGS, put in verb 76 enter.
SC Okay, verb 76 enter.
CAPCOM Okay, below guidance control EGS, the third step should be changed to be mode control both to ATT hold.
SC Okay. You want mode control both to ATT hold.
CAPCOM That's affirm.
SC Okay.
CAPCOM Okay. At minus 6 hours, or 6 minutes rather, under mode control PNGS ATT hold, which was scratched out, insert verb 41, noun 20 enter, and three more enters. So, so it's, it's shown in your procedure there.
SC Yes.
CAPCOM Okay -
SC Course align 000.
CAPCOM Below that put in DEDA 400 plus 5.
SC Okay, DEDA 400 plus 5.
CAPCOM Okay. Okay, we want back in again the next step which is at burn attitude verb 40 noun 20 enter.
SC Okay.
CAPCOM Okay, proceeding on down, delete at burn attitude and the step above it, which is 400 plus 5.
SC 400 plus 5 and the ATT burn attitude.
CAPCOM Correct.
CAPCOM Okay, that's all for page 32 Fred,. Next, page 33.
SC Go ahead.
CAPCOM Okay, under 4 minutes, minus 4 minutes, add back in mode control both to ATT hold.
SC Okay, mode control both to ATT hold.
CAPCOM Okay. Two steps below that add back in TTCA commander throttle min DPS, and add in DPS.
SC Wait a minute.
CAPCOM Standby one.
SC (Garbled)
SC Yes. Seems like these should be in jets since this is going to be - is this going to be RCS or DPS burn?
CAPCOM Okay, this will be jets for RCS and throttle for DPS.
SC I understand is what is this SPC likely to be. I thought it was going to be an RCS.
CAPCOM Well, we expect that, but we're remaining flexible.
SC Okay. Okay, I'll put it TTCA throttle min for DPS, jets for RCS.
CAPCOM That's correct. Okay that's all on page 33. Go to page 34.
SC Okay, 34.
CAPCOM Okay. Beneath everything on that page, add in the following. Return to entry LM -

SC Wait, wait.
CAPCOM Return to entry, LM prep checklist -
SC Hold on Vance, I don't understand, we want to delete everything on page 34?
CAPCOM No, that's not correct Fred. What we want to do is leave everything the way it is on 34 and add this one comment I'm giving you at the bottom of it.
SC Oh, okay. Okay, I misunderstood. Okay, go ahead with your added comment.
CAPCOM Return to entry LM prep checklist, add EI -
SC That's return to - return to entry LM checklist?
CAPCOM That's affirm. At EI minus 5 hours.
SC Okay. At EI minus 5 hours. Lt me take a look and see how that goes now.
CAPCOM Okay, and also you have a -
SC Okay, that would be the LM preentry procedure. Yes. Okay.
CAPCOM That's correct, and also on that page you, from our last correction or addition exercise, you have section called reestablish PTC. We'd like to scratch all of that of course.
SC Rog.
CAPCOM Okay Fred, that's all except for one comment that we have, just a second. Stand by one. Fred, we're polling the room for comments here, any last minute thoughts from people. We'll be right back with you.
SC Okay.
CAPCOM Aquarius, Houston.
SC Okay, go ahead.
CAPCOM Okay Fred, just two changes, comments to what we just gave you. The first is near the front at EI, in the section under EI minus 2 1/2 hours, power removal from CM-LM umbilical. We'll let you turn to that.
SC Okay, I'm there at EI minus 2 1/2 hours, power removal CM-LM umbilical.
CAPCOM Okay. Under LM, we have a step Bat to low voltage off reset then on. Next we have a step Bat to high voltage off reset then on. We request that you wait in between these two steps for us to give you a go. In other words, we'd like to look and see that all the relays closed and all that sort of thing before you throw Bat 2 high voltage to off reset and on.
SC Okay. After Bat 2 low voltage off reset I'll then on, I'll wait for a (Garbled) go before proceeding.
CAPCOM Right-o. Okay next, at - under the section of EI minus 1 hour 45 minutes - no change that, correction, EI minus 1 hour, 35 minutes, refer to the ECS section and we have a change.

SC All right, go ahead Vance.

CAPCOM Okay, Jim's right. We should cross out all this stuff with a couple of exceptions. Forward dump valve closed, the first step should remain. All other steps should be scratched except for the last one which is over head dump valve closed. That leaves two steps.

SC Okay, under ECS we delete all except the first step forward dump valve closed, and step 10 which is overhead dump valve closed, and leave in verb (Garbled) transfer list.

CAPCOM That's affirm. Leave in what follows, which is verified transfer lists and IVT and all that. IVT of course, meaning CDR transferring to the CM.

SC We wouldn't forget it.

CAPCOM Okay Fred-o, that's the changes, not quite as extensive as the CSM had but still pretty long. Any comments or questions for the house here?

SC No. It looks pretty good to me Vance.

CAPCOM Okay. Very good. Oh, and the other comment aside from the checklist, we've been watching your descent stage water and it looks - or your ascent water and it looks real good.

SC Okay.

CAPCOM Okay Fred, we're going to try to refrain from calling you from now on so that you can maybe get a couple of winks. We're getting a status around the room first to see if anybody has any comments for you and after that -

END OF TAPE

CAPCOM - the status around the room first, to see if anybody has any comments for you, and after that, we'll try to leave you alone for awhile.

SC Thank you.

CAPCOM Aquarius, Houston. Aquarius, Houston. Hey, Fred-O, are you there?

SC All right, go ahead.

CAPCOM Okay. We polled the room. We don't have much for you. Only comments as follows. Your consumables are looking good. Your entry GAMMA right now is minus 6.01. We're expecting a mid-course of 2.81 feet per second which should be about 21 seconds of RCS.

SC Okay. It sounds good.

CAPCOM Okay, Fred, see you in the morning.

CAPCOM Aquarius, Houston. Request you open the power amplifier circuit breaker and down voice backup, please.

SC Complete.

CAPCOM Roger.

PAO This is Apollo Control at 129 hours 43 minutes. Recounting events since the change of shift about 3 hours ago. We've completed passing up to the crew checklists for both the Command and Service Module and the Lunar Module - entry checklist, at about 128 hours 30 minutes, we had the crew switch over from the descent water tanks which were down to about 5 percent to the LM ascent stage water tank for cooling. We instructed the crew that they could drink all the water from the descent tank. At about 127 hours, 59 minutes, the Battery charging was terminated. This had been accomplised by using power from the LM batteries and using that to charge the Command Module entry batteries two of the three CM entry batteries. At the present time, Fred Haise is on watch, and Jim Lovell and Jack Swigert are scheduled for about 5 hours rest. We're also planning to place a minimum of calls to the spacecraft to allow Fred Haise to get a bit of rest also, at this time. Flight Dynamics Officer, and the Retro Officer - the Return to Earth Officer have currently predicted that our entry interface angle will be minus 6.03 degrees without a mid-course correction. We're presently planning for a mid-course correction - Mid-course correction 7 which would be 5 hours prior to entry interface. As it looks right now, this mid-course correction would be quite small to put us on the desired flight path angle of about 6 1/2 degrees-negative 6 1/2 degrees interface angle. To accomplish this, it looks as if we'll have about a 2.8 second - 2.8 foot per second burn with the Lunar Module reaction control system thrusters. This would require about

PAO - about 21 seconds of thrusting. During the course of the evening, both Deke Slayton and Tom Stafford have been standing by the CAPCOM console. Occasionally interjecting a comment. At one point, while Fred Haise was receiving a Lunar Module entry checklist, with a hot mike, with his mike open, we heard a comment from Lovell which prompted a remark from Deke Slayton to the effect that he would play up some guitar music if they thought that would soothe Lovell into getting a bit of rest. Ken Mattingly has also been here a good part of the evening. We don't see him at the console at this time. Our Capsule Communicator up until just a few minutes ago was Astronaut Vance Brand and he has since turned over those duties to Astronaut Jack Lousma. At 129 hours 46 minutes, Apollo 13 is 87 684 nautical miles - correction 74 900 nautical miles from the Earth, and travelling at a speed of 6 999 feet per second. All of the consumables aboard the LM remain in good shape at this time. We had Fred Haise remove the LM power amplifier and in effect reduce the effective power output — radio frequency power output from the LM from about 20 watts to about 1 watt, which is the normal powered down configuration we've been in with the LM for communications. We expect it will as it has in the past give us periods of noisy communications as the LM antennas rotate through the so-called null areas. Where the signal to noise ratio drops off - we get a high noise level and this will persist until the spacecraft rotates through to where we have good lockup on the LM antenna, and again at 129 hours 47 minutes, this is Apollo Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 11:04P GET 129:51 582/1

PAO This is Apollo Control at 130 hours 36 minutes. The Flight Dynamics Officer just reported that continued tracking data shows the spacecraft to be within the entry corridor still at about the same entry interface angle as previously reported. The tracking at this time shows that our entry interface angle remains at about minus 6.03 degrees. The midcourse correction plan for 5 hours prior to reentry which will be about 7 hours 3 minutes from now. It is planned at this time to be 2.81 feet per second. That would be about a 21 second burn with the spacecraft, the LM reaction control system thrusters. In about an hour, Flight Director Milton Windler plans to go over once again with the flight controllers all of the step by step procedures which the crew will be following tomorrow prior to entry while with the command and service module. At the present time Apollo 13 is 71 483 nautical miles from the Earth. Traveling at a speed of 7192 feet per second. All of our consumables on the LM remain unchanged. We're in good shape on water, battery power, and lithium hydroxide. The present level of carbon dioxide as measured in the spacecraft telemetered back to the ground is about .4 of a millimeter of mercury which is very good. We're showing a total average current on the LM, at this time, of between 10 and 12 amps, which has been the normal amount we've been running in the powered down mode with the lunar module. At the present time, all 3 of the astronauts are apparently resting. Astronauts Lovell and Swigert were to have begun a rest period at about 128 hours 17 minutes. We did hear once or twice Jim Lovell after that period. At the 129 hours 39 minutes or about 1 hours ago, we completed passing the lunar module a preentry checklist up to Fred Haise and advised him that we would keep communications to a minimum, and hoped he would be able to get a little rest also. At 130 hours 39 minutes this is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-16-70 CST 11:53P GET 130:40:00 583/1

PAO This is Apollo Control at 131 hours 14 minutes. Our last conversation with the spacecraft came at about 129 hours 39 minutes, a little more than an hour and a half ago. Since that time it's been relatively quiet here in Mission Control. Within the next hour, flight director Milton Windier plans for review again the procedures to be followed during the reentry with each of the flight controllers. These entry procedures were passed up to the crew, prior to the time they began their rest period. At this time we presume that all three crewmen aboard the spacecraft are resting. At the present time we show Apollo 13 to be 68 857 nautical miles from the earth. The velocity increase now up to 7346 feet per second and increasing ever more rapidly as the spacecraft nears earth. We're now 6 hours 25 minutes from the scheduled midcourse correction which will put Apollo 13 in the center of the entry corridor. And we're 11 hours 25 minutes from the beginning of reentry. At 131 hours 16 minutes, this is Mission Control, Houston.

END OF TAPE

APOLLO 13 MISSION COMMENTARY,4/16/70,CST 12:36A,GET 131:23:00,584/1

PAO This is Apollo Control at 131 hours 47 minutes. Apollo 13 now 66 596 nautical miles from the Earth travelling at a speed of almost 75 000 feet per second at the present time, and we're some 10 hours 53 minutes from reentry. 5 hours 53 minutes from the scheduled mid-course correction maneuver, mid-course correction 7, which is targeted to put Apollo 13 in the center of the reentry corridor. Our last communications with the spacecraft was at 129 hours 39 minutes when we completed passing up the Lunar Module pre-entry checklist to Fred Haise, and we presume that all three of the crewmen have been resting or at least relaxing since that time. At 128 hours 17 minutes or about 3 1/2 hours ago Fred Haise and - rather Jack Swigert and Jim Lovell were scheduled to begin a rest period. Although, we did hear from Jim Lovell once or twice, after that time, we have not heard from Jack Swigert since the rest period began. At 131 hours 49 minutes, this is Mission Control standing by.

END OF TAPE

PAO This is Apollo Control at 132 hours 29 minutes.
CAPCOM You asleep, Fred? In a couple of minutes we're going to hand over the Honeysuckles so there'll be - our uppoint will be terminated. We'll contact you when we get it back. After that I've got a couple minutes of work for you.
SC Alright. Go ahead.
CAPCOM Let's wait till after the handover.
SC Are you there, Jack?
CAPCOM Yes, I'm hearing you loud and clear -

END OF TAPE

SC Are you there, Jack?
CAPCOM Yes. I'm hearing you loud and clear. How me, Fred?
SC (garbled)
CCPCOM Okay. We want to get some ranging data on you for about 15 minutes. So close the power amplifier circuit breaker and go to nominal voice please.
SC Okay.
SC Okay. You ought to have it now, Jack.
CAPCOM Okay. You're coming through good now, Fred. I've got three DELTA's to the checklist. They're minor changes. I'd like to pass them along now. One of them is to the CSM checklist. So if you'll pick that up, I'll give it to you.
SC Okay. Which one?
CAPCOM Okay. Stand by one.
SC Is it the one Jack wrote them all in? The big long feed out? He also wrote something in the G&N book.
CAPCOM It's in the big, long one he wrote out at about EI minus 230. EMS entry check.
SC Okay. He's coming back down with it.
CAPCOM Meanwhile, Fred, I've got 2 for you on the LM prep checklist.
SC Okay. Jack's here now. I'll hand it down.
SC Okay. Houston. Aquarius.
CAPCOM Hello, Aquarius. I've got a couple of changes for you on your CSM checklist.
SC Okay. Stand by one. Okay. Go ahead.
CAPCOM Okay, Jack. The timeline between EI minus 230 and 1 hour is real crowded, so you're really going to have to hussle and we've decided to delete the EMS entry check at minus 230. That will give you a little more time in there. What we've decided to do with it is wait until after EI minus 1, just before you initialize the EMS. If you have time, and only if you have time, do the EMS entry check. Otherwise, forget it and go right on into EMS and initialization. Understand.
SC Okay. You're going to delete between 2 hours and 30 minutes and 2:15 there and you're going to add it, if there is time, only if there is time, at EI minus 1 hour where the EMS initialization occurs.
CAPCOM That's right. You got it correctly. Okay, Jack. One other item. Just before EI minus 2 hours and 15 minutes, we need (garbled) VERB 74 enter. Over.
SC Okay. Stand by one, would you? Okay. Right before 2 hours and 15 minutes, I assume that's

SC before (garbled) give their P27 update, I do a VERB 74. Right?
CAPCOM That's affirmative, Jack.
CAPCOM How much sleep did you get, Jack?
SC Oh, I guess - stand by. I guess maybe 2 or 3 hours. It was awful cold and it wasn't very good sleep.
CAPCOM Roger. You plan to try to get any more?
SC What GET do you have?
CAPCOM We got 132:37.
SC Well, if I get everything done, I'll try, but I'll tell you, it's almost impossible to sleep. All of us have that same problem. It's just too cold to sleep.
CAPCOM Roger. The way we're looking at it, looks like you ought to have a couple of free hours here before you have to really get with it.
SC We'll take it easy, but I - you know, we'll try to sleep, but it's just awful cold.
CAPCOM Present data indicates that your entry angles minus 6.03 degrees. You DELTA V at the mid-course is going to 2.8 feet a second.
SC Okay. Copy.
SC Jack, this is Jim. I understand this is going to be an RCS burn.
CAPCOM That's affirmative, Jim. It's going to be an RCS burn.
SC Okay.
CAPCOM And we need the suit circuit relief valve back to AUTO. Correction - back to CLOSE.
SC Hey, Jack, that didn't work. And one thing, comparing Jim's checklist with my own, I find one difference there at EI minus 2:30. His checklist has me changing a - opening a EPS sensor signal circuit breaker right prior to turning off LM power. Is - I'd like to find out which checklist is correct.
CAPCOM Hey, Jack, the LM checklist is just for information to Jim. It's just to tell him that you're changing back to command module power. Your checklist is correct.
SC Okay. And when do you figure that you'll be sending up the pads that you have?
CAPCOM Aquarius, all of your pad will be coming up in about 3 and a half hours, at EI minus 6:30. And one thing we want to remind you of when you remove power from the command module LM umbilical is to be sure that you open the LM power main B circuit breakers - both of them - before you start throwing the switches and circuit breaker in the LM. Do it as we've outlined it in the procedures

CAPCOM in that order. Over.
SC Okay. That's the way we planned on it. We'll let Jack do his three and then he'll tell us when we're go from there. What page is those changes on?
CAPCOM Okay, Fred. The one I've got for you is at the end of power removal from the command module LM umbilical. And just for your information, after you go through that entire procedure and about the time you're ready to transfer to the command module, at that time, power will be removed from the umbilical and it's okay to disconnect it. That is, after you've thrown the switches in the LM. Is that clear?
SC Roger. That's where I've got a remark here to check with you to see if it's all right to proceed.
CAPCOM Roger. And that would be just after panel 16, you open the ascent ECA control breakers.
SC What's that number at that?
SC The confusing thing is, Jack, where they told me to ait from this then go before proceeding was that bat 2 low volts off reset then on.
CAPCOM Okay. That's still affirmative. We'll give you a go after waiting 5 seconds and then down from there just a few steps, after you have opened the ascent ECA control breakers on panel 16, at that point, the umbilical is not powered and it's okay to disconnect them should you care to do so.
SC Okay. After the last step, then, I'm free to disconnect.
CAPCOM Right. And one other change we have is the - shortly after that, where we're configuring for jettison, we have closed both the forward dump valve and the overhead dump valve. And we don't want to get in a locked up position like that, so one way to get around it is to - after we close the forward dump valve, turn the descent oxygen valve off. Over.
SC Okay. After the forward dump valve add a sub in that says the descent off the valve off.
CAPCOM Okay, Fred. That concludes the DELTA's. And perhaps, you heard that our GAMMA's are still minus 6.03 and our DELTA V will be at 2.8 foot per second. RCS burn.
SC Roger.

END OF TAPE

CAPCOM Fred-0, We've got one more change we'd like to give you to clarify a question that Jack asked earlier. At E1 minus 230 -

SC Okay, hold on a minute, Jack. I meant to call Jack back down. I'm not familiar with the previous discussion.

CAPCOM Negative. This is on your checklist.

SC Okay. Go ahead.

CAPCOM At EI minus 230, during power removal from the umbilical, first thing we do is 2 steps with the CSM. We open the main B - the LM powered main B powered circuit breakers and then there's a third step which says, circuit breaker EPS sensor signal Main B open. Just delete that step. Over

SC Okay. Delete the third step.

CAPCOM And Aquarius, for your information, as far as our water supply is concerned including our plans for power up, we have an additional 18 hours of water remaining from this point.

SC Okay. 18 hours of water remaining from this point, Jack.

SC Hello, Houston, Aquarius.

CAPCOM Hello, Aquarius. Go ahead.

SC Okay, Jack. This is Jim. I just want to make sure that you'll fill in any of the changes to the checklist that come up, and make sure that they're absolutely essential. When we don't have procedures, we can only do it one time, and we can't make changes at the last minute. We'd like to do the best that's conceivably possible, but unless the changes are really essential, don't bother sending them up.

