STDN No. 601/AS-512

NETWORK OPERATIONS SUPPORT PLAN

for the

AS-512 MISSION

Volume 1

September 1972

This NOSP is effective upon receipt.

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Volume one of the Network Operations Support Plan for the AS-512 Mission was prepared by the Goddard Space Flight Center for use during the Apollo 17 mission. The original document was provided by Richard Stachurski. Richard is a retired U.S. Air Force colonel whose career was spent in aeronautic and astronautic development programs. His military service included six years on loan to NASA with the Apollo lunar landing program. He participated as a Network Controller in the Apollo 5 mission, and the Apollo 9-14 missions. He received his copy of the Apollo 17 NOSP from his friend and co-worker David Young as a pre-departure gift just prior to his leaving the Manned Spacecraft Center.

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DCN CONTROL SHEET

Use this control sheet to record the DCN changes to this document.

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SECTION 1. MISSION OPERATIONS

1.1 MISSION DESCRIPTION

1.1.1 GENERAL

The AS-512 (Apollo 17) mission will perform the sixth manned lunar landing and will involve the use of the Command and Service Module (CSM-114), the Lunar Module (LM-12), and the Lunar Rover Vehicle (LRV-3). The mission will last approximately 12 days and will include a lunar stay of up to 75 hours.

1.1.2 LAUNCH THROUGH TRANSLUNAR INJECTION

1.1.2.1 The AS-512 space vehicle will be launched from Pad A of Launch Complex 39 at the Kennedy Space Center. The boost into a 90-nmi Earth Parking Orbit (EPO) will be accomplished by sequential burns and staging of the S-IC and S-II launch vehicle stages, and by a partial burn of the S-IVB stage. The S-IVB/IU and spacecraft will coast in a circular EPO for approximately two revolutions while preparing for the first opportunity S-IVB Translunar Injection (TLI) burn, or for three revolutions if a second opportunity TLI burn is required. Both injection opportunities will occur over the Atlantic.

1.1.2.2 The translunar trajectory will be targeted at TLI so that the following can be achieved:

a. Transearth return to an acceptable entry corridor without the use of the Service Propulsion System (SPS) or LM propulsion during at least the first 5 hours after TLI cutoff.

b. Earth return using the SPS or LM Descent Propulsion System (DPS) until at least pericynthion plus 2 hours, if Lunar Orbit Insertion (LOI) is not performed.

1.1.3 TRANSLUNAR COAST THROUGH LUNAR ORBIT INSERTION

1.1.3.1 Within 2 hours after TLI, the CSM will be separated from the S-IVB/IU and the Spacecraft-LM Adapter (SLA). The CSM will then transpose, dock with the LM, and eject the LM/CSM from the S-IVB/IU. The S-IVB/IU will perform an evasive LM maneuver to alter its circumlunar coast trajectory to one which is clear of the spacecraft trajectory.

1.1.3.2 The spent S-IVB/IU will be impacted on the lunar surface at 7 degrees south, 8 degrees west, in order to provide a stimulus for the experiments deployed on prior missions. The Delta Velocity (ΔV) required to alter the S-IVB circumlunar trajectory to the desired impact trajectory will be achieved by the dumping of residual Liquid Oxygen (LOX) and burns of the S-IVB/Ascent Propulsion System (APS) and ullage motors. The final maneuver will occur within $10\frac{1}{2}$ hours after liftoff. The S-IVB/IU will have an S-band transponder for trajectory tracking.

1.1.3.3 Spacecraft passive thermal control will be initiated after the first Midcourse Correction (MCC) opportunity, and will be maintained throughout the Translunar Coast (TLC) phase unless interrupted by subsequent MCC's or navigational activities. The Scientific Instrument Module (SIM) bay door will be jettisoned $4\frac{1}{2}$ hours prior to LOI. Multiple operation covers over the SIM bay instruments (see figure 1-1) will provide thermal and contamination protection when the experiments are not in use.

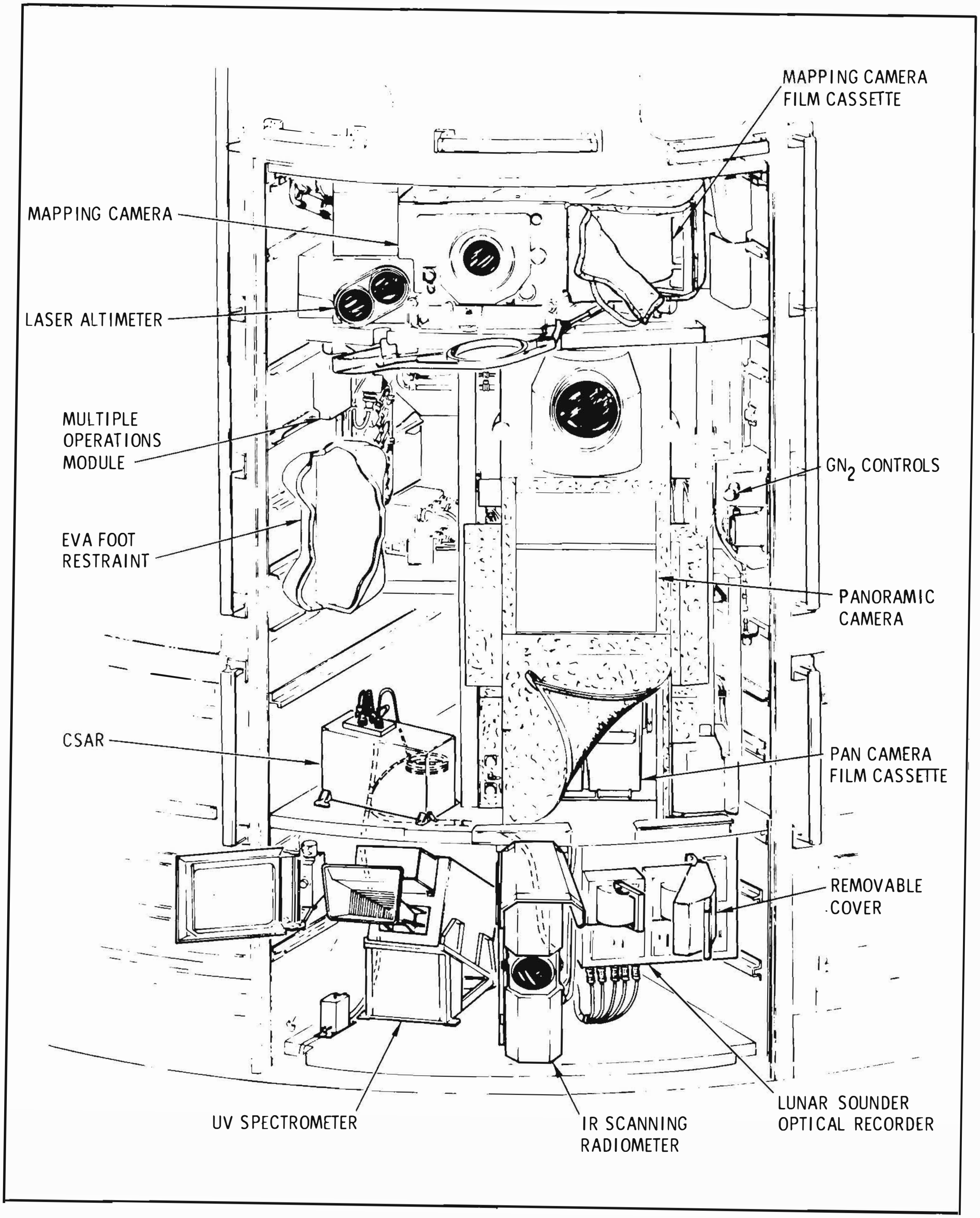


Figure 1-1. SIM Bay Description

1.1.3.4 A retrograde SPS burn will be used for the LOI of the docked spacecraft into an approximate 60-by-170 nmi orbit, where it will remain for approximately two revolutions. The first Descent Orbit Insertion (DOI) maneuver (a second SPS retrograde burn at the end of lunar revolution two) will place the CSM/LM combination into an approximate 14-by-61 nmi orbit.

1.1.4 UNDOCKING THROUGH LM LANDING

A "soft" undocking will be accomplished during the 12th lunar revolution using the docking probe capture latches to reduce the imparted ΔV. Spacecraft separation will be executed by the Service Module (SM) (see figure 1-2) Reaction Control System (RCS). Following separation, the CSM will circularize its orbit to about 61 nmi during the 12th revolution. After the CSM circularization maneuver, the LM RCS will be used to lower the pericynthion (DOI-2) to 40,000 feet, about 10 degrees west of the landing site. During the 13th revolution, the LM DPS will be used for a powered descent, beginning approximately 28 degrees east of pericynthion. A terrain profile model will be available in the LM Guidance Computer (LGC) program to minimize unnecessary LM pitching or thrusting maneuvers. A LM yaw maneuver may be performed to ensure good LM steerable antenna communciations coverage with the Spaceflight Tracking and Data Network (STDN). In order to enhance landing site visibility, a descent path of 25 degrees will be used from high gate to an altitude of about 200 feet or until crew manual takeover.

1.1.5 LUNAR SURFACE OPERATIONS

1.1.5.1 General. The nominal stay time on the lunar surface is planned for a maximum of 75 hours. The overall objective is to optimize effective surface science time relative to hardware margins, crew duty cycles, and other operational constraints. Three Extravehicular Activity (EVA) periods are planned, each lasting up to 7 hours. The Lunar Communications Relay Unity (LCRU) and the Ground Commanded Television Assembly (GCTA) will be used in conjunction with LRV (see figure 1-3) operations. Television coverage will provided by the GCTA during each specified science stop when the LRV is in use. (See figure 1-4 for lunar communications without the LCRU activiated.)

1.1.5.2 Surface Activities. The first EVA will include LM inspection, LRV deployment and checkout, and deployment and activation of the Apollo Lunar Surface Experiments Package (ALSEP). A geology traverse will be performed after ALSEP activation. Lunar samples collected will be verbally and photographically documented. If possible, television will be deployed on the LRV in this period for observation of crew activities near the LM. Experiment activities other than ALSEP include the deployment and activiation of the surface electrical properties transmitter at least 70 meters east of the LM, deployment of some of the seismic profiling charges, traverse gravimeter readings, measurement of surface electric properites, and emplacement of the lunar neutron probe. Following the third EVA, the LRV will be positioned to allow GCTA-monitored LM ascent and other TV observations of scientific interest. Figure 1-5 shows the currently planned traverses at the Taurus-Littrow Landing Site. Figure 1-6 shows the total CSM/LM/STDN EVA communications capability rather than the specific configuration mode to be used.

1.1.6 LM ASCENT TO TRANSEARTH INJECTION

1.1.6.1 General. After completion of the lunar surface activities and ascent preparations, the LM APS and LM RCS will be used for launch and rendezvous with the CSM. Prior to LM liftoff, the CSM will complete a plane change in order to permit a nominally coplanar rendezvous.