CAPCOM Roger. We won't. The Chairman of the CPCB is still active, and one thing that we're trying to do is to save you all the time we can between EI minus 230 and 1 hour.

SC That's affirm. That's a real important time.

CAPCOM For your information, Jim. I don't know whether you heard that originally, but time for 2 1/2 to 1 has been run about 3 times, and it's pretty tight, so we've tried to weed out what we could which isn't much, but I think the other message you might impress on Jack when you get around to winding that platform - don't try to get it down too neat. It doesn't have to be all that good. Just do a nice quick and dirty one and that's going to be good enough anyway.

SC I concur. I think for reentry, we don't have to have a real accurate platform, but I haven't told Jack that.

CAPCOM Roger. Hey, Jim, while you're up and things are nice and quiet, let me give you a couple of other things to think about. One specifically. I know that none of you are sleeping worth a damn, because it's so cold, and you might want to dig out the medical kit there around 135 or in that ballpark and pull out a couple of dexadrenes apiece and try one about then and another round - about 139 to 140.

SC Fred brought that up. We might consider it.

CAPCOM Okay.

PAO That was Donald K. Slayton, Director of Flight Crew Operations interjecting some comments to the crew from a CAPCOM console. Also -

CAPCOM Could figure a way to get a hot cup of coffee up to you, it would taste pretty good about now, wouldn't it?

SC Yes, it sure would. You don't realize how cold this thing becomes when in a PTC mode that slowing down and I just clocked the cycles on my (garbled). And, it's about 11 or 12 minutes now, and the Sun is simply on the edge - is turning on the engine now of the Service Module. It's not getting down to the spacecraft at all.

CAPCOM Hang in there. It won't be long.

END OF TAPE

CAPCOM Hang in there, it won't be long now.

SC That's right. As a matter of fact, doing this alinement on the Earth will kind of be like making a landing with a fogged up windshield.

PAO This is Apollo Control at 133 hours 11 minutes. At 132 hours 28 minutes CAPCOM Jack Lousma put in a call to the crew. Fred Haise responded and we had him turn on the power amplifier which addition to greatly improving the quality of voice communications we get, also gives us ranging data which the Flight Dynamics Officer's using for making final computations of the midcourse correction to be performed in about 4 and a half hours. Jack Swigert reported that he received - gotten about 2 to 3 hours sleep which he said was not very good sleep due to the cold in the command module. Swigert said it is almost impossible to sleep because of the cold and Donald K. Slayton, Director of Flight Crew Operations, and who has been at the CAPCOM console a good part of the evening and into this morning, came on the circuit and advised Jim Lovell to consider taking Dexedrine tablets for each of the crewmen. This is a stimulant contained in the medical kit. Lovell said that they had considered that and would think about it. At the present time Apollo 13 is 60 249 nautical miles from the Earth. The spacecraft velocity is up to 7900 feet per second and we're some 9 hours 27 minutes until reentry. We'll continue to stand by for any further communications with the crew. We don't have any plan to pass up to them in the next few minutes or so. One of the things under discussion, however, at the present time in Mission Control are procedures which might possibly be used to increase the temperature in the Lunar Module and the LM environmental and electrical systems engineer's looking into the power status right now. As far as consumables are concerned, with the possibility in mind that perhaps bringing some additional equipment on line in the LM to bring the temperature up there.

END OF TAPE

PAO We're presently showing the cabin temperature in the lunar module at about 54 degrees, and although we do not have a measurement on the command module we presume that it is lower than that, and we'll continue to keep you advised on the status of the discussion going on at present in Mission Control on the advisability of powering up the LM more fully to bring up the temperature.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Okay skipper, we figured out a way for you to keep warm. We decided to start powering you up now, and what we want you to do is stick your entry LM prep check list and start at the top where it says Bat 5 normal feed on and then jump over as it says to your 30 minute activation, and do all of the 30 minute activation up to but not including the burn. Uou copy?

SC Okay, if I understand you correctly then that gives me leeway to maneuver when we get up to activation complete and we can be in position for the burn but we will not burn. We don't have a pad anyway.

CAPCOM That's affirm Jim. Y ou could maneuver to burn attitude or you could maneuver to an attitude which should put the sun in the windows to warm the place up.

SC Sounds good and you're sure we have plenty of electrical power to do this.

CAPCOM That's affirmative. We've got plenty of power to do it. I can get you a number though.

CAPCOM Jim, you've got about 100 percent margins on everything from here on in.

SC That sounds encouraging.

CAPCOM Rog. That's in the LM. We're not talking about the CSM right now.

SC I understand.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Okay, question, this short turn-on step 3 on page 24 has us only turning on the oxygen system AB 2 clocks and the breakers are still out on panel 11. Do you want those in too or are we just going to use 1 set of heaters.

CAPCOM Stand by.

CAPCOM Aquarius, Houston, go as the checklist recommends for now, when you get into the circuit breaker panel configuration you're going to get the number 1 set of heaters on anyway.

SC Okay.

PAO This is Apollo Control at 133 hours, 34 minutes. We're following the progress of the crew as they power up the lunar module, according to the checklist, and

PAO at the present time we show the total average current -

SC Houston we'd like to get a hack to set our mission timer here Jack.

CAPCOM Okay Fred-o, set it at 133 35 straight up. You've got about 30 seconds to set it.

SC Stand by.

CAPCOM Okay, I'll give you the 2 second delay in there. Stand by to start. Start.

SC Okay. We've got it.

CAPCOM Okay, I counting 133 35 10.

SC Right on.

PAO We're showing about 34-35 amps total current now.

CAPCOM Aquarius, Houston. One other way to warm things up in a hurry in there is when you get your ac on to turn on the window heaters.

SC Okay. I guess the only question I have is what the (Garbled) will do to it - it looks like almost a frost on it now. As I said Jack, I'd like to let it maybe warm up just a little bit more before hitting it with the heatload.

CAPCOM Not a bad idea.

SC And as you can see Houston, turn on we got our old friend down link 2 pass.

CAPCOM Roger. We've seen it Fred. Aquarius, Houston. It looks like you're proceeding toward the gimbal lock there. We'd like you to check that please.

SC Roger. There's not much we can do about it. We can't use the boosters, Houston.

CAPCOM Okay, forget it now, we'll get it later.

SC And Houston, Aquarius, I got the next thing for the PNG for the course align 000 but I guess we ought to hold up now until we get the up time on the RCS thrusters.

CAPCOM Roger. We're looking at them. We'll give you the go on them. Okay, Aquarius, your quads are 120 to 133 now, so you're cleared for thrusters.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Rog. Did you get my go for RCS?

SC That's affirm. (Garbled) all we're doing now Jack is letting the spacecraft drift in its mode to pick up the earth again.

CAPCOM Okay.

SC I don't want to just go flying throughout the sky and get high rates because I don't have any od the down rates (garbled) on until the earth comes back up again, and once I get the earth in sight, we have strain on down rates no (Garbled) That part on the earth that is.

SC It's going to be interesting today, Jack. The earth's a lot bigger, the crescent is a lot more pronounced than it was yesterday.

CAPCOM Well, you're going in the right direction.
SC That's right.
PAO This is Apollo Control at 133 hour, 55 minutes. Jim Lovell has stabilized the spacecraft at this point using the LM reaction control system thrusters. We're showing a power level on the lunar module right now ranging between 45 and 50 amps. The power up procedure followed by the crew will have another effect in addition to warming up the LM, and that is they're beginning a portion of the preentry checklist that had been scheduled for 6 hours prior to entry interface, and that was begun at about 9 hours. So, they'll be getting a bit of a leg up on that portion of the time line. At the present time Apollo 13 is -
SC Jack I guess we haven't changed our angle much with respect to the sun 93 million miles away, so it ought to be in about the same place in the AOT isn't it, Charlie?
CAPCOM Hold on on that Fred. I'll get an answer for you.

END OF TAPE

CAPCOM Aquarius, you're ASA is warmed up now. You can activate the AGS.

SC Okay.

CAPCOM Aquarius, Houston. When you look at a detent 2 in the proper burn attitude, what you ought to see is the Sun at 12 o'clock about half way between the top of the AOT and the center of the pipper. And you ought to see the Earth -

SC - o'clock. Okay. It's getting a little warmer in here now. Thank you.

CAPCOM Duck blinds are always warmer, Jim when the birds are flying.

SC Right. Jack, I got so used to flying attitude with the ATCA. I won't be able to do it normally.

CAPCOM Say again, Jim.

SC I said that I got so used to flying attitude with the translational control, I won't be able to do with the ACA.

CAPCOM Aquarius, we see your glycol temperature getting up there. If you want to make it a little warmer or you can try putting your suit temp valve to high, if you haven't already gotten it there.

SC Okay.

CAPCOM Aquarius, something we're thinking about right now is if we can do it without using a lot of RCS, it would be to our advantage time wise to try to get in aline-ment.

SC Okay. You mean a P52?

CAPCOM We're —

SC (garbled)

CAPCOM A combination of 51 and 52.

SC I'll see what we can do, Jack.

CAPCOM Okay. And we plan to use the Moon and the Sun for that.

CAPCOM Aquarius, Houston. On panel 16, we'd like for you to close the cross tie val loads breaker, please.

SC (garbled).

CAPCOM And it looks like we can support a alinement in a few minutes if you will be willing to go ahead with that.

SC Jack, it sounds good. I think from our position here we know where the Sun and Moon are and it's strictly going to be a PITCH maneuver. But (garbled) and I'll see what we can do.

CAPCOM Roger.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC We're all set to go. Are you going to ship us up a REFSMMAT?

CAPCOM Yes, we are. Stand by 1.

SC Okay.
SC The sunshine's wonderful. It's shining in the rendezvous window.
CAPCOM And Aquarius before we can ship you a load, we'll have to have on panel 11 under COMM the updata link circuit breaker closed.
SC It's closed.
CAPCOM Roger. -
SC (garbled).
CAPCOM Okay. And it'll be a few minutes here, Jim. We're still cranking it up.
SC Okay. Stay with it, Jack, and I'll go back to data.
CAPCOM Roger.
SC I got BATT at about 33 and a third percent on that uplink. (garbled)
CAPCOM Say again on that, Fred.
SC I just got another uplink too fast when I took the data switch back off to a third.
CAPCOM Roger.
CAPCOM Aquarius, Houston. We're ready with your load if you'll give us the DATA please.
SC Going for DATA. You got it.
CAPCOM Aquarius, Houston. After the uplink you'll have to set the drift and the REFSMMAT flag as on page 8 of the contingency book, steps 5 and 6.
SC Page 8, steps 5 and 6. Roger.
SC Are you done with the computer now, Jack?
SC Negative. We'll give you the word.
CAPCOM Roger. Aquarius. We're through with it. It's your computer.
SC Thank you.
CAPCOM And Aquarius, Houston, take option 1 on a P52 when you get to it. And I've got some ball angles for a Sun and Moon
SC Okay. We'll run an option 1 and you've got some ball angles for Sun and Moon. And right now, Jim's got the Sun pretty well squared away right in the middle of AOP.
PAO This is Apollo Control at 134 hours 42 minutes. The crew began powering up the Lunar Module at about 133 hours 29 minutes. A little over an hour ago, we've since seen the currents in the Lunar Module come up from about 10 to 12 amps to their present level of about 40 amps. These currents actually went to a high of about 70 amps befoe stablizing out at the lower level as the heaters came on line and brought the equipment up to a proper temperature and then dropped off line. The crew reported it is getting somewhat warmer within the Lunar Module at this time. The accounted temperature reading that we have on the ground is based on the temperature

PAO of the glycol and water boiler, which is related to the amount of heat being transferred into the water boiler, and is about the best indication we have of cabin temperature. And that shows that the cabin temperature now has come up from about 54 degrees to about 56 degrees. This temperature, however, does show some lag and we would expect the cabin temperature has come up propably a bit more than is indicated by the temperature we're showing on the ground.

SC Got some plan in vectors for us, Jack?

CAPCOM Okay, Fredo. With the Sun I've got 246, for the Moon I've got 250.

SC You're talking about ball data angle?

CAPCOM Negative. I was - I was reporting the code for NOUN 70.

CAPCOM They're in the computer, Fred.

SC Oh, okay.

SC Houston. We have the stunt marks and I'll start at PITCH now to go over and pick up the Moon.

CAPCOM Roger.

SC Houston, Aquarius.

CAPCOM Go ahead.

SC Just as a note of interest, this docked configurations for P52. The command module docking probe is right down the middle of the docking - right down the middle of the detent.

SC And when the Sun flashes on it, it really makes it difficult.

CAPCOM Roger.

END OF TAPE

CAPCOM Roger.

PAO This is Apollo Control at 134 hours 56 minutes. In Mission Control at this time, we're in the process of handing over shifts. Flight Director, Gene Kranz is taking over from Flight Director, Milton Windier. We will not have a change of shift briefing. The Flight Director plans to remain in the Control Center through splashdown, and we therefore, as I said, will not have a change of shift briefing - news briefing for this shift. In summarizing, briefly the events during the past 8 hours, from about 127 hours until about 130 hours, we passed up the Command Module and Lunar Module preen try checklists to the crew. Following this, the crew was advised to attempt to get some rest. Fred Haise remained on watch, but we limited the number of calls to the spacecraft to allow Fred also to get some rest, and about 128 hours 17 minutes, Jim Lovell and Jack Swigert indicated that they were going to begin a rest period. Fred Haise began a rest period at about 129 hours 39 minutes. At 132 hours 28 minutes, we put in the first call to the crew after Haise began his rest period. All three crewmen responded shortly thereafter, and Jack Swigert reported that they had gotten about 2 or 3 hours of sleep. They said that it was not very good sleep, that it had been quite cold, and almost impossible to sleep. Deke Slayton, Director of Flight Crew Operations who has been in the Control Center during the night and early morning advised Lovell at that point to consider taking dexedrine tablet. This is a stimulate carried in the medical kit. Lovell said he would consider it. We've heard no report from the crew at this time as to whether they have or not taken any medication. In response to the crew comments on the cold, we began looking at some methods of bringing the LM temperatures up. It was decided that we had adequate power margins in the LM batteries and also adequate water margins to power up the LM early, and this had been planned to occur at 6 hours prior to reentry, and we began the procedure about 3 hours earlier than that. Beginning to power up at about 9 hours prior to entry interface. At 133 hours 29 minutes, the crew began the checklist procedures to power up the LM and the current levels in the LM came up from about 10 to 12 amps, which is the normal power down, current level to about 70 amps, and then as heaters brought equipment up to temperature, and the heaters began to drop off line, the temperature stabilized out at about 40 amps, and the crew reported the temperature is coming up within the LM and we've seen a corresponding rise in temperature on our displays here. The temperature we were reading in the cabin prior to the power up was about 54 degrees since the equipment

PAO - has been turned on, we've seen the temperature come up about 2 to 3 degrees. At the present time, we're 7 hours 40 minutes 54 seconds from entry interface, and 2 hours 40 minutes 51 seconds from the mid-course correction. Correction number 7, which is planned to occur 5 hours prior to reentry. The Flight Dynamics Officer is computing final maneuver PAD for this mid-course correction. The preliminary information on it was that it would be about 2.8 feet per second using the LM ascent stage - actually the LM reaction control system thrusters, and burning them for about 21 seconds duration. We expect that we will get an update to this when the FLight Dynamics Officer completes the final computations for the maneuver. We will also have some preliminary numbers for the entry. We suspect that these will change once the mid-course correction is completed. These are the same numbers which were passed out at the previous change of shift briefing. They are as follows: We are predicting entry interface at a point in which the spacecraft reaches the 400 000 foot level to occur at 142 hours 40 minutes 40 seconds. The drogue chutes would deploy at 142 hours 48 minutes 53 seconds, and the main chutes, the main parachutes would come out at 142 hours 49 minutes 43 seconds with splashdown at 142 hours 54 minutes 40 seconds. As I said, we expect these times will shift somewhat when the mid-course correction has been completed. We also have the times for the beginning of blackout and the end of blackout.

CAPCOM Yes. It was good training.

PAO The time we show for the beginning of blackout is 142 hours 40 minutes 58 seconds, and time for ending of blackout is 142 hours 44 minutes 3 seconds.

SC Jack, that's what it says the torquing angles are.

CAPCOM We haven't got them yet. Aquarius, hold on the torquing angles, please.

SC We're doing that.

CAPCOM Jim, the reason for the delay is that we're not seeing the data yet. We're having to check a point here, and as soon as they come up, we'll let you know what to do with them.

SC Okay. We had a large(garbled). 112 and our torquing angles, Jack, are minus 01713, minus 03278, minus 01395.

CAPCOM Roger. Minus 01713, and we see them now. Aquarius, torque them.

SC Okay. 3504 25.

END OF TAPE

CAPCOM Aquarius, do you have a star close by there you could check?

SC I'll look around, Jack. I was just trying to get a check on the moon, again, to see if those angles were indeed true and we got the moon back and get it centered.

CAPCOM Roger.

SC Okay, Jack. Would you read now the angles? We had the moon centered and it's pretty close to what we have on the eight ball, I guess. Close enough for any entry that we'd like to do.

CAPCOM Roger. And I'm told that the nimbula and regulus are near by if you wanted to make a star check.

SC Okay. I'm going to start pitching around again and see if I can pick them up. I have a line out here to my left a little bit, but it's pretty close to the - oh, here. I've got Sirius. That's a nice one. How about that?

CAPCOM Sounds good here.

PAO Apollo Control, Houston. 135 hours 11 minutes now into the flight of Apollo 13. That was Apollo 13 Commander Jim Lovell talking with capsule communi cator Jack Lousma. While Apollo 13 is alining the platorm in the lunar module, our digital displays now show Apollo 13 at 50 905 nautical miles away from earth. The spacecraft velocity reads 8670 feet per second. We're at 135 hours 12 minutes, continuing to monitor. This is Apollo Control, Houston.

CAPCOM Aquarius, is Jack sitting on the rumble seat there?

SC He was. He just headed upstairs to take another look around.

CAPCOM Okay. I've got a minor addition to the entry checklist for him. This time it's in the - -

SC Okay, Jack.

CAPCOM - - entry book.

SC Okay. Stand by one. He has that in his pocket.

SC What I'm doing, Jack, is just - I'm pitching over now. I'm going to pick up another star. Sirius was just too far off. I thought it would use too much gas getting there.

CAPCOM Roger.

SC By the time I get alined in the AOT - be nice if we didn't have Odyssey attached, we could just AUTO maneuver over to these things.

CAPCOM Looks to us like you've got her alined, Jim, so I wouldn't worry about it too much.

SC Yes. I'm pretty confident that the platform's fairly decent.