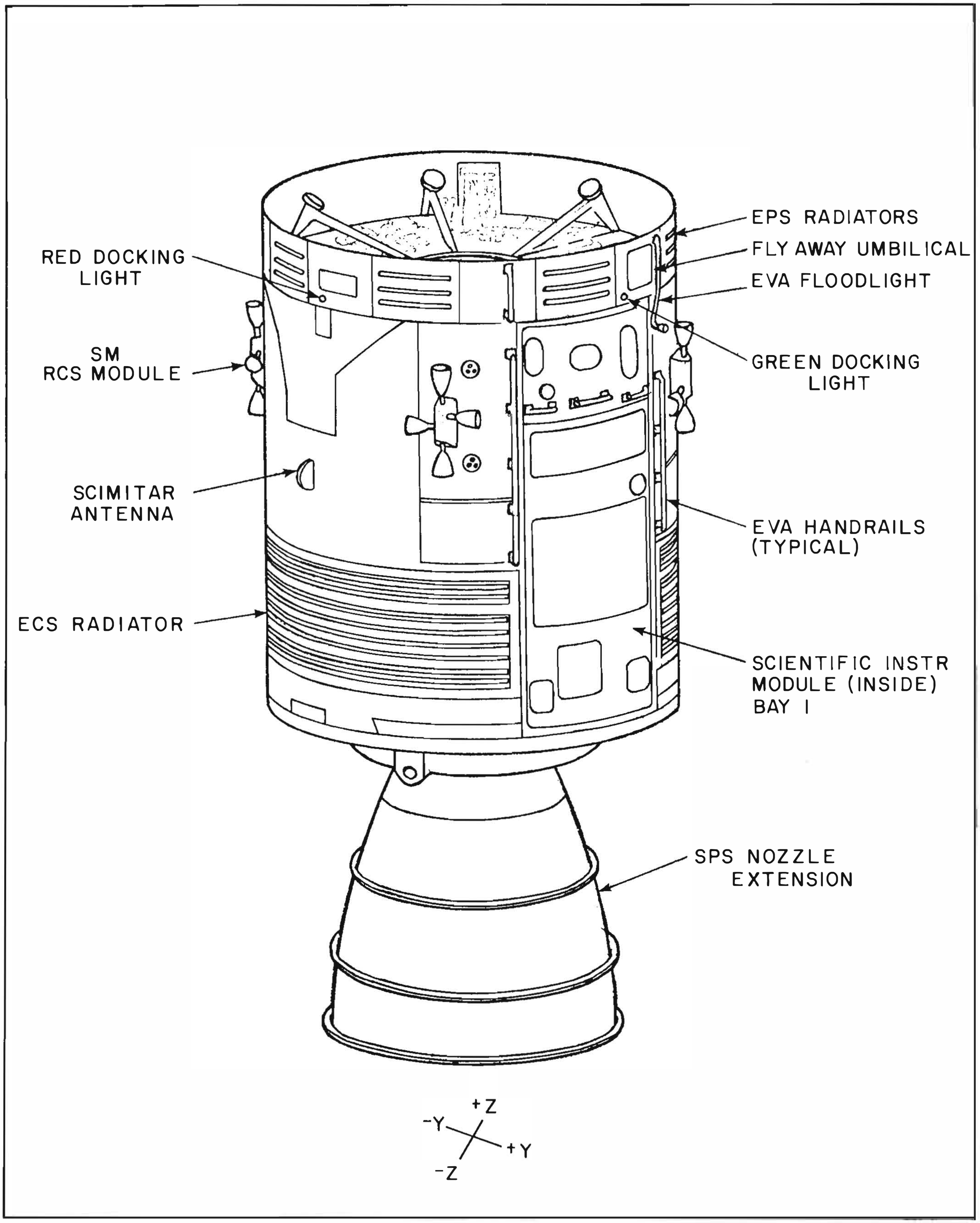


Figure 1-2. SM Description

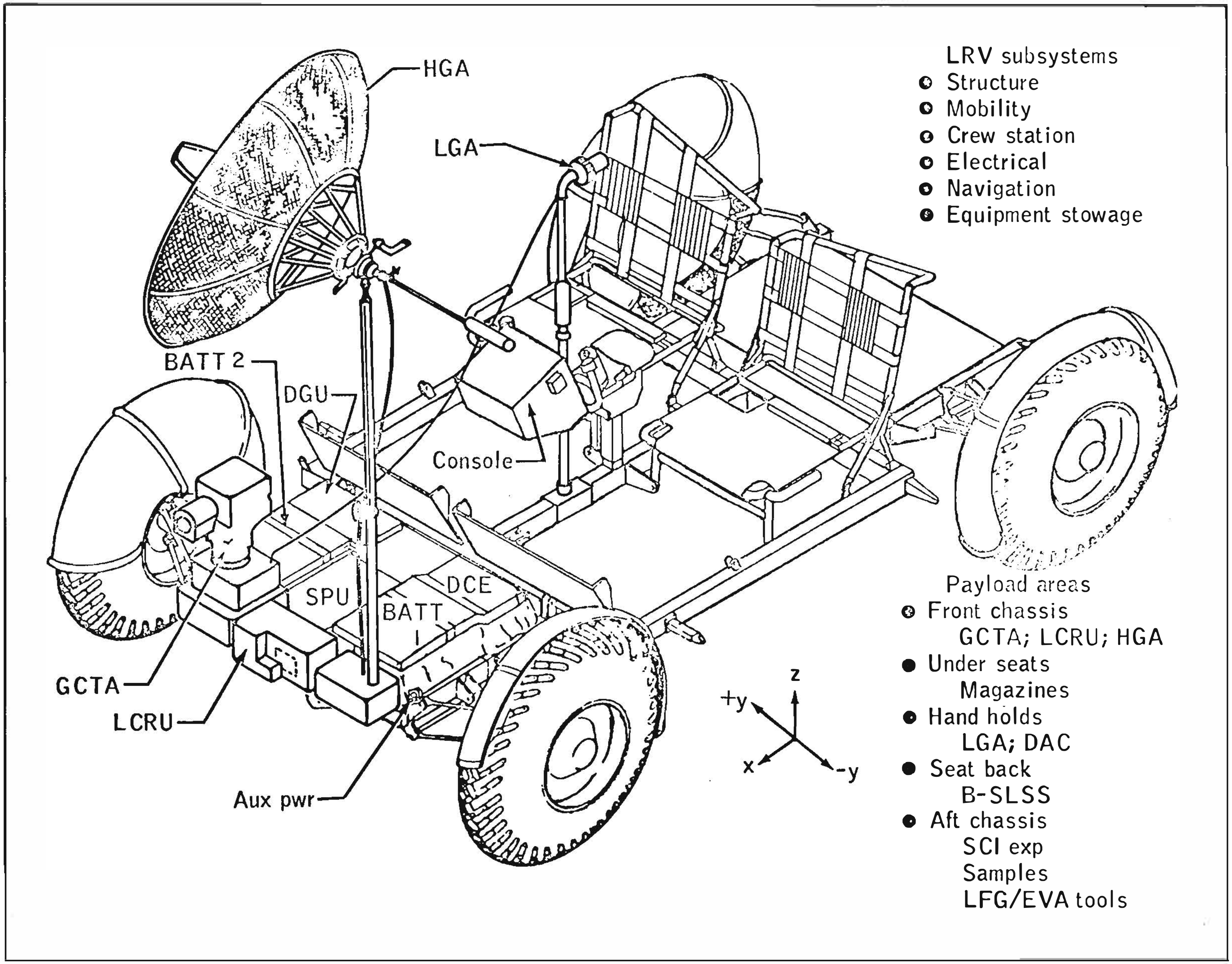


Figure 1-3. LRV Components and Dimensions Showing LCRU and GCTA

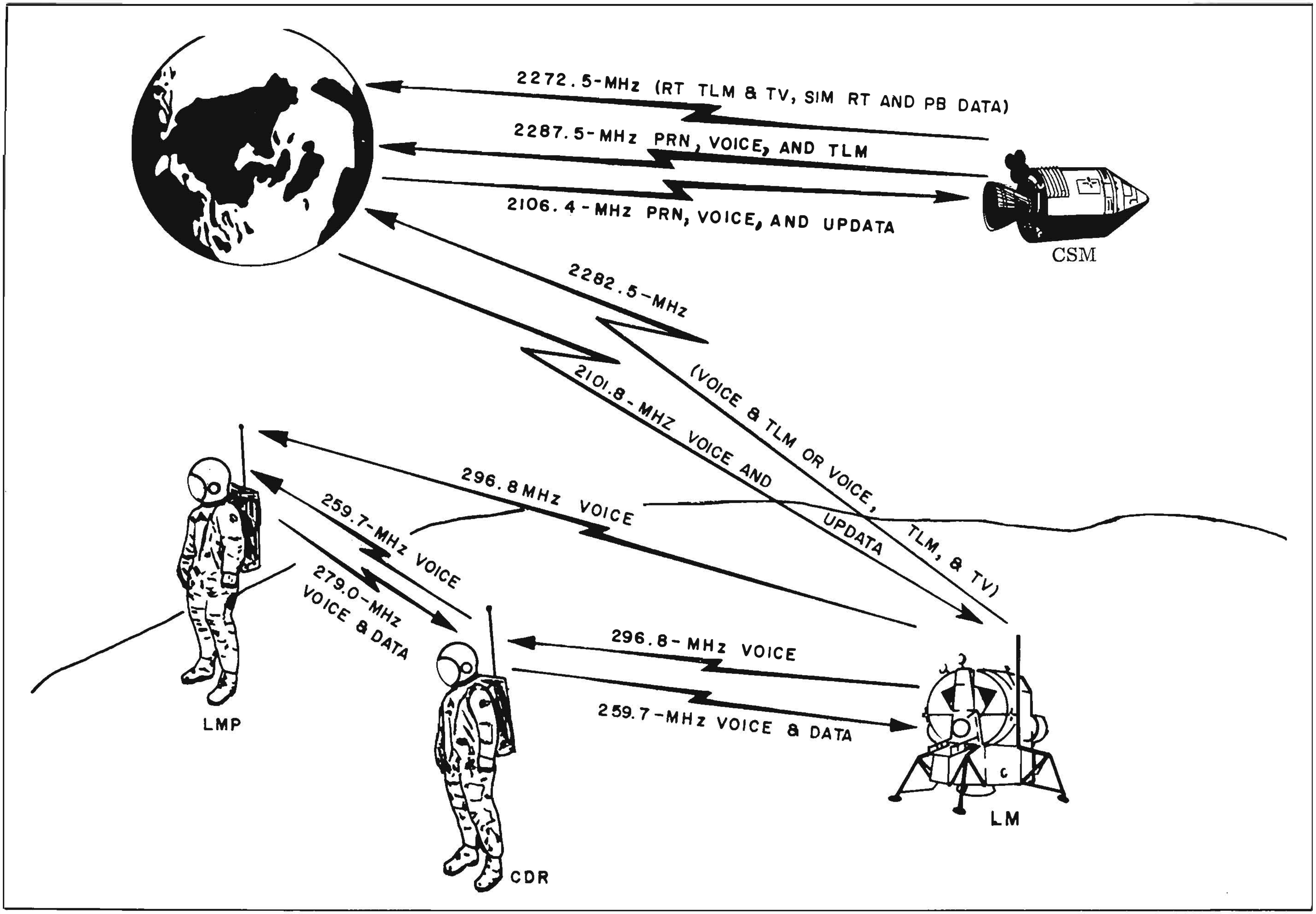


Figure 1-4. Communications During Lunar Surface Operations Without LCRU Activated