CAPCOM Aquarius, Houston. We need an E mode VERB 74 when you've got a chance please.
SC Okay. Coming to you.
SC Okay, Jack. Go ahead.
CAPCOM Okay, Jack. On your entry checklist, on page 2-5, down there on step 9, where it says 152 degrees pitch at 05 g. Adjacent to that, so that recovery can see you better on the way down, we want you to turn your S-band power amplifier to high. Over.
SC Okay. Turn S-band power amps to high at 05 g time.
CAPCOM That's affirmative.
SC Okay. Is that it?
CAPCOM That's it, Jack.
PAO Apollo Control, Houston. 135 hours 27 minutes now into the mission. We're 2 minutes - 2 hours 12 minutes away from scheduled time of ignition for MCC-7. And our space digital design show 13 - Apollo 13 - at a distance of 49 577 nautical miles out from earth, travelling at a speed of 8790 feet per second. This is Apollo Control, Houston.
CAPCOM Aquarius, Houston. We're considering doing the midcourse with PGNS unless you'd rather do it in AGS.
SC No. PGNS is fine with me. I just aline myself up with the old ball again. I've got you a four sided again, but any way you want to do it.
CAPCOM Like you say, you might as well go first class.
SC I guess you're right.
SC Now wait a minute, Jack.
CAPCOM I just lost a lot of friends there.
SC And, Jack, you can tell Owen Morris that the RCS system AB 2 quad 1 breaker is still nicely in.
CAPCOM Roger. We'll pass the word.
PAO This is Apollo Control, Houston. That was Fred liaise talking to Jack Lousma. Owen Morris referred to in that conservation, is the deputy manager for the lunar module in the Apollo Spacecraft Program Office. here at the Manned Spacecarft Center. We now show Apollo 13 at 48 822 nautical miles away from earth. And at a velocity of 8861 feet per second. At 135 hours 37 minutes, this is Apollo Control, Houston.
CAPCOM Aquarius, Houston. We think we've figured out a way to save you some time at a very critical - very full schedule. And that's by doing a docked course aline since we got the LM up now. That would save you a number, too.
SC Houston, Aquarius. It seems to me a docked course aline might be quicker for Jack.

CAPCOM Yes. We think it would be and save quite a bit of time at a place where you're going to be pretty busy. Also save you some petro.

SC Affirm.

END OF TAPE

CAPCOM Okay Jim, we're looking at doing this in the service module Sep attitude and the optics will be pointed away from the sun, so, it should be a good attitude for a P52.

SC Okay. So, we'll be going to the service module Sep attitude and which time we'll do a Dock course align, and then you want, you want Jack then to do a P52?

CAPCOM The way we'll do that in our time line Jim, is to go ahead and do the service module jet and then we'll just stay in that attitude and when it comes time in our time line as we've outlined bring the platform up, we'll proceed with the P52, course align, and then the P52.

SC Okay. Are we going to use the same techniques that we normally do for LM activation, in other words, I try to maintain an attitude and give him some angles and then are you going to give him the angles, then he does the 52.

CAPCOM Basically it's the same procedure just reversed Jim.

SC Okay.

CAPCOM The other nice thing about this, it's one we've done before.

CAPCOM And Aquarius, one thing however, that we do not plan to do it to proceed with the command module power up prematurely.

SC Roger. I understand

SC Okay, Houston, this is Jack.

CAPCOM Go ahead Jack.

SC Okay, I just wanted to talk over with you, it looks like we've had some changes in the flight plan here, due to Jim's P52. Do you have - can you talk over with me what your plans are?

CAPCOM Roger Jack. Since we've got the PNGs up we plan to use that information to give the CMC a docked course align and then we're in the service module jettison attitude we'll wait until it comes time to power up the CMC and we'll get a CMC a docked course align, and we'll pick some good stars to give you a fine align with, and it looks like we can pick some stars that are looking away from the sun in which you can find in that service module jettison attitude, so, we'll save you quite a bit of gas and save you some time in a very busy time.

SC Hey, that sounds good. Really fine.

CAPCOM Keeping warm?

SC Hey, it's warmed up here now. It's almost comfortable.

SC I'm looking out the window now Jack, and that earth is whistling in like a high speed freight train.

PAO That's command module pilot, Jack Swigert,

PAO describing the temperature and Apollo 13, as you copied. The comfort level is going up.

CAPCOM clocking at 48 000 miles and coming in at about 9000.

SC I don't think there's many left that's seen it like this.

SC I'm still looking for Fra Mauro and Cone Crater.

CAPCOM You're going the wrong way son.

PAO That was Donald K. Slayton who came on the Capcom line to point out to Jim Lovell that they're headed the wrong way for Fra Mauro and Cone Crater. Our displays now show Apollo 13 at 47 858 nautical miles out from earth. Velocity reading 8956 feet per second. We're at 135 hours, 48 minutes, now into the flight of Apollo 13. This is Apollo Control Houston.

SC Okay Jack, it looks, just looking over what I may expect here, it looks like I'm just going to get 3 angles to do a verb 41 noun 20 right?

CAPCOM That's what it looks like from here Jack. It's pretty much the opposite of the LM activation procedure where we do the docked course align.

SC Yes, except in a way we did a lot of verb 06 noun 20 enters simultaneously and then you all ship him up post torque values. You're not going to do anything like that are you?

CAPCOM Say again please Jack.

SC Okay. During the activation parts we do a lot of verb 06 noun 20 enters simultaneously reading you out the difference in the angles and then this then inverted to say post torquing angles, in order to get the platform fine aligned. Do you plan something like that or just 3 course align angles.

CAPCOM Jack, we're going to give you 3 course align angles and then you can go right to your checklist as we're giving it and start in with the verb 40 noun 20.

SC Okay, real fine.

PAO Apollo Control Houston now 135 hours, 52 minutes now into the mission. Our displays in Mission Control indicate the lunar module cabin temperature now getting up to around 60 degrees. The spacecraft currently running around 40 amps. This is as compared to 10 to 12 amps when 13 was in a powered down state. As you recall, we brought the lunar module -

SC Jack, how do you read?

CAPCOM 5 square

PAO As you recall, we brought the lunar

SC Jack's around shooting pictures of all the debris inside here, before we left, and I inadvertantly changed

SC the settings on the DC command module

(Garbled) camera that we need for the service module pictures, the one that FAO (Garbled) what we need F stop and B.

CAPCOM Okay Fred, stand by.

PAO We brought the lunar module power up about 3 hours early this morning, because Apollo 13 now has the luxury of margins in both power and water. This does give an added bonus. It puts the 13 crew a step ahead in what could be considered a very busy time line. We're now at 135 hours, 54 minutes into the flight. We show Apollo 13 at 47 312 nautical miles away from earth, velocity now reading 9010 feet per second. This is Apollo Control Houston.

CAPCOM Fred, in regards to the camera settings, for black and white 3400 film, the settings were F 5.6 at a 250 -

SC Okay, I'd guessed right then that's all, but thank you.

END OF TAPE

CAPCOM - 3400 film. The settings were F 5.6 at a 250th. Over.
SC Okay. I'd guessed right after all, then, but — Thank You.
CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston.
CAPCOM Okay, Jim. I got MCC-7 pad when you're ready to copy. Over.
SC Okay. Stand by.
PAO Apollo Control, Houston. W e're standing by for -
SC I got 1 pad left.
CAPCOM Okay. We'll take care not to change this one. Ready to go?
SC Go ahead, Joe.
CAPCOM MCC-7 137 39 48 39 minus 00031 plus all O's plus 00001 N/A plus 00205 00031 023 008 359. The rest is N/A. Remarks plus X 4 jet RCS. And your weights for the DAP load LM weight 25181, CSM weight 62468. Over.
SC Okay, Joe. MCC-7 137 39 48 39 minus 00031 plus all balls, plus 00001 N/A plus 00205 plus 00031 023 008 359. The rest of pad N/A. Remarks plus X 4 jets RCS ullage The LM weight 25181, CSM weight 62468.
CAPCOM Okay, read back correct
CAPCOM And Aquarius, Houston. I have a service module sup pad if you want to copy that now. Over.
SC I'll take it, Joe.
CAPCOM Roger, Fred. I have a service module sep pad with the attitudes. Don't need a pad sheet for it just any old blank sheet will do.
SC Okay. I was going to say I don't carry a service module sep pad.
CAPCOM Yeah, we'll have to change that.
SC Okay. I'm using a P27 here. Go ahead.
CAPCOM Okay. The pad reads as follows and then I'll repeat the angles for you so you can copy them. The following MCC-7 maneuver the LM to the following FDAI attitudes ROLL 000 PITCH 91.3 YAW 000. Now do you want those editors repeated, Fred?
SC Okay. Following MCC-7 we're to maneuver to the following attitudes ROLL 000 PITCH 091.3 YAW 000.
CAPCOM Okay. That's correct. And the last part of the pad is at GET 138 10 00 which is EI minus 4.5 hours execute a push of 0.5 feet per second for jet plus X. Perform SM sep then execute pull 0.5 feet per second for jet minus X. Over.
SC Houston, Aquarius. Jack's entering the command module now.
CAPCOM Okay, Jim.

SC Okay. That last Joe was execute at the GP at 138 1000 which is DI minus 4 and half hours. Execute a push of 0.5 feet per second for jet ullage. Then execute SM sep followed by a pull of .5 feet per second with respect to a nomenclature on the PTCA, I think we really need an up of .5 and then a down of .5.

CAPCOM That's correct, Fred.

CAPCOM Okay, Aquarius. The last pad I had for you right now is the LM jettison pad. Similar to the - Stand by one Aquarius.

CAPCOM Okay, Aquarius, Houston. Request P00 and DATA for the data load. Over.

SC You got it.

CAPCOM Okay. And I was about to say the LM jettison pad is similar to the SM sep pad, Fred, when you're ready to copy.

SC Just about the same number of lines?

CAPCOM Yes.

SC Okay, go ahead, Joe.

CAPCOM Okay, Fred. Prior to 141 40 00 which EI minus 1 hour maneuver the LM to the following FDAI angles. ROLL 130 PITCH 125 YAW 012.4. The corresponding CSM gimbal angles will be ROLL 291 PITCH 196 YAW 045, and that's the pad. Over. And a computer is yours, Aquarius.

SC Thank you.

SC Okay. A LM sep pad prior to 141 40 00 EI minus 1 hour maneuver the following attitudes. ROLL 130 PITCH 125 YAW 012.4. The corresponding CSM gimbal angles are ROLL 291 PITCH 196 YAW 045.

CAPCOM Readback correct.

PAO Apollo Control, Houston. Now 136 hours 15 minutes now into the flight. That maneuver pad for mid-course 7 it was passed up. Shows that the time of igition of 137 hours 39 minutes 48.39 seconds, with a DELTA-V of 3.1 feet per second, and a burn duration of 23 seconds. Jim Lovell reported Jack Swigert entering the command module, and we copied that time.

SC Go ahead, Joe.

CAPCOM Okay. We're so efficient down here that we got an entry pad ready, Fred. Do you want to copy that for Jack? Over.

SC Stand by. I'll have to try to borrow his book from him.

CAPCOM Roger.

SC Can we hold off on that a little bit, Joe?

CAPCOM Absolutely, Jim. We're well ahead. I just wanted to let you know that we had it.

SC Okay. I hope that when you send up all those uplinks to Jack that you could get them up to him quickly.

CAPCOM We're shooting for less than 5 minutes.
SC Sounds good.
PAO We copied Jack Swigert -
CAPCOM That's a negative, Fred. The computer is yours.
PAO We copied Swigert entering the command module at 136 hours 10 minutes 49 seconds -
SC Okay.
PAO Joe Kirwin, by the way, is taking over the position as capsule communicator in the Mission Control Center. Well, in the command module Swigert will be warming up some of the systems. Throwing the circuit breakers and main bus B and some of the heaters for equipment onboard the command module. Almost at the same time as Swigert entered the command module, Ken Maddingly came in the control center still in an apparently spotless condition. We're at 136 hours 18 minutes into the flight. We show Apollo 13 at an altitude of 45 255 nautical miles, traveling at a speed of 92 222 feet per second. This is Apollo Control, Houston.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.
SC Okay. I just want to clarify one thing on the LM sep pad, it appears to me that in my configurations I could probably use a VERB 49 -

END OF TAPE

SC - - loading in 622, yaw, pitch, and roll, in that order and then being able to fly out at 58 gain in roll, pitch, and yaw. Is that correct?

CAPCOM Stand by. I'll verify it, Jim.

SC Okay, Joe. And while you're doing that I've got a question about the command module checklist.

CAPCOM Okay, Jack. Go ahead with your question.

SC Okay. Either I copied the circuit breaker wrong, or - I can't read it. Comes down just about the - oh, about the 20th one down, after panel 276, where it says CB instrumentation power control 3 and 4 open. The next circuit breaker on panel 5 - I - would you give that to me again?

CAPCOM Roger. That's CB essential instrumentation power main B. Over. And it's closed.

SC Okay. I just can't write - I just can't read my writing. Essential instrumentation power main B closed.

CAPCOM That's affirmative.

CAPCOM Aquarius, Houston.

SC Go ahead, Joe.

CAPCOM Roger. The word we have is that you can't make a VERB 49 maneuver to the LM jettison attitude because those are FDAI angles we gave you. They don't correspond to the gimbal angles for the load. It'll have to be a manual maneuver. Over.

SC Okay.

CAPCOM And mind out for gimbal lock.

PAO Apollo Control, Houston at 136 hours 26 minutes now into the flight. Our clock in Mission Control shows the time of ignition for the midcourse burn at 1 hour 14 minutes from this time. 30 minutes after the midcourse, or 4-1/2 hours prior to entry interface, the service module is scheduled to be jettisoned. At that time Jack Swigert will be in the command module. Jim Lovell and Fred Haise in the lunar module. Lovell will fire the lunar module thrust to push the service module about 1/2 foot per second. Swigert, then, activates the pyros with a switch in the command module. After separation, Apollo 13 will back off with the lunar module reaction control system at 1/2 foot per second providing a separation DELTA velocity of 1 foot per second. All three crewmen will be trying to take pictures of the service module at that time. Swigert out of window number 5 in the command module. Lovell and Haise out of the lunar module. Upon separation, Apollo 13 will pitch about 90 degrees along the radial axis. That would be 90 degrees off the flight path angle. And at

PAO time of entry interface, or entry into the earth's atmosphere, the command module and service module should be more than 16 000 feet apart. We're at 136 hour 28 minutes into the flight. We show Apollo 13 at a distance of 44 395 nautical miles, and a velocity of 9312 feet per second. This is Apollo Control, Houston.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead, Houston.
CAPCOM Roger. We're looking at LM current to see if Jack has started his preheat, and we haven't seen it yet. Is he doing okay down there?
SC Houston, Jack said he's already started it, and he said that in one more minute, he'll be up to 20 minutes.
CAPCOM Oh, roger that. Jim, Houston. Have him let us know what his test meter reads when he's done.
SC He says that he has a battery A voltage drop of 2 volts and he'll try to look at the test for you right now.
CAPCOM Okay.
SC He's been looking at them, but they haven't been coming up so far.
CAPCOM We copy.
SC It's your turn now, Houston.
CAPCOM Standby one on that Jim. That's affirmative, Jim. It looks like we are seeing one now.
SC Okay. And thanks for keeping us on it.
CAPCOM Okay. Aquarius, Houston.
SC Go ahead.
CAPCOM Roger. Reminder P41 for the RCS burn.
SC Thanks for keeping us honest.
CAPCOM We got to protect our jobs, Jim.
SC It's been so long here.
CAPCOM Yes.
PAO Apollo Control, Houston. 136 hours 47 minutes. The Flight Control team here in Mission Control monitoring the display noted that Jim Lovell had punched his onboard computer into program 40 which is the thrusting program for the descent propulsion system. Then came the reminder to go to program 41 for a reaction control system of mid-course burn. We show that we're 51 minutes 50 seconds from time of ignition, with Apollo 13 at a distance of 42 599 nautical miles away from Earth with a velocity of 9 515 feet per second. That's 51 minutes 30 seconds now from time of ignition for mid-course - for the mid-course burn. This is Apollo Control, Houston at 136 hours 49 minutes now into the flight.
SC Okay, Houston, I finished up the maneuver and all of maneuver 41, but my roll and Yaw deals seem to be offset. Pitch is okay.
CAPCOM Okay, Jim, we copy. Standby. Aquarius Houston. We recommend PGNS mode control to Att hold. Save a little gas and standby on the error needles.
SC Okay.

SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Did you call?
SC Roger, Joe. We're going to do this burn in PNGS now, I ought to give you an update on the contingency book pages 32, 33, and 34 because the last time we went through this portion, we were burning it in AGS.
CAPCOM Okay, Fred. Standby. We've been talking about possibly having you doing it in AGS. We recommend at this time that you do an AGS to PNGS align the 400 plus 3 -

END OF TAPE

CAPCOM - - simply having you do it in the AGS, we recommend at this time that you do an AGS to PNGS aline, the 400 plus 3 procedure only. Over.

SC Okay.

CAPCOM And, Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Roger. We recommend that you perform this burn in AGS as you did the last midcourse maneuver. We think it will save gas. Over.

SC Okay. Do you want me to line up the same way we did the last one too?

CAPCOM Stand by on that.

PAO That was capsule communicator Joe Kerwin, passing along to Jim Lovell the recommendation to perform the midcourse burn with the abort guidance system.

SC - -temperatures that can (garbled) plug them in.

CAPCOM Roger. Go ahead with those.

SC Okay. 5 Charlie, 4.0, 5 dogs, 3.7, 6 able 3.5, 6 Bravo, 4.1, 6 Charlie, 4.2, 6 Delta, 3.8.

CAPCOM Okay. Copy those, Fred.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Okay, Jim. Our recommendation on this burn is that you maneuver to the burn attitude in PNGS min impulse then do a body axis aline 400 plus 5, followed by 400 plus 0 and then do the burn in AGS. Over.

SC Okay. Now (garbled) with the PNGS that you gave us for a PNGS attitude. Is this the wrong one? Do you want me to just aline up the earth as I did before in the last midcourse?

CAPCOM No. We don't want you to do that. Read me your FDAI angles and let's compare them with what we have down here.

SC Okay. You're looking at them in the DSKY I've got roll of 847, pitch of about 051 and yaw looking at about 3.750.

CAPCOM Okay, Jim. Those are very close — I guess all you need to do is trim them up a bit.

SC I plan to do a final trim - auto trim. And then a 4 jet translation.

CAPCOM Okay, Jim. For fuel conservation, we'd prefer you to trim it up min impulse and there's really very little trim required. And then go ahead and do it AGS. We're on the expected fuel usage, but we're just being old ladies about it.

SC Okay. Understand. My only question Joe, is the fact that both the roll and the yaw needles D&D

SC not go to null when I did an auto maneuver. I tried to go manaully to the attitude and then went to auto but the roll and the yaw do not coming at all.

CAPCOM Roger. I haven't got an answer on that yet, but your attitude looks very close.

SC Okay. I can (garbled). And Houston, Aquarius. I'm not sure that if I follow and null the needles that will be the proper attitude.

CAPCOM Okay. Stand by one, Jim. We're talking about it. It's going to be very close in any event close enough.

SC Okay.

CAPCOM And, Jim, just for your information, I have the entry pad. I have the landing area weather summary which you probably don't even have to copy, but which I'll read up to you when you're ready. And some stars for Jack that I'm holding for him for later on.

SC Okay.

SC And Joe, Jack says all the injector temperatures - he just checked them again and they're all in the 3.9.

CAPCOM If he knows the needles - -

CAPCOM That they're all over 3.9 now. Thanks a lot.

CAPCOM You can tell him that it's looking good to us. They were even happy with the previous ones.

SC Okay.