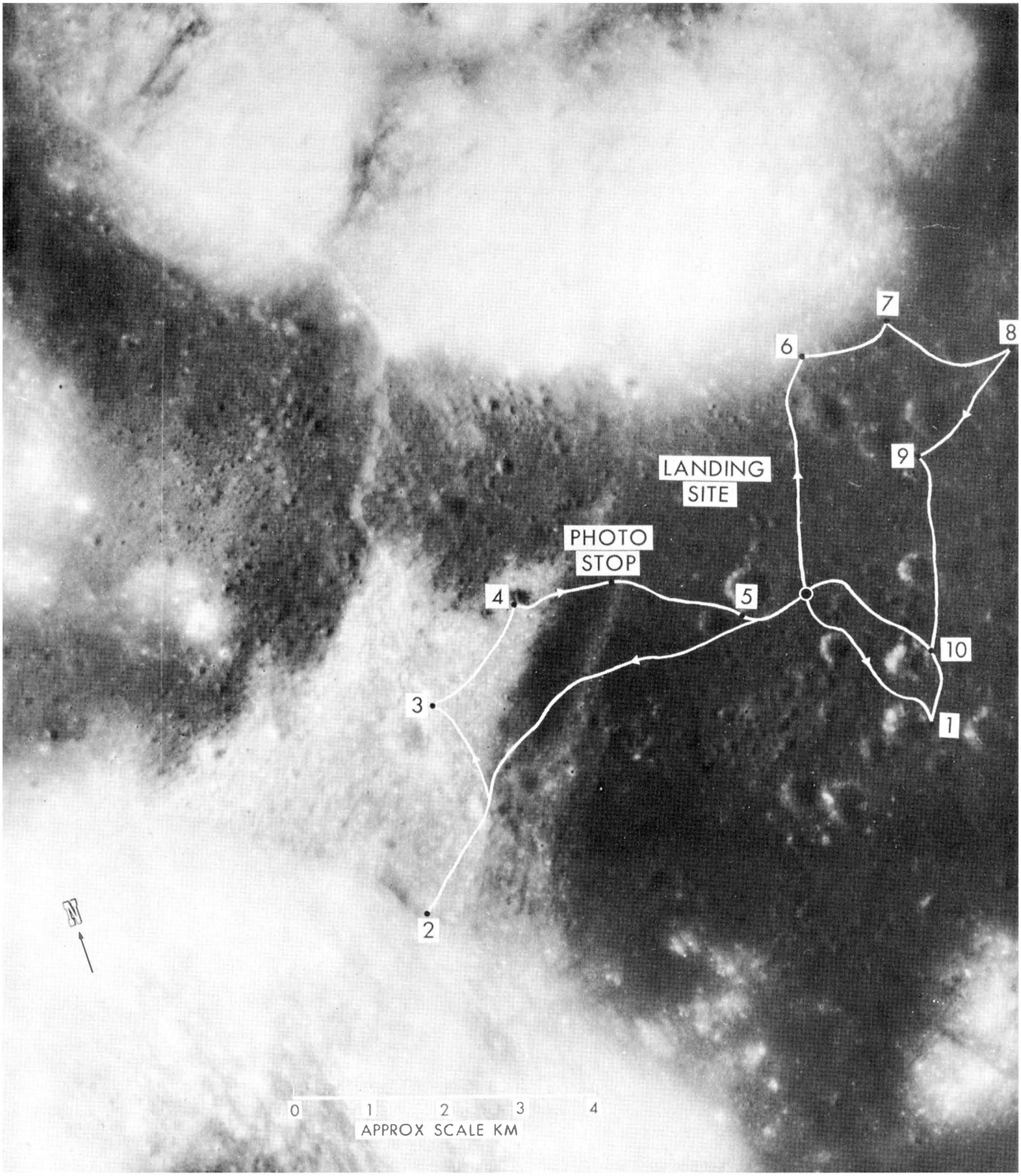


Figure 1-5. Taurus-Littrow LRV Traverses

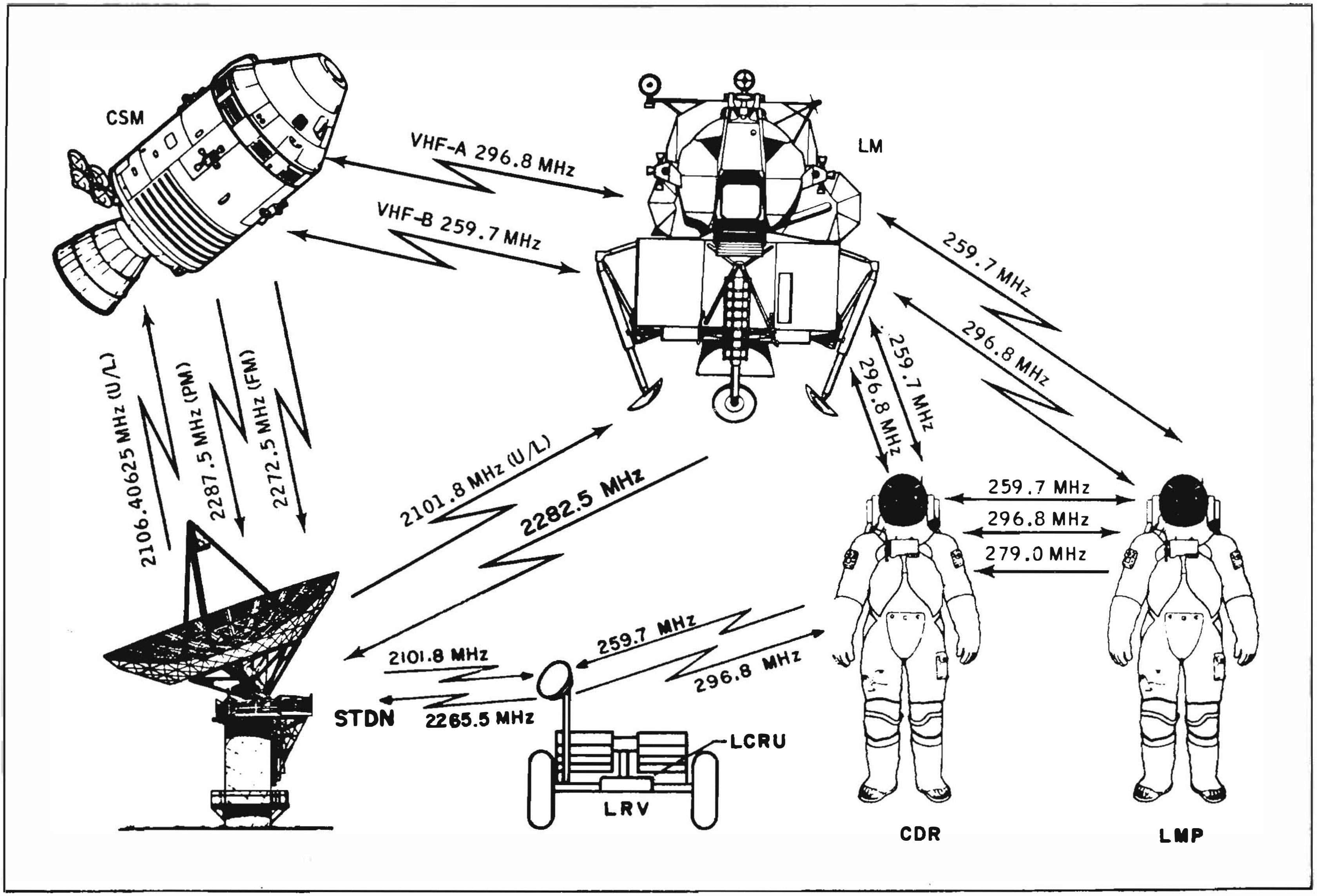


Figure 1-6. CSM/LM/STDN /EVA/LCRU Communications with LCRU Activated

1.1.6.2 Rendezvous Procedures. A direct rendezvous technique will be used. The liftoff window duration is about 30 seconds and is constrained to keep the perilune above 8 nmi. The LM will be inserted into a 48-by-9 nmi orbit such that an APS Terminal Phase Initiation (TPI) burn will be performed approximately 38 minutes after insertion. Terminal Phase Finalization (TPF) will occur about 130 degrees (45 minutes) later. Total time from insertion to rendezvous will be about 85 to 90 minutes. If it is determined in real time that additional rendezvous time is required, the coelliptic rendezvous will be flown by delaying the liftoff time or by performing a preplanned bailout maneuver subsequent to LM insertion.

1.1.6.3 Docking and LM Jettison. The final docking maneuvers will be performed by the CSM using SM RCS. After docking, the LM crewmen will transfer to the CSM with lunar sample material, exposed film, and designated equipment. The LM ascent stage will be jettisoned and subsequently deorbited to impact on the lunar surface at 19.9 degrees north, 30.5 degrees east, in order to provide a known stimulus for the emplaced experiments. A period of orbital science activities will be conducted following LM jettison.

1.1.7 TRANSEARTH INJECTION TO RECOVERY