PAO This is Apollo Control, Houston. 137 hours 15 minutes now into the flight. We show a time of ignition of - for the midcourse burn a little over 25 minutes away now. This will be a burn with a DELTA V of 3.1 feet per second. Duration of the burn 23 seconds. It will be done retrograde. It's a relatively long duration on the burn.

SC Houston, do you want me to null the PNGS needles manually?

CAPCOM Okay. Stand by one more minute, Jim.

PAO - - relatively long duration on the burn because of the large spacecraft weight at this time. We show the spacecraft weight at 87 649 pounds at the present. Again the midcourse burn will be done retrograde. We're at 137 hours 16 minutes Tinto the flight. We show Apollo 13 at 40 081 nautical miles away from the earth and travelling at a speed of 9814 feet per second. This is Apollo Control, Houston.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Yes. I guess the basic question is

SC comparing the balls here and out the window it doesn't look too unreasonable, and if Jim says the COAS is yawed and roll slightly off from what he might eyeball, but yet, the FDAI air needles for PNGS are showing a full scale left in roll and full scale left in yaw. (garbled)

CAPCOM Okay. Go ahead.

SC Yes. It appears if we track those we obviously aren't going to be on the attitude that we burned the last midcourse.

CAPCOM Okay. Well, this attitude we passed to you is not quite alined to the terminator and stand by on this.

CAPCOM It should be off about 8 degrees right.

PAO This is Apollo Control, Houston, 137 hours 20 minutes into the flight. A goodly gathering of the astronaut corp in the Mission Control Center now, Donald K. Slayton is here, as is Tom Stafford, cheif of the astronaut office. Charlie Duke is here, Ken Mattingly, Gene Cernan in addition to Joe Kerwin, immediately around the capcom console. On the first row is Ron Evens and Tony England. Meanwhile, in the back is Jim McDivitt, manning one of the positions at the management console. Jim McDivitt, as you recall, is the manager of the Apollo Spacecraft Program Office at present. We're at a distance now of 39 635 nautical miles away from earth.

CAPCOM We're getting there, Jim. We're all agreed that you're almost, but not quite, in the proper attitude and we're just trying to get you a one firm recommendation on how to proceed from here.

SC Okay. I have nulled the roll needle and the pitch needle now and I'm yawed - rolled left - I'm rolled left about - -

END OF TAPE

CAPCOM - want to confirm recommendation on how to proceed from there.
SC Okay. I have nulled the null roll needle and the pitch needle now and I'm YAWED, ROLLED left now - ROLLED left about 9 degrees.
CAPCOM Okay. Understand the needles are nulled.
SC The YAW isn't, but the PITCH and ROLL are.
CAPCOM Roger that.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay. Here's the big story. Your attitude really looks quite good except in ROLL and we'd like you to do the following in main impulse PNGS we'd like you to trim to 0 PITCH, which is about where you are now to 008 degrees in ROLL which is about 16 degrees from your present ROLL attitude and to 0 degrees in YAW about where you are now. And then we'd like you to do the body axis aline 400 plus 5 400 plus 0. PITCH and ROLL to PULSE, select AGS, do the burn in AGS. How does that sound? Over.
SC Okay. I've rolled the wrong way that is what you're saying right.
CAPCOM That's right.
PAO Apollo Control at Houston. We're 15 minutes away now -
SC ROLL, and then a bit pulse I've got to use TPTA's.
CAPCOM That's right, Jim. Sorry.
PAO Less than 15 minutes away now from the scheduled time of the midcourse burn. 137 hours 25 minutes into the flight and Apollo 13 now 39 206 nautical miles away from Earth with a speed of 9927 feet per second.
SC And you don't want me to automatically trim 58 D I take it.
CAPCOM That's affirm, Jim. Don't trim 58D.
SC Okay.
CAPCOM We just want you to cycle on through P41 to get the average phi P and burn it out.
SC Okay.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Just for your information, we see 3.0 in - register one. We read you up 3.1 on pad. The actual DELTA-V was 3.05 and they warn me that it might come out 3.0.
SC Okay. That's a little burn.
CAPCOM Right.
CAPCOM Aquarius, Houston. You're attitude looks real good. We will give you a mark at 10 minutes to the burn which is in 28 seconds.
SC Okay. We're burning AGS in the AGS volt.
CAPCOM Right. I was looking at the wrong clock, and we;re a little under 10 minutes now. I'll give you a mark at 9 minutes. Okay.

SC That's fine.

PAO Apollo Control. That was Joe Kirwin confirming to Jim Lovell, Spacecraft Commander, that spacecraft attitude for the burn does look good. We're at 137 hours 30 minutes into the flight. Now showing, Apollo 13 at 38 700 nautical miles away from Earth, current speed 9990 feet per second.

CAPCOM Aquarius, Houston. We have 10 seconds till the burn. 3, 2, 1 mark 9 minutes.

SC Very well. That agrees with out event timer.

CAPCOM Okay.

PAO Apollo Control coming up on 6 minutes to time of the midcourse burn. This burn performed will be a backup guiding system aboard Aquarius. The burn retrograde will provide a delta velocity of 30 feet per second and with a predicted burn duration of 21 seconds. We're at 137 hours 34 minutes into the flight, and this is Apollo Control, Houston. One correction. That burn duration is 23 seconds not 21 seconds. We're at 137 hours 35 minutes into the Flight. We show Apollo 13 at 38 303 nautical miles away from Earth, and with a velocity of 10 045 feet per second. Less than 5 minutes now away from scheduled time of ignition.

END OF TAPE

PAO - the flight, we show Apollo 13 at 38 303 nautical miles away from earth, and with a velocity of 10 045 feet per second. Less than 5 minutes now away from scheduled time of ignition.

SC Okay Houston, about 3 minutes to go and we're all squared away.

CAPCOM And Aquarius, Houston roger that and we're standing by for your body axis align and your zeroing 404 405, 406 going to 470.

SC Okay. You'd asked me before Joe to go up 400 plus 3 which I did. I assume you've changed the script again.

PAO Less than 2 minutes away now from scheduled time of ignition. We're at 137 hours, 38 minutes in the flight.

CAPCOM Okay Fred, we did tell you to do that a while ago and it doesn't matter, you're looking good

SC Okay.

PAO One minute away now.

PAO Ten seconds away now.

SC Yes, it looks like we had a minus point 2 bias at 470, we're burning.

CAPCOM Copy that Fred.

PAO Fred Haise reporting that the burn is underway. We're at 137 hours, 40 minutes into the flight.

PAO We've shut down.

CAPCOM Roger. (Garbled)

SC Okay up here.

SC Okay if you're happy can we maneuver to service module Sep attitude now?

CAPCOM That's affirmative Aquarius.

PAO That was Fred Haise requesting that 13 maneuver to service module separation attitude following this this burn which went right on the money. We're at 137 hours, 41 minutes.

SC - to the proper attitude.

CAPCOM Okay, we're looking at it.

SC And again it's necessary to use the GTZA to pitch.

CAPCOM Okay. Affirmative

END OF TAPE

PAO For the Service - module separation, Apollo 13 will pitch about 90 degrees along the radial axis. That's 90 degrees off the flight path angle. We show 13 at the present time at a distance of 37 581 nautical miles away with a velocity of 10 138 feet per second. We're now at 137 hours, 42 minutes into the mission. This is Apollo Control Houston.

CAPCOM Aquarius, Houston.

SC Go ahead, Houston.

CAPCOM Okay, recommend you terminate P41.

SC Okay.

CAPCOM Hey, Jim, have you broken into the medical kit per our recommendation a few hours ago?

SC Yeah, everything is taken care of Deke.

CAPCOM Okay, fine. You might hit it again in about 2 hours.

SC Okay.

PAO Apollo Control Houston, 137 hours, 48 minutes. That was Donald K. Slayton on the line talking to Jim Lovell; the recommendation he referred to was the recommendation he made earlier in the morning that the Apollo 13 crew take Dexedrine tablets. We now show Apollo 13 in an altitude of 36 969 nautical miles. Apollo Control, Houston. The guidance and control officer for the lunar module here in mission control confirms they are moving in an attitude now for separation.

CAPCOM Aquarius, Houston, aft omni.

SC I beat you to it Houston.

CAPCOM Yeah, I thought you did, but I thought I'd say it anyway.

PAO Our count down clock shows that we are 19 minutes away now from time of separation; service module jettison; for this Jack Swigert is in the command module; Jim Lovell and Fred Haise in the lunar module; Commander Lovell will fire the thruster, or fire the thrust, LM thrust to push the service module at one half foot per second; Swigert activates the PYROS with a switch in the command module. After separation, 13 will back off with the lunar module RCS at one half foot per second, providing the separation delta velocity of one foot per second. We are 137 hours, 52 minutes into the flight and Apollo 13 now 36 616 nautical miles away; this is Apollo Control Houston.

CAPCOM Okay, Aquarius, Houston. That attitude looks pretty good; how's Jack getting along?

SC He's getting along; all but the PNGS ATT hold.

CAPCOM Roger.

CAPCOM Aquarius, Houston.

AQUARIUS Go ahead.

CAPCOM Roger, again for fuel consumption reasons, we would like you to go back to the AGS Mode that you were in, rather than PGNS, ATT hold.

SC Okay, I'm in PGNS minimum impulse right now while we are firing.

AQUARIUS And I'll go back to the AGS mode.

CAPCOM Okay, Jim, PGNS minimum impulse is okay; ags is okay too, its your choice.

SC Soon as we get rid of the service module, Joe, I think I'll be able to maneuver a lot better.

CAPCOM Sure thing.

SC Okay, Jack, this is the point where all thrusters fire up both rings.

CAPCOM Real fine. Real fine.

CAPCOM That was the test of the thrusters on the command module, and as you heard, they all fired - we are at 137 hours, 58 minutes into the flight, and this is Apollo Control Houston.

SC And SM jett at 138:12.

CAPCOM Roger - understand. SM jet 138:12. Its not that time critical Jim.

SC Can we do it at any time, Joe?

CAPCOM I think so, but let me check.

CAPCOM Aquarius, Houston, that is affirmative; you can jettison the service module when you are ready, no big rush, but any time.

SC Okay; sounds good.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Roger. We recommend that you use the AGS for the separation maneuver, because we would like to get the proper weight in, for the DAP, before we use the PGNS.

SC Roger - we will.

SC Stand by.

PAO Apollo Control Houston, 138 hours, 1 minutes into the flight; as you heard earlier, Joe Kerwin told Apollo 13 that they could separate at their convenience, that followed a time identified by Jim Lovell, which would be some 2 minutes after what we had earlier carried on the ground, we now show Apollo 13 at a distance of 35,729 nautical miles away from Earth, traveling at a speed of 10,400 feet per second. At 138 hours, 2 minutes, into the flight, this is Apollo Control Houston.

SC And that's [redacted] SEP

CAPCOM Copy that.

PAO We copied that report from Jim Lovell, that service module separation at 138 hours, 2 minutes, 8 seconds. And as you heard, that was ahead of schedule. We presently show Apollo 13 at 35, 611 nautical miles away from Earth.

END OF TAPE

SC It just did, Jack
CAPCOM Okay, Aquarius Houston. I recommend you terminate the average g. Over.
SC Okay, I've got her. Roger.
CAPCOM Beautiful, beautiful. And for your information, Jim, you'll be coming up on an RCS caution light, prettily and no sweat. Over.
SC And there's one whole side of that spacecraft missing.
CAPCOM Is that right?
SC Right by the, look out there, wait a minute. Right by the high gain antenna, the whole panel is blown out, almost from the base to the engine.
CAPCOM Copy that.
SC It looks like it got to the SPS valve too, Houston.
CAPCOM You could see the SPS engine go, huh?
SC The way it looked. Just a dark brown streak. It's really a mess.
PAO You heard that report from Jim Lovell, as Aquarius is moving away from the service module at the present time.
CAPCOM Take pictures, but we want you to conserve RCS. Don't make unnecessary manuevers. And Jim, Houston, in particular, of course, we don't want any translation manuevers.
SC Right on that. Joe you realize that when I went up to the SM SEP attitude I had to use GPCA to do it.
CAPCOM That's affirm. We know that. That's okay.
PAO Fred Haise followed Jim's remark with the comment that it got through the service propulsion system bell 2. That it was really a mess. We're at 138 hours 7 minutes into the flight. Apollo 13 now 35 200 nautical miles -
SC Looking out the windows now, Houston.
CAPCOM Okay.
SC Okay Joe, I'm looking down the SPS bell, and it looks okay on the inside, maybe it was just a -
CAPCOM Okay, copy that Fred. Was the bell deformed on the outside or just nicked or what?
SC I think the explosion, from what I could see Joe had stages, I don't know whether it did any actual deformation or not.
CAPCOM Okay.
SC Man, that's unbelievable.
SC And Joe, looks like a lot of debris is just hanging out the side near the S-band antenna.
CAPCOM Roger, Jim.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM I know you're busy, but when Jack gets a chance, we'd like BAT C current and MAIN A voltage in the command module.
SC Houston, Aquarius.
CAPCOM Go ahead, Aquarius.

SC Okay. I (garble) up to about 180 degrees now, and do you want me to go to the LM SEP attitude for his alinement.
CAPCOM Stand by on that Jim.
CAPCOM Aquarius, Houston.
SC Roger. We want you to go to the service module SEP attitude.
SC Okay.
CAPCOM And Jim, when you have leisure to copy. I have NOUN 46 and NOUN 47 DAP data load numbers.
SC Okay. Go ahead.
CAPCOM Okay. NOUN 46, 31021, NOUN 47, plus 25248 and plus 09050. Over.
SC Roger. 31001 plus 25248 plus 09050.
CAPCOM That's correct.
SC And now, Houston. Do you still think that AGS are going to be less expensive then volts
CAPCOM That's affirmative, Jim.
SC Okay, on those AGS, pulse A now, it's pulse A.
CAPCOM Okay, we concur.

END OF TAPE

SC Okay. We concur.
SC Going back to LM sep attitude are CSM sep attitude.
CAPCOM Roger that.
PAO This is Apollo Control Houston at 138 hours 15 minutes now into the mission. Apollo 13 presently 34 350 nautical miles out from Earth traveling at a speed of 10 607 feet per second. Meanwhile, in the Mission Control Center, the crowd is beginning to increase. Already here are Dr. Thomas Paine, NASA Administrator, Mr. George Low, a NASA Deputy Administrator, Representative George Miller from California and Chairman of the House Space Committee, Representative Olin Teague of Texas.
SC Stand by. Jack's on the line and he says that he can't get the computer to go to stand by.
CAPCOM Okay. Have him tell us what he looks at. And remind him that he won't see the light. He won't see the standby light. It's not powered up.

SC Okay Joe
SC Okay, alright, Joe.
CAPCOM Go ahead, Jack.
SC Joe, Okay, I get a flashing 37, I then program 06. There is no standby light, so when I enter, I don't get the three balls 62 displayed like I suppose to.
CAPCOM Okay, Jack -
SC And this -
CAPCOM Go ahead.
SC And this occurs on both 50's.
CAPCOM Okay. Understand. We're thinking about it and stand by one.
CAPCOM Okay, Jack, Houston. We'd like you to go verb 37 enter 06 enter, again. Over.
SC Okay. It worked.
CAPCOM Okay.
PAO Continuing with those present at the Control Center, now, are Representative Jerry Pettis of California, General Phillips, who is previously the Apollo Program Director, George Miller, also a NASA alumni and formerly Associate Administrator for Manned Space Flight, Dave Scott, Rusty Schweickart are among the astronauts in the viewing room at the present time, along with Buzz Aldrin. Dr. Elbert Hart Reese, the Director of the Marshall Space Flight Center is in the viewing room, as is Dale Myers, Associated Administrator for Manned Space Flight at present. Mr. Walter Caprian, Director of Launch Operations at Kennedy Space Center. Dr. Kirk Debus the Director of Kennedy Space Center is in the viewing room, as is Lew Evans, the President of Grumman.
SC Back in the service module sep attitude.
CAPCOM Okay, copy that, Jim. Looks good. You know whether Jack got any pictures out of window 5. Was it still fogged up. Over.

SC I don't think so. I think he came right down here, because I think he saw it first in the LM.

CAPCOM Okay. Good deal. And whenever you get cleaned up, we've got the entry pad and the landing area summary for you.

PAO Needless to say, all of these gentlemen

SC Okay.

CAPCOM Go ahead.

SC Okay. Doing a verb 37 enter 06 enter does bring us to three balls 62 display, but I can't proceed on it on either DPS key and a verb 33 doesn't work either.

SC It's still just a flashing 5025 with a code 000 62.

CAPCOM Okay, copy that, Jack. Stand by one.

PAO Needless to say, all of the distinguished visitors in the Control Center were most interested in the report from Apollo 13 of the service module condition, as the 13 crew moved away following the jettison.

CAPCOM Jack, Houston. How long did you hold PROCEED before you quit on it?

SC Well it was varying length. Is it supposed to be a long-time PROCEED?

CAPCOM We think it may be, Jack. We think it may be 15 to 20 seconds, and our recommendation is that you throw and hold it down for a good period of time, probably half a minute or more and see if the (garble)

SC Okay. Alright, I didn't hold it in that long. Maybe 2 or 3 seconds is as long as I held it. Okay and we're -

CAPCOM Okay.

SC Okay, Jack just came down to the tunnel again and said the computer is okay.

CAPCOM Okay. Good to hear it. And did you ever get that batt C main A reading for us?

SC I did the reading of the batt alright, but forgot to give it to you, I guess. Stand by.

CAPCOM Okay.

SC Batt C current was 2 amps and batt A voltage 30.2.

CAPCOM Copy. 2 amps, 30.2. And that sounds good to us, Jim.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Okay, we'd to have Jack verify that the pyros in logic are safe, and we'd like to remind him to do no further power up of the CSM until EI minus 2 plus 30.

SC Roger. He reports that the pyros are safe and we're standing by for 2:30.

CAPCOM Okay. Real good.

SC Well, I can't say that this week hasn't

SC been filled with excitement.

CAPCOM Well, James, if you can't take any better care of the spacecraft than that, we might not give you another one.

CAPCOM Hey, Jim, Houston. You might ask Jack while he's down there to take a peek through the telescope and tell us whether he can see any stars. Over.

SC Okay.

PAO That time earlier identified at 2 hours and 30 minutes is the time in the flight plan that the command module batteries will be brought on the line. In a normal mission, the batteries would not be brought up until some 30 minutes prior to entry into the earth's atmosphere. We show Apollo 13 presently 33 369 nautical miles away, velocity now reading 10 757 feet per second. This is Apollo Control Houston.

SC Joe, Jack tells me that there's still a lot of particles floating around and he can't pick out any constellation that he recognizes so far. But it might clear here in a little while.

CAPCOM Okay, understand.

END OF TAPE

CAPCOM Aquarius, Houston. Over.
SC Go ahead.
CAPCOM Okay. E COMM is looking at that battery amperage that you gave us a while ago. He'd like to see it about a half an amp to an amp lower. We'd like you to ask Jack to just check the circuit breaker switches that he's pulled in so far and make sure he doesn't have any extra loads on main A, specifically the flood light configuration and his caution and warning circuit breakers and his essential instrumentation power circuit breakers. Over.
SC Okay.
CAPCOM Thanks.
SC Okay, Jack' s reported that he turned out all the flood lights.
CAPCOM Okay.
CAPCOM We'd like to have him check the amperage on there and see what you have now and give us a voltage reading, too.
SC Okay, will do.
SC Okay, Joe, this is Jack.
CAPCOM Go ahead.
SC Okay. I've been not reading any voltage all on bat B, and the amperage looks like about 2 amps, but that could be kind of noise level stuff. I've got all the flood lights off and I — can you think of anything - I'd like to power down the lower main A.
CAPCOM Okay, how about reading the voltage off of main A.
SC Okay, oh, this is Ken. Okay. Ken, it was 30.2.
CAPCOM Okay. We're checking out the flood lights we need. Actually, Jack, you ought to be able to go ahead and use the lights we gave you. There's no reason to sit in the dark. They're supposed to be coming off of main B and we're checking that now.
SC Okay, it's not bad down there. We're in

plenty of light, but should I be reading the voltage on bat C?
CAPCOM Jack, you should be reading bat C voltage. That circiut breaker should be open.
SC Okay. Okay, can you think of anything else you want to get turned off to lighten load on main A?
CAPCOM Okay, we're (garbled) that subject right now, Jack. It's really not that big a thing, just something we wanted to dress up.
SC Okay.
PAO Apollo Control Houston 138 hours 38 minutes into the flight —
CAPCOM Aquarius, Houston.
SC Go ahead.

CAPCOM Say, Jim, we'd like to have Jack in the ring 1's auto coils which are probably on main A. Have him turn those off and take a look at the readings.

SC Okay.

PAO The Flight Dynamics Officer has just reported to Flight Director Gene Kranz that initial tracking following the mid-course burn shows that that burn was performed precisely as planned. WE're at 138 hours 39 minutes into the flight, Apollo 13 now 32 012 nautical miles away with a velocity of 10 982 feet per second. This is Apollo Control Houston.

SC Okay, Jack has turned off ring 1 that was on main A, and he's still reading 30.2 volts.

CAPCOM Roger that, Jim. What's his amperage? Did you read that off?

SC I did and he said it's down in the mud, it's less than 2 amps.

CAPCOM Down in the mud, okay, understand that. Request he turn them back on and - okay, Jim, that's the auto coils back on ring 1 main A, and when you get that done I'd like you to copy the entry pad.

SC Okay, Joe, stand by to copy the entry pad.

CAPCOM Okay, here we come. Entry Pad: Mid Pacific 000153 000. The next 2 lines will be the GET of moonset and the moon check attitude. 1423817 178 NOUN 61 minus 2166 minus 16537 067 36211 651 11689 36292 1424040 0028. The next 4 are in slash A, D sub zero is 400 0204 0017 0322 08 -

END OF TAPE

CAPCOM 03 22 08 14 33 35 31 299. Borsight star is Sigma Libra. Down 088. Left 04. Lift vector UP. Comments GDC for entry alinement, stars 31 and 23. The roll aline 041. Pitch 245. Yaw 024. Use EMS non exit pattern. Maintain moon check attitude until moon set. Then go to entry attitude or track horizon with the $36^{1}/_{4}$ window mark. Last comment, constant G entry is roll right. Over.

SC Entry pad as follows (GARBLE) 000 153 000 142 38 17 178 minus 2166 minus 16537 067 36211 651 11689 36292 142 40 40 0028. Next four columns are (GARBLE) is 400 0204 0017 0322 0814. 33 35 31 299. Zebra libra or something like that beta libra is down 08.8, left 04, lift vector UP, GDC entry alined, stars 31, 33. Roll 041, pitch, 045, yaw 024. EMS non exit pattern to be used. Maintain moon check attitude until moon set and the ball involved in constant G entry is - roll is right.

CAPCOM Okay. Roger that, Jim. I want to verify a couple of things I'm not sure I heard you read back. That first one was Zebra Libra - that's Sigma Libra. The set stars 31 and 23. Did you get that. Over.

SC Okay, no I have 31 and 33 and I got Sigma Libra now and it'll be 31 and 23 for the set pattern.

CAPCOM Okay and you're GDC pitch aline, I wasn't sure whether that was - whether you read back 245 or 045. The correct number is 245. Over.

SC It's true because I have 045 down. 245.

CAPCOM Okay and the moon check here, unlike the horizon check, is on the 36 degree window mark all the way. Just wanted to repeat that.

SC Moon check on the 30 degree window mark.

CAPCOM That's 36 degree window mark, Jim.

SC Many thanks, Roger.

CAPCOM Okay, readback correct. And Aquarius, Houston if you want me to read you the landing area summary. I'll do that.

SC Sounds good.

CAPCOM Okay, in the mid-Pacific landing area the weather is good. The cloud cover is 2000 scattered. The visibility 10. Winds 060 at 10. Wave heights are 4 feet and the alsimiter 2986, if you care. Scattered showers less than 10 percent of the area. Recovery forces are as follows, the Iwo Jima will be at the touchdown point, the Aircraft call sign will be Recovery 1, on station with swimmers on board. The - we have the constant G backup reentry area covered with the USS Hall, the Good Liberty Ship and the other Recovery Aircraft whose call signs you may hear are some -

END OF TAPE

CAPCOM - and the other recovery aircraft whose call signs you may hear are Somoa Rescue C130's.

SC Okay, we have the Iwo Jima as the prime when we get to that point, we have some stars with corresponding shaft and trunnion angles to pass to him as backups in case the computer doesn't happen to point him straight at one. And its the summer triangle.

SC And are you tracking us and do you have any results on last midcourse?

CAPCOM Stand by - it looks good. I'll try to get you numbers.

SC It feels nice to use the hand controller again.

CAPCOM Go ahead Aquarius.

SC I just said Joe it feels nice to use the hand controller again.

CAPCOM Oh Roger that. Fido says he's got you nailed within a half a foot per second - the midcourse looks real good.

SC Okay.

CAPCOM And I've got two things we'd like Jack to do in the command module to ease the load on main A, one of them is to verify or turn the CM RCS heater switch to OFF, we are done with that, and even though the circuit breakers are pulled, the switches might be drawing a little current. And the second one is we would like him to turn SCS logic power 2/3 to OFF; we don't need it now; its called up in the checklist at the appropriate time, and we'd like him to turn that off. Over.

SC Okay, I'll tell Jack to check to see if the CM RCS heaters switch is OFF, and if not turn it off, and also turn off the SDS logic power 2/3 switch off, when comes up later in the checklist.

CAPCOM That's correct.

SC Houston, Aquarius. We are recording maybe a voltage up to 31.0.

CAPCOM Roger that. 31.0.

CAPCOM We are smiling.

PAO This is Apollo Control Houston. You heard the entry pad being passed up to Apollo 13; this pad based on the last midcourse; lets quickly summarize the meaning of some of those numbers. We are presently looking at splash coordinates of 21 point 66 south lattitude, 165.37 west latitude, or longitude, max g of 6.7, velocity at entry inter-

PAO face of 36 211 feet per second, and an entry angle of minus 6.51; time of entry interface at 142 hours, 40 minutes, 40 seconds ground elapsed time; begin blackout 17 seconds, following entry innerface, end of black out 3 minutes, 22 seconds following entry interface, deployment of the drogue chutes at 8 minutes, 14 seconds. Our digital display now shows Apollo 13 at a distance of 30 226 nautical miles away, with a velocity of 11 290 feet per second. We are 138 hours, 56 minutes into the flight, and this is Apollo Control Houston.

SC Houston, Aquarius.

CAPCOM Go Aquarius.

SC Okay - how about my pitch attitude of about 115 instead of about 91. I think Jack can use the optics a little bit better at that angle.

CAPCOM Jim - that's perfectly okay with us; if it looks good for stars.

SC He just looked at them briefly, I'll go down and let him look a little bit better here.

CAPCOM Okay, with the new attitude of shaft and trunnion angles we were going to pass him don't mean anything, but its more important to have a good star field.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, Jim. We've been talking about your going to a different attitude than the pad attitude for better star field vision on the command module and what we'd like to have you do is this: If you can predict now or sometime soon what attitude it is that you would like to hold at that time and go to that attitude now, we'd like to be able to compute the course aline gimbal angles for the CSM and we can do that if you go to the selected attitude, hold it, call up a VERB 06 NOUN 20 and read us your LM gimbal angles, we can take those and compute CSM course aline gimbal angles on the assumtion that when we get back into the CSM course aline you will return to that selected attitude. Does that sound okay? Over.
SC Yes, I'll try to hold the attitude we select directly while you're giving me the course aline attitude. We're not too sure what's the best attitude. I'm going to ask Jack again if 115 is sufficient for him.
CAPCOM Okay, you can take some time figuring out the best attitude and then you won't have to hold it all the way from now until then if you just get back to it.
SC Houston, Jack would like to know what constellations are in his (garbled) field of view at an attitude of about 105 pitch, 0 roll, 0 yaw. Can you give that to us?
CAPCOM Okay, we'll sure give it a go. As I said we have some stars. They're not centered with the shaft and trunnion zero. Let us take a quick look at 105 pitch shaft and trunnion zero and see if we can get you an answer.
CAPCOM Aquarius, Houston.
SC Go ahead.
CAPCOM Roger. None of these stars will be exactly centered, but at a pitch attitude of 115 we had computed that Vega, Altair, Rasalhague, and Deneb would all be in the telescope field of view and the first 3 were also in view at 91 degree pitch, so he should be able to see one or more of those 4 stars. Over.
SC Okay, thank you very much.
CAPCOM Okay, and Jim, I can give shaft and trunnions if he's interested.
SC Okay, why don't you give us the shaft and trunnion for, say Altair at 115 and I'll go up there and I'll see if he can pick it up.
CAPCOM Okay, real fine. At 115 degrees of pitch, Altair, shaft 274, trunnion 22.2. Over.
SC Roger, shaft is 274, trunnion 22.2.
CAPCOM That's affirm.
CAPCOM Aquarius, Houston.

SC Go ahead, Joe.
CAPCOM Okay, Jim. In the LM there we show battery 3 only drawing about an amp and we think it's probably time to get it off the line. Battery 3 to OFF RESET. Over.
SC Battery 3 is OFF RESET.
CAPCOM Okay.
SC How are our comsuptions, Houston, just out of curiousity?
CAPCOM I'll verify you, Jim. I'm sure it's okay.
CAPCOM Okay, Aquarius, Houston. With the present amount of power you've got in the LM, which is over 500 amp hours and the rate you're using them we figure you've got almost 12 hours of power left.
SC 12 hours, huh, we could reenter with it.
CAPCOM That's affirm.
CAPCOM That's enough for 2 touch and goes and a full stop, Jim.
SC That's right, Joe. If we could meet a crater like Cone Crater I might hit it.
CAPCOM Okay.
SC Jack reports that he thinks he can see Altair.
CAPCOM Very good.
SC He says he thinks he can see Altair.
CAPCOM Okay, I'll take back the "very" but I'll leave the "good".

END OF TAPE

PAO This is Apollo Control Houston. We're now at 139 hours 19 minutes into the flight. Our digital displays show the Apollo 13 spacecraft at a distance of 27 698 nautical miles away from earth. Velocity increasing, now reading 11 779 feet per second. As you heard the discussion earlier about LM descent battery number 3 has been taken off the line. Five batteries, including 2 in the ascent stage are now on the line. This gives almost 12 hours of light time remaining. To quickly recap what has transpired earlier, the midcourse burn number 7 was performed as scheduled at 137 hours 39 minutes 48 seconds into the flight. This was a burn of 23 seconds in duration with a DELTA-V of 3 feet per second. Our flight dynamics tracking confirms that the burn was performed precisely as planned. Command Module Pilot, Jack Swigert is now in the command module. Earlier he powered up the main BUS B, and powered up some of the equipment in his checkout process. The command module computer was verified as looking good. Service Module separation occurred a little earlier then planned. Of course, this is not a time critical event. Jim Lovell decided to separate from the service module some 8 minutes in advance of that time previously considered. We copied a separation time -

CAPCOM Aquarius, Houston. Go.

SC I ran back there to take a look to see what I could see of this in the (garble). It looks pretty grim back there right now. It might be that we have to go across the line and maybe copy the fine line docking angles if we have time.

CAPCOM Okay. We'd like to do that to. Wait a minute. Stand by Jim.

PAO We copied service module separation 138 hours 2 minutes 8 seconds ground elapsed time. Jim Lovell vividly described the condition of the service module as Apollo 13 moved away from it as having 1 whole side missing. Fred Haise then reported that the service propulsion system engine bell appeared damaged. Looking ahead, we plan to bring up the command module batteries 2-1/2 hours prior to entry interface some considerably in advance of what would transpire if we had a normal mission. The batteries are normally brought on the line about 30 minutes prior to entry interface. Right now our clock is counting down to lunar module jettison. And we show a time of 2 hours 17 minutes from this time. We're at 139 hours 23 minutes and this is Apollo Control Houston.

CAPCOM Aquarius, Houston. Do you read?

SC I read you loud and clear.

CAPCOM Okay. What we'd like to do, Jim is, we'll go ahead and get the course alined for the gimbal angles that you're going to be holding course, and we'll get the platform up, and then when you call P52 and you sue it probably

CAPCOM won't be close enough to put the star in the sextant, but if you can see any kind of a bright star in the general vicinity, I mean 2 to 3 degrees from the center of the telescope so you have some clue as to which way to go then the identification problem shouldn't present much of a difficulty. Once you get the thing in the sextant, then you can go ahead and treat it like any other single burn.

SC That sounds great, one little problem, there are some little fluffy white objects floating around and also that (garble) part of Aquarius is just reflecting light like

END OF TAPE

SC - and also that the jet's tearing at the bottom of aquarius is just reflecting light like mad. We're going to try. There's no problem there; if we can see it, we'll get it.

CAPCOM Okay, and in the event that that doesn't work, we're standing by with the original scheme - a set of LM FDAI angles to fly to that will point the LM module optics st the Moon and the Sun; so we can always go back to that.

SC Okay.

CAPCOM And, Aquarius, Houston. We'd like you to verify the suit relief valve to CLOSED. Over.

SC Stand by.

SC It's closed.

CAPCOM Okay.

SC Okay, Houston, Aquarius

CAPCOM Aquarius, Houston. Go.

SC We'll go with your original 91 degree angle, if you have the stars figured out and the course aline angle for us.

CAPCOM Okay. Roger that, Jim. In a minute, at your convenience here, we'd like you to go to that attitude as close as you can get and call up the NOUN 20 for us.

SC Okay, at work now.

CAPCOM Okay.

SC Houston, Aquarius.

CAPCOM Go ahead, Aquarius.

SC Okay, I take it that if Jack cannot see stars at this attitude after you give the the course aline angles, we've just got to read down to you our gimbal angles and let you figure out a target angle for Jack, or did you want him to do a sighting on the Moon and the Sun. Is that correct?

CAPCOM That's roughly correct, Jim. Jack will course aline at that attitude. This is what we're having you maneuver to the - to that attitude for. We're going to compute course aline gimbal angles and pass them up to him and the first thing he'll do when there, per his checklist, is to course aline his platform. Then, he'll go to the P52, and if he can't see stars, we will quickly pass up to you the - your FDAI angles to put him in the Moon view attitude and he'll do a P52 on the Moon and then have you maneuver to the Sun and complete the P52 on the Sun.

SC Okay, but I'm going to have to maneuver to the Moon to help him out.

CAPCOM Oh, that's affirmative. If he can't see stars at the sep attitude that you'll be holding, you'll have to maneuver to the Moon attitude then to the Sun attitude for him.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Just like to mention that even if for some reason we run out of time or something and don't complete the Moon/Sun P52, Jack will have a platform course aline to the entry REFSMAT which we feel will be plenty good enough.

SC That's my feelings, too.

CAPCOM Okay.

PAO This is Apollo Control, Houston, 139 hours 42 minutes now into the flight. Apollo 13 is presently 25 227 nautical miles out from Earth, traveling at a velocity of about 12 307 feet per second. As you heard the earlier discussion, Jack Swigert having some difficulty seeing stars through the command module optics. These sightings are used as a reference in platform alinement - that's the computer platform. The problem is caused by sunlight reflecting off the surface of the lunar module and this reflection getting into the optics and washing out the view of the stars. If Command Module Pilot Swigert is unsuccessful in his star sighting efforts, Jim Lovell will maneuver with the lunar module to give him the opportunity to sight off the Sun and Moon. We're at 139 hours 42 minutes and continuing to monitor. This is Apollo Control, Houston.

END OF TAPE

CAPCOM Aquarius, Houston.
SC Hello there, Houston.
CAPOCM Hi. Jim, we - we've gone ahead and computed the CSM course aline gimbal angles, based on your being at the service module SEP attitude at the time that Jack cranks up the computer and in course alines the IMU. That is, we assume that you're going to be at Roll 0, Pitch 091, Yaw 0, and if you concur on that I'd like to pass up the angles for Jack to have.
SC Okay, I'll be there to the best of my ability.
CAPCOM Good show, ready to copy?
SC Go ahead.
CAPCOM Okay, CSM course aline angles. Roll plus 2 98.95. Pitch plus 271.30. Yaw plus 000.20.
SC Okay, Command Module angles will be roll 298.95. Pitch 271.30 and yaw 000.20.
CAPCOM That's affirmative and that's for his VERB 41, NOUN 21 he gets there.
PAO This is Apollo Control, Houston. 139 hours 53 minutes now into the flight of Apollo 13. Our display shows this 13 spacecraft at 23 873 nautical miles now out from Earth. Less than 20 minutes from this time, Jack Swigert aboard the Command Module will start drawing power from the 3 command module entry batteries. With this event forthcoming, Flight Director, Gene Kranz, advised his flight control team on the loop to review all checklist procedures for power transfer. You may recall that yesterday the entry batteries A and B were recharged from the LM. Presently there are 118 amp hours showing for the 3 entry batteries on the Command Module, this is within 2 amp hours of the lift-off number. We're at 139 hours 55 minutes into the flight and this is Apollo Control, Houston.
PAO This is Apollo Control, Houston at 139 hours, 59 minutes now into the flight of Apollo 13. We presently show Apollo 13 at 23 196 nautical miles away from Earth and with a speed of 12 798 feet per second. The retrofire officer advised the flight director, Gene Kranz, that our entry times are holding quite firm. There's only a one second change in ground elapsed time for entry interface. We're now looking at 142 hours 40 minutes 39 seconds for time of entry into the Earths atmosphere and at a velocity of 36 211 feet per second, at an entry angle of 6.5 minus 6.5 degrees. We're at 140 hours now into the flight and this is Apollo Control, Houston.
CAPCOM Aquarius, Houston. Over.
SC Go ahead, Houston. Aquarius here.
CAPCOM Okay, Jim. We're getting about 9 minutes

CAPCOM from the commencement of Command Module power up, and we wanted to just mention to you for Jacks benefit that, although the batteries are looking real good, in case their cool and have a little difficulty hacking the load, just at first, would like him to monitor main BUS voltage.

END OF TAPE

CAPCOM probably hacking the load just at first. We'd like him to monitor MAIN BUS voltage to 24 volts or above during the power UP procedure and if it falls below, we'll have a couple of circuit breakers for him that will solve the problem.

SC Okay, and I take it you are also monitory MAIN BUS voltage.

CAPCOM Negative. Not in the command module at this time because we don't call up telemetry until a little bit later on.