After completion of the post-rendezvous CSM orbital activities, the SPS will perform a posigrade burn to inject the CSM onto the transearth trajectory. The nominal return time will not exceed 110 hours and the return inclination will not exceed 70 degrees with relation to the earth's equator. During the transearth phase there will be continuous communications coverage from the time the spacecraft appears from behind the moon until shortly prior to entry. Midcourse corrections will be made if required. A 6-hour period, including pre- and post-EVA activities, is planned to perform an inflight EVA to retrieve film cassettes from the SIM bay in the SM. TV and photographic tasks will be conducted as scheduled in the flight plan. Selected CSM experiments may be conducted during transearth coast. The Command Module (CM) will separate from the SM 15 minutes before the entry interface. Splashdown will be in the mid-Pacific and will occur approximately 12.7 days after launch.

1.1.8 RECOVERY OPERATIONS

1.1.8.1 Splashdown will be at 18 degrees south, 166 degrees west. Following splashdown, the recovery helicopter will drop swimmers and life rafts near the CM. The swimmers will install the flotation collar on the CM, attach the life raft, and pass fresh flight suits to the flight crew.

1.1.8.2 Biological Isolation Garments (BIG's) will be available for use in case of unexplained crew illness. The crew will be transferred from the spacecraft to the recovery ship via life raft and helicopter and will be returned to the Manned Spacecraft Center. Flight crew debriefings will be conducted in accordance with the approved debriefing plan.

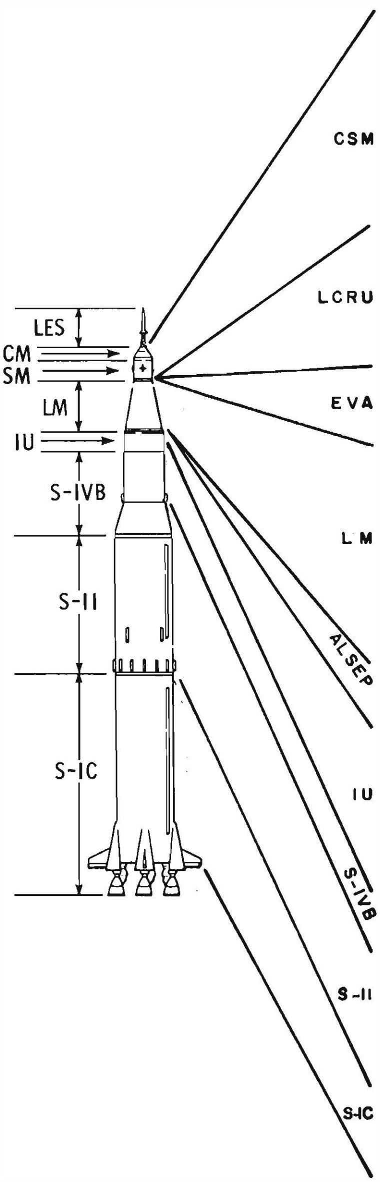
1.1.8.3 An attempt will be made to recover the earth landing system main parachutes. After flight crew pickup, the CM will be retrieved and placed on a dolly aboard the recovery ship. Lunar samples, film, flight logs, etc., will be retrieved for shipment to the Lunar Receiving Laboratory (LRL). The spacecraft will be off-loaded from the ship and transported to an area where deactivation of the propellant system will be accomplished. The CM will then be returned to contractor facilities.

1.1.9 FREQUENCY ASSIGNMENTS

See figure 1-7 for assigned frequencies during the AS-512 mission.

1.1.10 NETWORK CONFIGURATION

Table 1-1 shows the Network configuration and the support to be provided by each station.



Band	Capability (T/R)	Freq (MHz)	Track	TM	VC	Other
USB	R	2106.4	PRN (U)*		AG*, BU	Command
USB	T	2287.5	PRN (D)*	1-PM*	AG*, BU	Emergency key
USB	T	2272.5		FM, PB	AG, PB	Scientific data, TV, SIM
VHF	T/R	A-296.8			LM/CSM	VHF ranging
VHF	T/R	B-259.7		LM LBR (R)	LM/CSM	
VHF	T/R	243.0				VHF recovery beacon (T only), voice
X-band	T/R	9720.2/ 9832.8				LM RR transponder
USB	R	2101.8		PM	1-AG*	Command
USB	T	2265.5		PM or FM	AG*, BU	Biomed, EMU, TV
VHF	T	A-296.8			EVA2/EVA1/LM	
VHF	R	B-259.7			EVA2/EVA1	EMU data, biomed
VHF	T/R	A-296.8			EVA2/EVA1/LM	
VHF	T/R	B-259.7			EVA2/EVA1/LM	EMU data
VHF	T/R**	279.0			EVA2/EVA1	EMU data
USB	R	2101.8	PRN (U)*		1-AG*	Command
USB	T	2282.5	PRN (D)*	PM or FM	AG*, BU	Biomed, EMU, TV, key
VHF	T/R	A-296.8			LM/CSM	VHF ranging (T) LM/EVA VC
VHF	T/R	B-259.7		LM LBR (T)	LM/CSM	EMU data, VHF ranging (R)
X-band	T/R	9832.8/ 9792.0				Rendezvous radar
X-band	T/R	10510.0				Landing radar (velocity)
X-band	T/R	9580.0				Landing radar (altimeter)
USB	T	2275.5		PM		Experiment, housekeeping
USB	R	2119.0				Command
CCS	R	2101.8	PRN (U)			Command
CCS	T	DP-1B 2282.5	PRN (D)			
C-band	R	5690.0	Radar (U)*			
C-band	T	5765.0	Radar (D)*			
VHF	T	DF-1 250.7		FM		
VHF	T	DP-1 245.3		PCM*		
VHF	T	CP-1 258.5		PCM*		
UHF	R	450.0				Range safety receiver
VHF	T	BF-1 241.5		PAM		
VHF	T	BF-2 234.0		FM		
VHF	T	BP-1 248.6		PCM*		
UHF	R	450.0				Range safety receiver
VHF	T	AF-1 256.2		FM		
VHF	T	AP-1 244.3		PCM*		
UHF	R	450.0				Range safety receiver

*Prime operational mode   **EVA2 T only, EVA1 R only   VC = Voice
AG Air-to-ground   BU Backup   T = Transmit
PB Playback   R Receive