SC Oh, so - that's right, I forgot. Okay, I will tell him.

CAPCOM Thank you.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Okay, you're go to start powering up the command module.

SC Righto. We'll start it now.

CAPCOM Okay.

SC And we have LM power breakers

CAPCOM Okay. Houston you're looking at it.

CAPCOM Okay. Roger. Stand by.

CAPCOM Okay. Press on, Fred.

SC Okay, that's it Joe.

CAPCOM Okay, real good.

PAO Apollo Control Houston. 140 hours 16 minutes down in the flight - the network

SC Go ahead.

CAPCOM Roger. We have command module AOS. Request nominally CHARLIE in the CM. Over.

SC Nominally CHARLIE. Okay, stand by.

PAO That call off from Joe Kerwin confirming that HONEYSUCKLE has acquisition of signal of the command module S-band. We're at 140 hours 16 minutes. Apollo 13 now 21 092 nautical miles away.

SC This is known as yelling through the tunnel.

CAPCOM (laughter) The one MC.

SC I've got Fred up there with Jack, now helping to power up the CM and I'm staying down in good old Aquarius.

CAPCOM Understand, Jim.

PAO Apollo Control, Houston. We're 140 hours 18 minutes, now into the flight. That last report from spacecraft commander Jim Lovell, reporting that Fred Haise, now in the command module, helping Jack Swigert power up the systems. The nominal timeline called for Lovell and Haise is to transfer into the lunar module at about minus 1 hour 30 minutes from time of entry interface. So lunar module pilot, Haise has stepped ahead slightly in that timeline. We now show that we're 1 hour 22 minutes away from time of jettison of the lunar module. With 140 hours 19 minutes into the flight, this is Apollo Control Houston.

PAO Apollo Control Houston at 140 hours 21 minutes now into the flight. We're receiving the command module tracking data now and the data is looking good.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM Just to inform you. We've got data from Odyssey and it's looks good.

SC Hey, great.

PAO However, in looking over some of the command module displays it appears -

SC Joe, Odyssey is trying to call. Can you read them?

CAPCOM Negative. Don't read Odyssey yet. Is he got his intercom panel configured?

SC I'll double check. They're hearing you.

CAPCOM Okay. Good deal. I don't hear them yet.

PAO It appears to be a little chilly inside the command module cabin at the present time. We have a reading of 38 degrees.

SC VERB 74.

CAPCOM Stand by for just 1 minute, Jim.

SC Good day Houston.

SC I know it.

CAPCOM Okay, Aquarius. Houston. Recommending Odyssey that he switch to power amplifier to low. Over.

SC Power amplifier to LOW.

SC It's been switched to LOW, Houston.

CAPCOM Roger. Okay, verify the power AMP talk back is grey, Jim.

SC Okay. Stand by.

PAO We're at 140 hours 23 minutes now into the flight. We presently show Apollo 13 at 20 257 nautical miles

END OF TAPE

PAO - in to the flight. We presently show Apollo 13 at 20,257 nautical miles away and having a velocity of 13 622 feet per second. This is Apollo Control Houston.

CAPCOM Aquarius, Houston.

SC Go ahead.

CAPCOM We have high bit rate; we are standing by for the VERB 74 interim and the E MOD dump.

SC Roger. Joe, how do you read?

CAPCOM Okay, read you babe.

SC Okay, loud and clear, VERB 74 coming down.

CAPCOM Okay, copied that Jack.

SC And I'll be ready for your P27 update. And P00 and ACCEPT.

CAPCOM Okay. Understand you are in P00 and ACCEPT; verify OMNI Charlie.

SC Okay. Joe, we are OMNI Charlie; we had little bit better signal strength on another optics.

CAPCOM Okay, stand by.

SC Okay, Odessey, Houston. Select your best OMNI and repeat VERB 74 interim; over.

SC Okay, Houston.

CAPCOM Okay, Odessey, Houston; we are locked on solid high bit rate now; repeat the VERB 74 interim; over.

CAPCOM Belay that; hold the VERB 74 one minute.

SC You're too late Joe; its coming down.

CAPCOM Okay, Odessey, Houston.

SC Go ahead.

CAPCOM Okay, we are going to skip the E MOD dump for right now and get the uplink in.

SC Okay, P00 and ACCEPT.

CAPCOM Okay, P00 and ACCEPT. And Jack, you can go ahead with the IMU and optics power up; over.

SC Roger - its in works.

CAPCOM Okay.

END OF TAPE

PAO Apollo Control Houston 140 hours 34 minutes now into the flight. We're presently in the process of updating the command module computer, the CMC now in program 27. We show 1 hour 7 minutes away from scheduled time of jettison of the lunar module. This Apollo Control Houston.

SC We are unable to read any bat B voltage. We do have current, so (garbled)

CAPCOM Okay, copy that, Fred.

CAPCOM You're looking good on the ground, Odyssey.

SC Okay.

CAPCOM And I think the reason you don't read voltage is it's a circuit breaker that we have called as being out.

SC All right.

PAO This is Apollo Control Houston now 140 hours 37 minutes now into the flight. We presently show Apollo 13 at 18 623 nautical miles from earth and with a velocity of 14 144 feet per second. This is Apollo Control.

CAPCOM Odyssey, Houston. The uplink is going well. We have one more load to get in.

SC Okay, real fine.

END OF TAPE

SC - - computer right now, Joe?
CAPCOM Stand by one second.
CAPCOM Okay, Jack, we'd like the verb 74 enter and it'll take less than a minute for the MOD dump
SC Coming down.
CAPCOM And, Jack, Houston. It'll be 170 (garble)
SC Okay, Can I go to block on the (garble)
CAPCOM Not just yet, Jack.
CAPCOM Odyssey, Houston. You can go to uphill block. Over.
SC Uphill block when the computer's monitoring.
CAPCOM Not yet, Jack. We're still in the MOD dump, and Aquarius, Houston.
SC Okay.
SC Go ahead, Houston.
CAPCOM Okay, we're coming up on time for the course aline, Jim, so you can hold you're attitude real good.
SC Rog.
CAPCOM And Odyssey, Houston, the computer is yours, so press on.
SC Okay.
SC Houston, Aquarius.
CAPCOM Aquarius, Houston. Go ahead.
SC I (garble) the course aline. I'm going to the jettison attitude.
CAPCOM Copy that.
CAPCOM Aquarius, Houston. I copy that you have completed the course aline, he's going into the P52 now, is that right?

END OF TAPE

CAPCOM - a P52 now, is that right?
SC Let me check. I think he is.
CAPCOM Okay. You're staying in your present attitude, aren't you?
SC Yes, and we'll all stay in the present attitude.
CAPCOM Roger that.
SC Okay, Houston, I got a 220 alarm here. (garbled)
CAPCOM Odyssey, Houston. If you set the drift lights and the REFSMAT light.
CAPCOM Odyssey, Houston.
SC (garbled)
CAPCOM You were noisey, I didn't copy. Have you set the drift and REFSMAT light?
PAO Jack Swigert reported a 220 alarm, this indicating that the IMU is not alined. We're at 140 hours 45 minutes into the flight. We show Apollo 13 at 17 461 nautical miles away at the present, now traveling at a speed of 14 552 feet per second. Apollo 13 now 54 minutes away from the time of lunar module jettison. To dispose of Aquarius, the crew inside the command module after installing the hatch will vent the lunar module tunnel to 1-1/2 or 2 pounds giving a DELTA pressure of 3 psi across the docking tunnel hacth. This to insure a proper sealing. To jettison the lunar module the pyros are fired aboard the command module and pressure in the tunnell gives a separation velocity of some 2 feet per second. The command module will do most of the moving at this point because it will be the lighter of the 2 spacecraft. Separation could be likened to the releasing of a baloon and having air propel it along. We're at 140 hours 47 minutes now into the flight and Apollo 13 now at a distance of 17 225 nautical miles from earth traveling at a speed of 14 629 feet per second. This is Apollo Control Houston.
SC Okay, Joe, I don't have a star in the sextant. I'm going to hunt for it in a minute.
CAPCOM Roger that, Jack.

END OF TAPE

SC Okay, Joe, can you give me any stars that I might try here?
CAPCOM That's affirmative. Vega and Altair should be good. Vega is 36 Altair is 4.0.
SC Okay, we'll give that a try.
CAPCOM Okay and you might look for them in the telescope with the OMNI sextant light off. (GARBLE)
SC Okay, I got all that down. (GARBLE)
CAPCOM (GARBLE)
SC I have an (GARBLE) thank you.
CAPCOM Okay, Jim, that's the one we warned you about some time ago. Low helium, no sweat.
SC Oh, okay.
SC Okay, Houston there's a triangle difference with stars 36 and 40.
CAPCOM How about that, baby.
SC An odd maneuver Houston.
CAPCOM Roger that. Copy you're maneuvering to a LM JET attitude - is that right?
SC That's affirm.
CAPCOM That's affirm.
SC Going to be a full stroke gimbal angle.
CAPCOM Torque them babe.
SC There it is. Now I have this star check.
CAPCOM Okay.
SC 140 53.
CAPCOM Okay, Odessey, you're suddnely ahead of the timeline.
CAPCOM Odessey, Houston. Request OMNI BRAVO.
SC (garble)
CAPCOM Okay.
SC Okay, Houston the sextant star check passes.
CAPCOM Say again, Jack.
SC I did our star checking. It passes. It puts that star right in -

END OF TAPE

SC - I did a star check and it passes - it puts the star right in the (garble)
CAPCOM Good enough.
SC (garble)
CAPCOM You can press on in the checklist Jack. Find out LM gimbal lock Jim.
SC It's the command module's gimbal lock I'm worried about.
CAPCOM Ha Ha; okay.
PAO Apollo Control Houston. 140 hours, 55 minutes into the flight; that star check report confirms proper alinement of the command module platform. We are 45 minutes away now from scheduled time of LM jettison.
CAPCOM - Houston.
SC Go ahead.
CAPCOM Roger - if you concur, we would be in= clined to recommend that you go to AGS for the maneuver cause you'll have to be there later on anyway.
SC Okay.
CAPCOM And AGS pulse is the recommendation.
SC We're having trouble maneuvering Joe without getting it in gimbal lock.
CAPCOM Okay - you can -
SC You picked a lousey attitude though to separate.
CAPCOM We apologize; just take your time; Jim, we've got time now.
SC Okay.
SC Houston, why can't I stay in PGNS that whole - for the LM attitude hold?
CAPCOM Stand by on that Jim.
CAPCOM Aquarius Houston over.
SC Go ahead.
CAPCOM Okay - our recommendation is that you stay in AGS for the LM jett simply because we've thought it through; we've got the right dead bands set up; over.
SC Okay. It's a lot easier for me to maneuver in PGNS Joe than it is the AGS.
CAPCOM Yeah - you can maneuver in PGNS Jim; I'm sorry, I thought you were talking about the apt hold and the LM jett afterward. You can maneuver in PGNS if you want to.
PAO Apollo Control, 140 hours, 58 minutes, Apollo 13 now 15 786 nautical miles away. Velocity now read- ing 15 192 feet per second.
SC We're ready to give gimbal lock; I have the yaw at about - I'd say about - almost 50 degrees.
CAPCOM Roger that - just stay out of gimbal lock and the 45 degree isn't critical, the out of plane that is.

CAPCOM Odessey, Houston, requrest OMNI Charlie.
SC Okay, going OMNI Charlie.
CAPCOM Thank you.
SC There.
CAPCOM Okay, good.
CAPCOM Roger - that's VERB 46. Roger. Aquarius, Houston.
SC Go ahead.
CAPCOM Okay, Jim, the particular DAP configuration we have set up now is using more fuel than we'd like out of system B; we'd like you to reconfigure the DAP to 30021; over.
CAPCOM Thank you. Odessey, Houston.
SC Go ahead.
CAPCOM We would like to have you turn the optics power off until you need them again, and we would like to have you check the RCS ring 1 and 2 temps for us; over.
SC Optics power going OFF.

CAPCOM Okay.
SC Okay, Joe, Our ring 1 is 50, ring 2 is plus 42.
CAPCOM Ring 1 50; copy, what was the other?
SC 42.
CAPCOM Got it. Thank you.
SC Okay, Houston, Aquarius, I am at the LM sep attitude and I'm planning on bailing out.
CAPCOM Okay, I can't think of a better idea Jim.
SC I'll go to AGS and hold it if you want me to.
CAPCOM We recommend that Jim.
CAPCOM Okay, Aquarius, Houston, in AGS and hold, we recommend wide dead band; over.
SC I'm in that dead band.
CAPCOM Roger. Aquarius Houston -

END OF TAPE

CAPCOM Okay. Aquarius, Houston. In AGS hold, we recommend wide deadband. Over.
SC We're in the AGS right now.
CAPCOM Roger.
CAPCOM Aquarius, Houston.
SC You need to relay something downstairs, Joe?
CAPCOM Odyssey, Houston.
SC Go ahead, Joe.
CAPCOM Okay, our troops would like to have you go to the systems test meter and read out the injector temps on RCS for us.
SC Okay
SC Okay, in work.
SC Okay, Houston. Let me read out the injector temperatures for you.
CAPCOM Go ahead.
SC Alright. 5Charlie 4.2, 5 Dog is 4.6, 6 alpha 4.3, 6 bravo 4.3, 6 charlie 3.6, 6 dog 3.6.
CAPCOM Okay, copy that; no complaints.
SC Okay, we're ready to proceed with hatch closeup.
CAPCOM Okay, Did Jim get the film out of Aquarius?
SC Yeah, we - you mean the film we took this morning?
CAPCOM That's affirmed.
SC Yes we transferred that.
CAPCOM Okay, good deal.
CAPCOM Jack, let me mention something about the hatch integrity check. You're going to vent the tunnel until you get a 3 psi delta P. That should take 9 or 10 minutes and it's our firm feeling that you don't have to wait another 10 minutes after that for a leak check. If it holds pressure for a minute or so or even (garble) you know you've got a good hatch. Over.
SC Okay. Copy that.
CAPCOM Okay.
PAO Apollo Control, Houston. 141 hours 8 minutes now into the flight. Apollo 13 presently 14 468 nautical miles out from Earth. All three crewmen now in the command module preparing to install the hatch. We show 32 minutes 40 seconds away from scheduled time of lunar module jettison. This is Apollo Control, Houston.
PAO This is Apollo Control, Houston, now 141 hours 11 minutes now into the mission; it's less than 30 minutes away from the scheduled time of jettisoning the lunar module. We show Apollo 13 at an altitude of 14 020 nautical miles. We have an estimate of an altitude of 9729 nautical miles at the time of jettisoning the lunar module.

PAO We're at 141 hours 11 minutes continuing to monitor. This is Apollo Control, Houston.

END OF TAPE

SC Okay, Houston. We've got an 02 total high.
CAPCOM Okay, Jack are you -
SC Well, we might be pressurizing a lot of the systems that was not pressurized.
CAPCOM Roger. I expect that's the case. Let's check.
SC Okay. Take a good look at cabin.
CAPCOM Odyssey, Houston. Just verify your direct 02 is off. Over.
SC Yes sir. That is verified.
CAPCOM Okay and -
SC It's dropping now, Joe.
CAPCOM Roger. We think that you were just pressurizing the cabin up to that regulators particular spec.
CAPCOM Odyssey, Houston.
SC Go ahead.
CAPCOM Okay. We're observing middle gimbal angle. Getting a little bit high. The LM appears to be deadbanding okay within it's attitude, but just wanted to let you know that we're keeping an eye on it and if it does get too high we might want to get a punch off early.
SC Okay.
CAPCOM And verify that the hatch is secured and then you are venting the tunnel. Over.
SC That's verified. We have a DELTA-V at 2.8.
CAPCOM Real good. Real good.
PAO This is Apollo Control Houston at 141 hours 16 minutes into the flight. Apollo 13 now 13 283 nautical miles away from earth with a velocity building up now to 16 350 feet per second.
SC plan. Can I proceed on and kind of punch off early or do you want me to punch off at exactly 1 hour?
CAPCOM Jack, when you are comfortably ready to punch off you can go ahead and do it.
PAO That was Jack Swigert receiving that confirmation from the ground from Joe Kerwin that he can jettison the lunar module at his convenience. So we'll stand by for that possibility at any time. We're at 141 hours 17 minutes into the flight of Apollo 13.
CAPCOM Odyssey, Houston. We just had a formal go for LM jet at your convenience.

END OF TAPE

CAPCOM Odyssey, Houston. We just had a formal GO for LM jet at your convenience. Over.

SC Okay, thank you Joe.

CAPCOM Okay.

CAPCOM Okay, Odyssey, Houston. We're ready for you to bring the B MAGS on and warm up and all other things being equal we'd like you to go through the LM jet on the checklist you've got. And that is B MAG (garbled)

SC Okay, will do.

CAPCOM That's B MAG 1 now, as you know.

SC Yes, B MAG 1 is in warmup.

CAPCOM Good deal.

PAO Apollo Control Houston now 141 hours 20 minutes now into the flight. While we're standing by we'll pass along some updated numbers from the retro fire officer. We show time of entry in the earth's atmosphere at 142 hours 40 minutes 39 seconds, blackout begins at plus 18 seconds from time of entry interface -

SC Do you have a command module weight for me?

CAPCOM Stand by one, Jack.

PAO Blackout ends at 3 minutes 23 seconds from time of entry interface.

CAPCOM Odyssey, Houston.

SC Go ahead.

CAPCOM Okay, I'm reminded that the entry dap is all you've got. It will initialize itself and you won't have an RCS dap so you don't have to fool with it.

SC

PAO Okay.

Drogue deploys at 8 minutes 16 seconds, main chutes deploy at 9 minutes 4 seconds from time of entry interface, predicted time of splash 14 minutes 1 second from time of entry interface. Standing by, continuing to monitor, this is Apollo Control Houston.

PAO Apollo Control Houston, now 141 hours 22 minutes into the flight. We show Apollo 13 presently at an altitude of 12 474 nautical miles at a speed of 16 761 feet per second.

SC Okay, Joe, do you have your checklist out there on the SPS power up?

CAPCOM That's affirm.

SC Okay, I'm coming down here to a step that says FDAI power OFF. Is that what you want right now I guess, huh?

CAPCOM Go ahead.

CAPCOM Okay, Jack. That FEAI power off is to stop momentary gliches as you bring up the B MAG to put it on and you turn right around and put the FEAI power right back on 1.

SC Okay. I don't have the B MAG temp light out yet. Do you want me to go ahead and put the B MAG on with the temp light still on?

CAPCOM That's affirm. We can go ahead and still have a good stable rate.

SC All right, let's do it.

PAO Apollo Control Houston 141 hours 24 minutes now into the flight. The flight surgeons now monitoring the consoles are taking readings on Jack Swigert and Fred Haise's heart rates on these gentlemen just running over 100, slightly higher than average indicating an increased work load. We now show Apollo 13 at 12 064 nautical miles away from earth, speed continuing to build up, now reading 16 989 feet per second. This is Apollo Control Houston.

SC Okay, Houston, we'll punch off at 141 plus 30.

CAPCOM Okay, Jack, we copy and we concur.

PAO That was Jack Swigert indicating that they plan to jettison the lunar module in about 3 minutes from this time.

PAO Apollo Control Houston 141 hours 28 minutes into the flight, Apollo 13 now 11 590 nautical miles away from earth. For reentry the 3 crewmen will be traveling in shirt sleeve nvironment, not in their space suits. We're standing by now for reports of jettison of the lunar module. At 141 hours 28 minutes this is Apollo Control Houston.

END OF TAPE

SC Okay, Houston, do we have a GO for pyro arm?
CAPCOM Odessey, Houston, we can give you a GO if you will put the logic on momentarily first.
SC Okay, the SECS logic is ON.
CAPCOM Okay, just copied that, and you are GO for pyro arm
SC Real fine.
SC 10 seconds.
SC Fine. LM jettison.
CAPCOM Okay, follow that. Fair well Aquarius; and we thank you.
CAPCOM Watch your gimbal lock there Jack.
SC Yeah, we did.
PAO This is Apollo Control Houston at 141 hours, 31 minutes into the flight; we have had lunar module jettison, and for Apollo 13, the age of Aquarius ended at 141 hours, 30 minutes ground elapsed time.
CAPCOM Odessey, Houston; requrest OMNI BRAVO.
END OF TAPE

PAO Apollo Control, Houston. 141 hours 35 minutes now into the flight. We have reports from recovery that Samoa rescue Aircraft, 1, 3 and 4 are now enroute to their respective stations. These C-130 aircraft. Samoa 1 will be positioned 105 nautical miles uprange. Samoa 4 200 nautical miles downrange. Correction to that last report Samoa 1 will be 345 nautical miles uprange. Samoa 2 240 nautical miles uprange. Samoa 4 200 nautical miles downrange. Continue to monitor at 141 hours 36 minutes. This is Apollo Control, Houston.

CAPCOM Odessey, Houston.

SC Go ahead.

CAPCOM Okay, Jack we'll have a pad for you in a few minutes we're getting data now on the tracking and although we suspect the changes from your preliminary pad will be very small we recommend that you hold off on initilizing the EMS until we get to the final pad. Over.

SC Okay. Will do.

CAPCOM Roger.

SC Okay, Houston, the sextant star check passes.

CAPCOM Houston, copy. Good show. That was some P52, Jack.

SC Yeah, I was kind of lucky, I guess.

CAPCOM Give you a big gold star for that.

SC Hey, Joe, we're standing by to copy your new pad.

CAPCOM Okay, Jack, it'll be a few minutes yet before we get it right up to speed.

SC Okay, I can proceed with the EMS check, can't I, Joe.

CAPCOM That's affirmative, Jack. You can go ahead with that.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-17-70 CST 10:52A GET 141:39:30 622/1

PAO This is Apollo Control Houston. 141 hours 40 minutes now into the flight of Apollo 13. Apollo 13 now at an altitude of 97 030 nautical miles from earth with a velocity now reading 18 504 feet per second. We have a report that the lunar module is continuing to hold altitude the way it should. Cabin pressure is holding and here in Mission Control we'll continue to track the lunar module, Aquarius until it reenters. We're at 141 hours 41 minutes into the flight, and this is Apollo Control Houston.

PAO This is Apollo Control Houston at 141 hours 44 minutes now into the mission. Apollo 13 presently at a distance of 9102 nautical miles from earth and with a velocity reading 18 952 feet per second. Meanwhile we have a listing of the crew members of the helicopters who will be airborn at the time of predicted landing. We read an estimated time of landing now of 1 hour 10 minutes

END OF TAPE

APOLLO 13 MISSION COMMENTARY, 4/17/70 CST 10:57 GET 141:45 623/1

PAO Aboard Recovery 1 Pilot will be Commander Charles B. Smiley, 39, of Oklahoma City, Okalahoma. Commander Smiley is the H-S4 Commanding Officer and picked up the Apollo 10 astronauts. Co Pilot Lt. Junior Grade Dana G. McCarthy, 25, of Chathum, Mass. First crewman, Ralph G. Slider, 28, of Paden City, West Va., Second crewman, Michael Longe, 21, of Shelburn, Vermont. The swimmer aboard Lt. Junior Grade Ernest Lee Jahncke, 26, of Greenwich Connecticut. Aboard Swim 1, Pilot Lt. Commander Carl John Frank, 35, North Merrick, New York, Co Pilot Lt. Jr. Grade Douglas Fillmore Hudson, Jr., 24, of Barrington Illinois. First crewman, Robert Peterson, 23, of Susanville California, Second crewman, Gary W. Neilson, 21 of Delhi Louisiana. Swimmer, Stephen P. Jewett, 25 of Ontario, California, and Second swimmer, Robert J. Pfanzelter, 19, of Burlington, Wisconsin, Third swimmer, Luco Palma, 19, of Tewksbury, Mass.

CAPCOM Odessey, Houston, over.

ODESSEY Go ahead Houston.

CAPCOM Okay, Jim, you cabin is looking real good; recommend you turn the suit compressor to OFF now; over.

SC Going off. Boy, its nice and quiet in here.

CAPCOM Okay, real good. Incidentally, your power is looking real good also Jim.

SC Okay.

PAO Aboard Swim Helicopter No. 2 Pilot Lt. Allen Leroy Willhite, 27, Oklahoma City, Oklahoma. Co Pilot Lt. Jr. Grade Vernon E. Wright, 27, Atlanta, Georgia, First crewman, Raymond Lloyd Morrison of Lynchburg, Va., Second crewman John William Towne, McCook, Nebraska, First swimmer Allan W. Starr.

CAPCOM - Houston, I have your final entry pad when you are ready.

PAO Allan W. Starr of Jackpot, Nevada.

CAPCOM Okay, Mid Pac. 000 152 000 142 38 19 178 and you will recall that is GET move set and moon check attitude. Noun 61 minus 2166, minus 16537, 052, 36211, 620, 11197, 36291, 1424046, 0030, the next four are N/A; DO is 400 0220, 0019, 0338, 0759. The rest of the pad is N/A for this one. You are -

END OF TAPE

CAPCOM - the rest of the pad is M/A for this one. You are lift-vector up at the very bottom. And the remarks all remain the same; if you want me to copy them, let me know, otherwise you can read back. Over.

SC Okay. Entry pad as follows: (garble) 000152000, 1423819, 178 minus 2166 minus 16537, 052, 36211, 620, 11157, 32691, 1424046, 0020, (garble) for N/A (garble) is 400 0220 0019 0338 0759, all the rest are N/A, except (garble) which is (garble)

CAPCOM Okay, Jim. That's a tiny hair shallower than we had you before, but it's based on solid tracking, and it still is lift-vector up comfortably.

SC Rog.

SC We never did bring that angle up, did we?

CAPCOM No, actually, we didn't.

PAO This is Apollo Control, Houston, now 141 hours 53 minutes now into the flight. Our final pad shows a time of entry interface at 142 hours 40 minutes 46 seconds; begin blackout at plus 19 seconds from time of entry interface in the blackout, 3 minutes and 38 seconds. Time of drogue deploy from entry interface is plus 7 minutes and 59 seconds; main chute deployment plus 8 minutes 46 seconds from time of entry interface and predicted time of splash, 13 minutes 44 seconds from time of entry interface. We're now at 141 hours 54 minutes into the mission continuing to monitor. This is Apollo Control, Houston.

PAO Apollo Control, Houston at 141 hours 55 minutes into the flight of Apollo 13. At the present, we're now feeding a downrange picture of the recovery on the closed-circuit television circuit. Further report from recovery: all recovery aircraft, the C-130's, are airborne and helicopters 1 and 2 with swimmers are airborne and proceeding to station at this time. This is Apollo Control, Houston, at 141 hours 56 minutes into the flight of Apollo 13.

END OF TAPE

PAO Apollo Control Houston 141 hours 56 minutes into the flight. Apollo 13 now 7084 nautical miles away from earth, velocity increasing. They are presently reading 20 770 feet per second. For the report from recovery, both ARIA aircraft are airborne and on station. This is Apollo Control Houston at 141 hours 57 minutes into the flight.

PAO Apollo Control Houston 141 hours 59 minutes - correction - 142 hours now into the flight. We show Apollo 13 at an altitude of 6613 nautical miles away, velocity really beginning to build up now, now reading 21 227 feet per second. We show 40 minutes from time of reentry into the earth's atmosphere.

CAPCOM Odyssey, Houston. Over.

SC Go ahead.

CAPCOM Okay, Jack, we'd like P00 and accept for your final state vector.

SC You've got it.

CAPCOM And Odyssey, Houston, we're also sending you a final PIPPA bias update and torque increment. Over.

SC Okay, fine, thank you, Joe. How does the LM look? Are you still tracking it?

CAPCOM All I've heard was that the cabin was holding pressure. I haven't heard anything more. And Odyssey, we're ready for you to warm up the B MAG number 2s at your discretion and we're curious whether the moon check attitude is good. Over.

SC Yes, Joe, it's coming down. I get just about 45 degrees now and it's coming on down.

CAPCOM Roger that.

END OF TAPE

APOLLO 13 MISSION COMMENTARY 4-17-70 CST 11:15A GET 142:03:00 626/1

PAO This is Apollo Control, Houston. 142 hours 3 minutes now into the flight. We presently show on one of our displays a splash coordinance of 21 degrees 39 minutes South. 165 degrees, 23 minutes West. Apollo 13 now at an altitude of 5862 nautical miles. Velocity now reading 22 085 feet per second.

CAPCOM Odessey, Houston. The computer is yours. Over.

SC Okay, thanks Joe.

PAO Apollo Control, Houston - 142 hours 7 minutes not into the flight of Apollo 13. Odessey now 34 minutes away from time of entry into the Earth's atmosphere. Mission Control has just passed a computer update to the onboard CMC and as you heard Joe Kerwin's last report to the crew, telling them that the computer now belongs to them. We're at 142 hours 7 minutes, continuing to monitor, this is Apollo Control.

SC The burn is coming down to about 38 degrees.

CAPCOM Okay, Jack. Sounds real good.

PAO Apollo Control at 142 hours, 8 minutes now into the flight of Apollo 13. Presently 5134 nautical miles away from Earth. Velocity now reading 23 023 feet per second. We're 33 minutes away from time of entry. This is Apollo Control, Houston.

CAPCOM Odessey, Houston.

SC Go ahead.

CAPCOM Okay, we'd like the S-band power amplifier to off center at this time, Jim.

SC Off center. (GARBLE)

CAPCOM Okay, you're still looking real fat on power - we show you having over 30 amps on the water If you do get into a bind and don't come up - that's amp hours - don't come up with recovery you can always power down and you can always put the PYRO batteries on. If you need them (GARBLE)

SC Okay

PAO This is Apollo Control, Houston. 142 hours 14 minutes now into the mission. Apollo 13 presently 4075 nautical miles out from Earth. Velocity now showing 24 619 feet per second. We're less than 27 minutes now from time of entry into the Earth's atmosphere.

END OF TAPE

SC Joe, are you planning on running us all the way down without the suit pressure?
CAPCOM Say again Jack.
SC Are you planning to turn on the suit compressor at all on the way down?
CAPCOM That's negative Jack; I'll verify it; but I sure don't think so. t
SC Okay, that's all right with us.
CAPCOM Okay, Jack, this is Houston, we have power, and you can cycle it for 10 minutes if you so desire, but we don't think you need to do it; over.
SC Okay, we'll hold that.
CAPCOM Okay, real fine. How did the EMS check go Jack?
SC EMS checked out Okay. Its been initialized and setting on entry.
CAPCOM Roger.
PAO Apollo Control Houston, 142 hours, 17 minutes now into the mission - our digital display at present shows Apollo 13 at 3505 nautical miles away from earth, now traveling at a speed of 25 693 feet per second. Jack Swigert confirms that the EMS check went well, which provides a good backup monitor for checking the guidance and navigation system performance; we are at 142 hours, 18 minutes into the flight, and this is Apollo Control Houston.
SC Okay, Joe, are you watching - you and Fido taking a look at our NOUN 60 here?
CAPCOM Thats affirmative; hold it just a second; we are looking at 6.13 and 4.80; I'll get a check on that.
SC Hey that's not too many g's.
CAPCOM Jack, Fido says that okay.
SC Okay.
PAO Apollo Control - that was a reading from the onbaord computer displays showing a velocity at entry of 36 211 feet per second.
CAPCOM Jack, Houston, your NOUN 63 looks good to us also.
SC Okay.
PAO Apollo Control Houston, at 142 hours, 22 minutes into the mission.
CAPCOM Our plot board up here, we can hardly see how far out we are.
SC Okay.
SWIGERT I know all of us here want to thank all you guys down there for the very fine job you did.
LOVELL That's affirm Joe.
CAPCOM Tell you - we all had a good time doing it.
PAO We now show Apollo 13 at a distance at 2581 nautical mile.

CAPCOM Houston; just for your information, it looks as though battery C will deplete around main chute time, thats expected you have plenty of amp hours in the other batteries.

PAO We now show velocity of 27 553 feet per second at 142 hours, 24 minutes.

CAPCOM Odessey, Houston, over.

PAO Apollo Control Houston at 142 hours, 25 minutes now into the mission - aboard Apollo 13 -

CAPCOM Houston; over.

SC Go ahead.

CAPCOM I was going to tell you about the hand over we just -

CAPCOM Houston. Over.
SC Go ahead.
CAPCOM Okay. I was just going to tell you about that handover we just had, but I was a little late on the ball. Since, we're fat on power and we'd kind of like to have S-band with you after the blackout, we'd like you to delete the step on your entry checklist page 2-5, after the end blackout that says power PMP to off. We'd like you to leave it on if you think of it. Over.
SC Okay.
CAPCOM Okay.
PAO We're now reading the onboard computer display, which shows a present velocity of 29 160 feet per second. This is what the crew is reading out. A range toe-to-go distance of 4984 nautical miles. We're at 142 hours 26 minutes into the flight. We show 14-1/2 minutes from time of entry interface. Thirteen minutes now from predicted time of entry. The onboard computer shows a velocity of 30 113 feet per second, range-to-go distance 4683 nautical miles. Retrofire Officer has just reported to Flight Director Gene Kranz, we look real good here now. Telemue has just reported to Flight Director Gene Kranz that we have now lost tracking on lunar module Aquarius. Eleven minutes away now from time of entry interface. Onboard displays show a velocity of 31 141 feet per second, range-to-go distance of 4332 nautical miles. We're at 142 hours 30 minutes into the flight of Apollo 13.
CAPCOM Odyssey, Houston. Over.
SC Go ahead.
CAPCOM Okay. At 10 minutes to 400 K. You're looking good, and we're real happy with the trajectory and a minute ago we just lost contact with your friend Aquarius.
SC Okay. Where did she go?
CAPCOM Oh, I don't know. She's up there somewhere.
SC She sure was a good ship.
CAPCOM Hey, just as I said that we got another burst of LM data so I guess it's still ticking.
PAO Nine minutes now from time of entry interface. The onboard computer now reading a velocity of 32 193 feet per second. A range-to-go distance of 3919 nautical miles.
CAPCOM Odyssey, Houston. Your DSKY is doing all the right things. The G&N is GO. Over.
SC Okay, thank you.
SC You have a good bedside manner, Joe.
CAPCOM Say again, Jack.
SC Laughter. You have a good bedside manner.
CAPCOM Laughter. That's the nicest thing anybody has ever said.
PAO Capcom Joe Kerwin, in addition to being an astronaut, is also a medical doctor.

SC Sure wish I could go to the FIDO party tonight.
CAPCOM (Laughter) Yes, it's going to be a wild one.
PAO Less then 7 minutes now from entry into the earths atmosphere. Onboard display now shows a velocity of 33 383 feet per second.
CAPCOM We'll cover for you guys. And if Jack's got any phone numbers he wants us to call, well pass them down.
PAO Range to go now 3271 nautical miles. We're 6 minutes now from time of reentry into the earthss atmosphere. Five minutes to go now for reentry into the earths atmosphere. Now reading a velocity of 34 335 feet per second. Range to go 2921 nautical miles. Flight Director Gene Kranz now going around the room posting his Flight Control team as to the status.
CAPCOM Odyssey, Houston. Over.
SC Go ahead.
CAPCOM Okay. We just had one last time around the room and everybody says you're looking great.
SC Thank you.

END OF TAPE

PAO 4 minutes to go now for entry interface, velocity now reading now 34 802 feet per second, range to go about 2625 nautical miles. Still receiving onboard data. Still looking good. Three minutes to go now from the time of entry into the Earth's atmosphere. Onboard display shows a velocity of 35 245 feet per second. Range to go 2301 nautical miles.

SC The mood fits the color.

CAPCOM Odyssey, Houston. Over.

SC Go ahead.

CAPCOM Okay. LOS in about a minute or a minute and a half. In entry attitude, we'd like OMNI Charlie. And welcome home. Over.

SC Thank you.

PAO Two minutes to go til entry. Velocity now reading 35 646 feet per second; range to go 1961 nautical miles.

PAO Apollo Control, Houston. We've just had loss of signal from Honeysuckle with Apollo 13. Our last velocity reading was 35 837 feet per second with a range to go of 1791 nautical miles.

PAO Apollo 13 should have entered the earth's atmosphere at this time. A few moments ago, we had a report from the retrofire officer that based on his data, a predicted set of coordiance for splash of 21 degrees 39 minutes south of 165 degrees 22 minutes west. The period of blackout for the spacecraft should have begun about 20 some odd seconds ago. Apollo Control, Houston. Apollo 13 should be coming up on max g right now. Our last estimate for max g was 5.2 g's.

END OF TAPE

PAO We have about a minute and a half to go during this period of blackout. Here in Mission Control the scene from the recovery ship Iwo Jima has been flashed up on one or our large screens for all our flight controllers to watch. We have about 1 minute to go now to time of end of blackout. About 30 seconds to go for blackout. Less than 10 seconds now. We will attempt to contact Apollo 13 through one of the ARIA aircraft. Continuing to monitor, this is Apollo Control Houston.

PAO Apollo 13 should be out of blackout at this time. We are standing by for any reports of ARIA acquisition, ARIA a C-135 type aircraft. Coming up now on 3 minutes until time of drogue deployment, standing by for any reports of acquisition. We're had a report that ARIA 4 aircraft has acquisition of signal.

CAPCOM Odyssey, Houston, standing by. Over.

SC Okay, Joe.

CAPCOM Okay, we read you, Jack.

PAO That was Jim Lovell responding with the "Okay, Joe." Correction there. That was command module pilot Jack Swigert.

CAPCOM We're looking at the weather on TV and it looks just as advertised, real good.

PAO Less than 2 minutes now from time of drogue deployment. Less than a minutes away now from time of drogue deployment. Less than 30 seconds away now from drogue deployment. The drogue deployment - these 2 chutes will provide breaking and stabilization prior to main chute deployment. Standing by now for - continue to monitor.

CAPCOM Odyssey, Houston, standing by for your NOUN 67 when you get it. Over.

SC We got 2 good drogues.

CAPCOM Roger that.

PAO A report of 2 good drogues. Coming up now for main chutes. Standing by for confirmation of main chutes.

CAPCOM (Applause) Odyssey, Houston, we show you on the mains. It really looks great.

PAO An extremely loud applause here in Mission Control.

SC (garbled)

PAO An extremely loud applause as Apollo 13 on main chutes comes through loud and clear on the television display here.

SC (garbled)

IWO JIMA Iwo Jima, roger.

RECOVERY Iwo Jima (garbled) Recovery. I have a visual bearing 190. Over.

IWO JIMA (garbled)

RECOVERY Iwo Jima, 101 has a visual of 1 10. (garble)

RECOVERY (garbled)
IWO JIMA Iwo Jima, Roger.
RECOVERY Apollo 13, Apollo 13, this is Recovery. Over.
PAO A recovery helicopter has just put in a call to Apollo 13.
RECOVERY Apollo 13, Apollo 13, this is Recovery. Over.
PAO We have a report from the Iwo Jima that Apollo 13 at a distance of 4 miles from the ship. The smoke you see is venting of RCS propellants, a reaction control system propellants.
SC We are going through 5000.
RECOVERY Roger, Apollo 13. This is Recovery and your chutes look good.
RECOVERY Apollo 13, this is Recovery. We observed your RCS burn. Over.
PAO You heard the conversation between the recovery helicopter and the crew of Apollo 13. The floor of the Mission Operations Control Room now crowded and there are visible smiles on the faces of the flight controllers and astronauts in this room.
RECOVERY - Recovery. Apollo 13 is descending to 2000 feet.
IWO JIMA Okay, (garbled) concur.
RECOVERY Roger, out.
PAO A report from the Iwo Jima that Apollo 13 is descending at a point 4 miles due south of the ship.
IWO JIMA Apollo 13 and Recovery passing through 1000 feet.
IWO JIMA Iwo Jima Roger.
RECOVERY At 500 feet.
RECOVERY Swim 1 on station.
IWO JIMA On station.
RECOVERY Photo 1 on station. Photo 1 observes splashdown at this time.
IWO JIMA (garbled)
RECOVERY Roger.
PAO Another cheer in the control room as we had splashdown.
RECOVERY Photo 1 splashdown at this time. The first chutes are in place, they are in the water -

END OF TAPE

RECOVERY 1 (GARBLE) 3-1/2 miles Iwo Jima.

(SPEAKER) Iwo Jima, Roger.

RECOVERY 1 This 401 the Command Module is stable 1 at this time. They are riding comfortably.

RECOVERY Recovery (GARBLE) main chutes.

PAO The spacecraft splashed in Stable 1. That's with the apex cover up, out of the water.

RECOVERY 1 The vertical axis are approximately 15 degrees.

RECOVERY Recovery is maneuvering to grab hold of the main chute the 2 itger chutes are still visible in the water. Siwn 1, you are clear to move up to position to retrieve the other chutes swin 1 this is photo 1, I observe the flashing light on top of the Command Module.

RECOVERY 1 on 270.

RECOVERY 1 Warm present (GARBLE) Winds in the area from 270 magnetic to approximately 6 knots.

PAO Recovery 1 will be the - will perform the pickup of the crew.

RECOVERY recovery beacon antenna Atop the command Module.

RECOVERY This is photo 1 The Mylar covering above the exterior of the Command Module has been removed in the area opposite the crew exit hatch.

ARIA ARIA, our recovery has been one of the main chutes (GARBLE) has deployed a raft, just opened. (GARBLE) (GARBLE)

RECOVERY 1 (GARBLE) in the Command Module there's swells 3 to 5 feet from the vehicle. Sea is approximately 1 to 2 feet.

IWO JIMA Photo, this is Iwo Jima. Interrogative astronaut condition ordered.

RECOVERY 41, Roger. Brings Apollo 13 a power condition, okay. Over.

RECOVERY 1 (GARBLE)

CAPCOM Roger. Copy, Iwo Jima.

IWO JIMA Iwo Jima, copy.

Iwo Jima This is for a (GARBLE) conditions in a recovery area, approximately 6/10, cloud cover, carbonation high sirius and low stratos.

RECOVERY 4 Iwo Jima, this is recovery. I am assuming Odessey commander just fine, unless otherwise directed commence a retrieval operation in one minute. Over.

IWO JIMA This is Iwo Jima, Roger.

RECOVERY 1 Continue retrieval of that magnitude 12 to 2. You're clear, got you ready for mission. Recovery is taking backup for the gentlemen.

RECOVERY 1 This is photo 1 presently unable to see the third main chute. But Swim 1 is grapling the second main chute.

(SPEAKER (GARBLE)
CAPCOM Okay, Jack you got 13's drift.
RECOVERY The Command Module is very slight at this time in the direction of and a 1 to 10 magnetic.
RECOVERY Presently Swim 1 is still attempting to make connection with the second main chute. Swin 4 unable to grab it at (GARBLE) before we could graple.
RECOVERY This is recovery, roger, understand.
SWIM 1 Swim 1 stand by for a hit.
SWIM 1 Swim 1, Over. (GARBLE) Over.
SWIM 1 Roger, swim 1 should (garble) so speeds to the apex cover and the (garble)
RECOVERY Swim 2, this is recovery. You're clear - to deploy a swimmer - -

END OF TAPE

RECOVERY 1 This is photo L, observe the uprighting bags are partially inflated at this time.

PAO We copied the report and see it visually; the uprighting bags inflated.

PHOTO 1 This is PHOTO 1 estimates uprighting bags are approximately 1/3 inflated. I can see partial inflation on all 3 uprighting bags.

RECOVERY 1 Apollo 13, This is RECOVERY SC

RECOVERY 1 Roger 13, this is RECOVERY will you confirm a successful RCS dump; over.

SC That's affirmative; we had a successful dump.

RECOVERY 1 We (garble)

PHOTO 1 This is PHOTO 1; the first swimmer has been deployed. The signals are thumbs up in the water; in good condition.

PHOTO 1 He is making his way to the Command Module. Inflation of the uprighting bags estimated to be 40 percent. 40 percent. The first swimmer is at the Command Module. They will commence to anchor an attachment shortly.

RECOVERY 1 Apollo 13, this is RECOVERY; over.

SC Go ahead RECOVERY; 13 here.

RECOVERY Roger; this RECOVERY; do you have lap to go on (garble) formula?

SC No sir; we closed the display, and were helping Houston copy it; we didn't let it out over the air.

RECOVERY (garble) Roger out.

SC Will you give us our distance to the ship?

RECOVERY It appears from RECOVERY your present distance from the ship 1 mile - 3002; you're splash down point 3. - 3 miles from the Iwo Jima.

SC Thank you.

PHOTO This is PHOTO 1; the sea anchor has been attached, and have done (garble) observed a thumps up from the swimmers.

RECOVERY Swin 2, This is RECOVERY. You are clear to deploy two swimmers and the flotation collar; over.

PHOTO Roger; roger.

PAO The sea anchor attached to a pad eye on the side of the Apollo 13 command module.

RECOVERY We're getting Thumbs up. Everything progressing satisfactorily.

PAO This done to slow down the drift.

RECOVERY Has oriented the command module in the customary manner. SWIM 2 is moving in; to deploy the flotation collar and two additional swimmers. SWIM 1 has deployed a smoke in the area, and is attempting to restrain the accessories. SWIM 1 has deployed a swimmer in the water. SWIM 2 has deployed 2 swimmers I see a theumbs up, and the flotation collar is deployed.

RECOVERY The uprighting bags are inflated approximately 90 percent at this time. The swimmers are working the flotation collar in, to the command module. The flotation collar is at the command module; the front seat is being extracted, and it is being pulled around the command module.

PAO The flotation collar will be pulled around the command module with a bungee cord.

RECOVERY One section of the bungee is being attached to the sea anchor attachment ring; it appears to be satisfactorily connected; the second section of the bungee is approximately 90 percent around the command module.

PAO The flotation collar will be hooked to a bungee line, by a line with rings on the flotation collar, and will be pulled around before it is inflated.

RECOVERY inflation collar has commenced. It is approximately 20 percent around the command module. The flotation collar is approximately 60 percent deployed around the command module -

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RECOVERY 1 (garble)

RECOVERY 1 There is no apparent drift of the command module at this time.

PAO And after the colar is secured the two 7-man life rafts will be dropped with sea anchors attached to the bottom. This is done to keep the rafts from turning over from helicopter backwash.

RECOVERY 1 We are standing by for inflation.

CAPCOM (garble) to Iwo Jima. Request your pass to Apollo. Turn off recovery beacon. Over.

CAPCOM Roger, Break Apollo 13 do you copy?

SC Roger, (garble) will turn off.

CAPCOM Roger.

RECOVERY Inflation of the flotation colar presently normal. Standing by for inflation. Our (garble) flotation taking place at this time. Recovery is 60 percent complete. Flotation of - inflation of the flotation colar appears complete at this time. Apollo 13 appears to be riding a little more comfortably at this time. The axis is negligible. The swimmer is installing Securing straps. This has (garble) to the power bolt on the upper deck. Efforts are made and he gives the signal for deployment of the egress raft.

RECOVERY 1 (garble) this is recovery. You are clear to deploy the egress raft (garble) backup position. Recovery goes to ready position.

????? Ready, roger.

RECOVERY (garble) One further adjustment is being made for the securing straps.

?????? (garble) is normal.

RECOVERY Swimmer 2 has commenced his maneuvering for deploy of the egress raft. Swimmer 2 is in position. The crewmen are standing by at the hatch. The egress raft is in the water now approximately 10 feet from the command module. Two swimmers have the raft (garble) and are swimming it to the command module. The raft is at the command module. The swimmers are opening it.

PAO The next step in our sequence is to open the hatch.

RECOVERY The inflation appears to be satisfactory. The swimmers are working to secure the egress raft to the flotation colar. We presently have three swimmers in the water and I affirm the signal. assembly here.

RECOVERY The Recovery is making approach to the deploy from the (garble).

RECOVER Swim leaddr is in the water, comes up. Good condition. Stand by.

RECOVERY Swim leader approaching the command module. At this time, the inflation of the platform of the egress raft has been completed and is satisfactory.

RECOVERY The situation static at this time presently has two swimmers in the egress raft, and two swimmers standing by in the water. The swim leader is standing on the flotation colar checking the interior of the command module.

?????? (garble) go ahead for (garble)

RECOVERY A swim rider is standing on the flotation colar apearing in the forward viewing windows.

RECOVERY Recovery is trying to approach to deploy the astronauts' flotation equipment. Recovery is moving into position; the rescue net is halfway down. Recovery is maneuvering to place the rescue net in the egress raft. A swim leader, has the rescue net in hand and it is in the egress raft. The equipment is being removed (garble). Now the rescue net is on its way back. The swim leader is at the crew access hatch. He appears to be getting ready to open the access hatch. He is checking into the forward viewing window.

END OF TAPE

RELAY Hatch is open The equipment is being passed to the astronauts. The hatch is closed again. (garble) Copy all. Situation static at this time. The swimmers are standing by in safety position in two the water. The two swimmers have the egress raft.

TRACKING SHIP Roger, sir. We copy and their picking it up (garble)

PAO The 3 Apollo 13 crewmembers will be hoisted up into the recovery 1 helicopter by the Billie Pugh net, the device you see that looks much like a half birdcage. For the first time, there are stifters in this net, the Billie Pugh net has been used on previous recoveries. These made out of aluminum to provide ridgity to the net. The 3 Apollo crew-members will exit the spacecraft into the egress raft. The Billie Pugh net, by the way, has a center of gravity, which is forward of the center line toward the open end to assure that

RELAY The situation is nominal at this time. Standing by while the astronauts make their preparations in-side the command module.

PAO This forward center of gravity is designed to assure that an individual being picked up would not tumble out.

RELAY The swim leader is opening the crew access hatch. It is completely open. The first astronaut is climbing out of the command module, and is in the egress raft. The second is now lon his way out, assisted by swin leaders.

IWO JIMA And you want that on all the third astronauts on the Iwo Jima raft third astronaut is standing on flotation colar egress raft (garble)

RELAY Swim leader is making his final check prior to closing the ascess hatch. The hatch is closed. He is securing it with the hatch (garble) We have three swimmers in the safety position in the water. Swin leader is giving the signal for the rescue net. Recovery is manuevering for position to receive the astronauts. The rescue net is half way down, the rescue net is in hand resting on the platform. The first astronaut is climbing aboard, the signal is given, ready for lift. The first astronaut is on his way up, next one (garble) wait, the first astronaut is half way up, the first astronaut is at the (garble) hatch and is safely aboard the helicopter.

HELICOPTER 1 Recovery I have Astronaut Haise aboard and his condition is excellent. Iow Jima copy. Recovery is in position for second retrieval. Rescue net is being positioned in the egress raft. The rescue net is in the raft. It's positioned on the platform. The second astronaut is climbing aboard. The signal is given for arise. He is on his way up. The second astronaut is half way up. Half point pickup, no oscillation. The rescue net is at the cargo hatch, and the second astronaut is safely aboard.

RECOVERY This is Recovery. I have astronaut Swigert onboard. He reports he feels fine.

IWO JIMA Iwo Jima, copy.

RELAY Recovery is manuevering for position. For the third retrival swin leader has the srescue net. It is positioned aboard the platform. The third astronaut is climbing aboard, it is thumbs up, ready to lift. The third astronaut is on his way up. The third astronaut is half way up. The third astronaut is nearing the cargo hatch. He is safely aboard.

RECOVERY This is recovery. I have Capt. Lovell aboard. He reports he feels fine. Over.

IWO JIMA Iwo Jima, Copy. (garble)

END OF TAPE

RECOVERY (garbled) starboard (garbled)
RECOVERY (garbled) this is Recovery. You are clear to deploy your (garbled) one.
RECOVERY Roger, roger.
IWO JIMA Recovery and Photo, this is Iwo Jima towers. Report your gear and you have charlie on spots 3 and 5. YOur wind is 10 starboard and at 10 knots.
RECOVERY This is Recovery. Roger. Copied. Be advised I'll make a wide circle in order to allow the passengers to get into their flight suits.
IWO JIMA Roger Recovery.
??? (garbled) FAO.
??? Hey, I'd like to update this (garble)
RECOVERY Iwo tower, this is (garbled) We - this is Recovery. We estimate we'll be ready to touch down in 4 minutes, 4 minutes away.
IWO JIMA Recovery, tower. R oger.
IWO JIMA Recovery, this is Iwo Jima tower. Pass to Captain Lovell that we will have a brief ceremony on the flight deck then they will be talking to their wives (garbled) in sick bay. Over.
RECOVERY Iwo Tower, Recovery, roger will do.
PAO Here is the Mission Control Center the tempo of conversation has picked up considerably. That's one thing you normally do not hear, is loud voices but they are certainly loud and happy voices at this point.
RECOVERY (Garbled) Apollo 13.
IWO JIMA Roger, you're at (garbled) Charlie at 3 by (garbled) to Recovery to 11.
RECOVERY Recovery, roger out.
??? (Garbled) photo wants to (garbled)
IWO JIMA Iwo tower, roger, your charlie (garbled) your (garbled)
PAO As we look around the room we see a large representation of the astronaut corps. Donald K. Slayton of course is here. He's been here all night. Alan Sheppard, commander for Apollo 14, and Joe Engle is here, Tom Stafford, chief of the astronaut office, Vance Brandt, who served as a support crew member for Apollo 13.
IWO JIMA Which swim aircraft remains out?
RECOVERY This is Recovery. Negative (garbled)
IWO JIMA Roger, Swim 1, we're moving in. You babies ready?
??? (garbled)
PAO Gene Cernan, backup commander for Apollo 14 is here, Tony England, who served as the scientist for the Apollo 13 crew is in the room at this time as is John Young.
IWO JIMA (garbled) Rescue 1.
??? to give you a hearty "well done".

IWO JIMA (garbled) 13.
RECOVERY Roger out.
??? (garbled)
PAO The applause you just heard in the Mission Control Center came from a message delivered by Administrator Thomas Paine over the flight director's loop congratulating - from the President of the United States congratulating the team of Apollo 13.
??? (garbled)
??? (garbled) net 1. Over.
IWO JIMA I want to commend you on your navigation. Welcome onboard the Iwo Jima.
IWO JIMA I would like to ask the chaplain to say a real brief prayer of thanks.
CHAPLAIN Let us pray. Oh Lord, we joyfully welcome back to earth astronauts Lovell, Haise, and Swigert. who by your grace, their skill -

END OF TAPE

SHIP Haise and Sweigert, who, by your grace, their skill, and the skill of many men survived the dangers encountered in their mission and returned to Earth, safe and whole. We offer our humble thanksgiving for the successful recovery. Amen.

PHOTO Now for some additional picture taking. Might not only be professional phographers aboard but also a good many -

SPEAKER (GARBLE)

SPEAKER Down into the sick bay, medical facility now for 3 hours, of physical examinations. Now they're on the elevator there now. Joking about those beards. Jim Lovell seemed to be having some fun there with his beard. A momentary wait on the elevator here while the photographers get a few more pictures. This is an elaborate medical facility the Iwo Jima has onboard. And, as we said, there will be nine doctors down there awaiting Jim Lovell, John Swigert and Fred Haise. That's 3 doctors to an astronaut. And the first two flip samples, the findings medically speaking will be flown off as soon as possible, to the laboratories. I've been getting a look from the hangar deck of the elevator, whose down from top side. the elevator they use of course to transport the helicopters from hangar deck to flight deck. Once they get down they'll have a fairly shot walk, maybe 30 or 40 yards over into the - an opening leading up the medical facility. Sick bay, which may be a misnomer in this case. It does not appear anybody is sick. That's Captain Kerkemo - I know that is. And of course there will be some fast telephone calls we assume to some waiting wives at home. I wouldn't be surprised to see those phones ringing very shortly. There they go. Into the entrance of the medical facility and that should be all we see of them now for the next 3 hours or so -

end of tape

IWO JIMA - 2 hours or so, and possibly get an early medical report on what their conditions indeed are. But - the Apollo 13 men home safely aboard the Iwo Jima out here; a perfect recovery; it couldn't have been better - it couldn't -

PAO This is Apollo Control, Houston, at the Mission Operations Control Room; there must be almost 200 people at this point and it appears as though everybody is talking, shaking hands, the cigars have been passed out -

IWO JIMA (garble) on display down here now. I have here with me right now Commander Spiuey. I'm prepared to put Commander Spiuey on the air as soon as he gets here in a couple of minutes. I would - we appreciate - (garble)

PAO The plack for Apollo 13 has just been placed on the wall in the Mission Control Room; that brought about this loud applause we just heard. (cheering and applause) This is Apollo Control, Houston; we expect to have 3 news conferences picking up shortly in the Bldg. 1 auditorium, the first starting in 30 minutes with NASA Administrator Thomas Paine and Dept. Administrator George Lowe, this will be followed approximately 30 minutes later involving Dale Myers, Associate Administrator for Manned Spaceflight, and Dr. Gilruth, Robert Gilruth, Director of the Manned Spacecraft Center, Mr. Roco Patrone, Apollo Program Director, Jim McDivitt, Manager of the Apollo Spacecraft Program Office at the Manned Spacecraft Center in Houston, and Mr. Chris Kraft, Deputy Director at MSC. Following that will be a third news conference with Mission Director Chet Lee, Director of Flight Operations, Sig Sjobert, and Lead Flight Director for this mission, Milt Windier, and Mr. Ozzie Covington, of the Goddard Spaceflight Center. We copied splashdown at 142 hours, 54 minutes, 44 seconds from liftoff, and this is Apollo Control, Houston, signing off at this time.

END OF TAPE