Figure 1-7. Instrumentation Configuration

Table 1-1. Network Configuration for AS-512

SYSTEMS / STATIONS	TRACKING		USB					TLM			DATA PROCESSING				COMM				OTHER		REMARKS
	C-band (High-speed)	C-band (Low-speed)	USB	TV to MCC	Voice	TLM	Command	VHF Links	Mag Tape Recording	Decoms	642B TLM	642B CMD	CDP	Acq Computer	High-speed Data	TTY	Voice (SCAMA)	Voice VHF A/G	Range Safety	SPAN	
ACN			X		X	X	X	X	X	X	X	X		X	X	X	X	X			
ANT	X	X																X	X		Note 3
ARIA(4)					X	X		X	X							X	X	X			Note 1
AOCC																X	X				
BDA	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X		
CNV	X	X																	X		Note 3
CRO	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X		X	
CYI			X		X	X	X	X	X	X	X	X		X	X	X	X	X		X	
GBI	X	X																	X		Note 3
GDS			X	X	X	X	X		X	X	X	X		X	X	X	X	X			
PIR			X		X	X	X							X							Note 2 & 5
GTK	X	X																	X		Note 3
GWM			X		X	X	X	X	X	X	X	X		X	X	X	X	X			
HAW			X		X	X	X	X	X	X	X	X		X	X	X	X	X			
HSK			X	X	X	X	X		X	X	X	X		X	X	X	X				
NBE			X		X	X	X							X							Note 2 & 5
MAD			X	X	X	X	X		X	X	X	X		X	X	X	X				
RID			X		X	X	X							X							Note 2 & 5
MARS				X	X	X															Note 2
MIL			X		X	X	X	X	X	X	X	X		X	X	X	X	X			
MLA	X	X																	X		Note 3
PARKES				X	X	X															Note 2
TEX			X		X	X	X	X	X	X	X	X		X	X	X	X	X			
VAN	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			Note 4
ETC			X		X	X	X		X	X	X	X				X	X				Note 6

Note

1. TLI and reentry
2. Post TLI coverage
3. High-speed C-band tracking data (launch phase only).
4. VAN TSP for AS-512 is ____________________.
5. Station designators refer to the STDN/DSN Integrated Stations, also referred to as wing stations in this document.
6. ETC special testing and S-IVB track; will not radiate except to the coll tower.

1.2 MISSION PREPARATION

1.2.1 MINUS DAY SCHEDULE

The minus day schedule will be supplied using the scheduling procedures in section 16 of this NOSP.

1.2.2 TERMINAL COUNT

Table 1-2 contains the Apollo terminal count for AS-512. Table 1-3 is an extract from the terminal count containing the CADFISS and Interface tests.

Table 1-2. Apollo Terminal Count

Note

1. Items marked by "L" in the Time column are referenced to predicted launch time and do not reflect built-in holds.

2. Unless otherwise indicated in a specific sequence, STDN interface testing will be coordinated on the Net specified below:

Coordination Net	Interface Test
Net 1	A-G remoting test
Net 2	HBR/LBR CADFISS/CISS interface test; MCC/STDN command interface tests; MCC/STDN boresight, collimation data flow test; SII FM/FM parameter ID and calibration sequence; FE600 checks; Biomed
Net 3	FE600 checks; Tracking CADFISS

3. The MCC/STDN command interface tests will be conducted as follows:

a. Station OPSR: confirm USB command carriers are up: System 1, CSM; System 2, LM/SLV; System 3, CSM; System 4, LM/SLV.

b. RTC: execute USB Status Request.

c. Load Control: execute Load Inventory.

d. CCATS Command execute: DCA Self Test, Terminate, CTE.

e. RTC execute (MIL only): Abort A and Abort B On.
Abort A and Abort B Off.

f. CCATS Command, Load Control: transfer Load 08XX.

g. Load Control execute: Load Inventory; Load Clear 08XX.
Load Inventory; CSM, LM, SLV
Type II Histories.

h. Load Control, Station OPSR: initiate EOF upon completion of histories.

i. RTC: advise Station OPSR, Network of test results. Network schedule reruns if required.

j. RTC (all except MIL): Request station OPSR to bring carrier down.

k. Upon completion of the command interface test, the OPSR will load all prelaunch loads and transmit a TTY inventory summary message to MCC.

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-61/00/00	MCC ComTech Comm Control MIL ComTech OPSR	1	Conduct MCC/STDN A-G Remoting Val Test 4043. Complete by T-59/00/00.		
T-51/00/00	MIL OPSR	2	Start SRT. Complete by T-45/30/00.		
L-72:00:00	MCC Voice FACS Comm Control KSC Comm Control CGIC	3	Astro Comm Checks. Complete by L-70:00:00.		
T-45/00/00	GSFC CADFISS TC MIL OPSR	4	F-2 day CADFISS. Complete by T-43/00/00.		
L-64:00:00	MCC Voice FACS Comm Control KSC Comm Control CGIC	5	Conduct MCC/KSC OIS Val Test 4041. Complete by L-61:30:00.		
T-34/00/00	MIL OPSR	6	On-station cals (S-band/VHF). Complete by T-28/00/00.		
T-33/00/00	MCC Track GSFC NOM	7	Send MCC 24-hour Tracking Requirements Message to NOM, if required.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-28/00/00	MCC Network	8	Send Countdown Status Message.		
	KSC ALDS	9	Start CASTS countdown transmission.		
L-37/00/00	GSFC Status	10	Transmit complete Site Status Report Message.		
T-26/45/00	MIL OPSR KSC Data Core		Begin data core/MIL A2A MUX checkout. Complete by T-25/30/00.		
	GSFC Voice NOM MIL OPSR	12	Goddard Voice establish Net 3 to MIL.		
T-25/15/00	GSFC CADFISS TC MIL OPSR	13	Send 29-point acq message to MIL.		
	MIL OPSR	14	F plus day SRT complete through phase III. Send SRT completion report message.		
	GSFC Comm Mgr MIL OPSR	15	Place MIL in network isolation.		
	GSFC Comm Mgr MIL OPSR	16	Start FE 600 line checks on Net 5. Complete by T-25/00/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-25/00/00	GSFC CADFISS TC NOM MIL OPSR	17	Start tracking data CADFISS. Complete by T-24/30/00.		
T-24/30/00	GSFC Comm Mgr MIL OPSR	18	Remove MIL from network isolation.		
T-24/00/00	GSFC NOM	19	Transmit network C-band tracking schedule.		
T-23/00/00	KSC ETMS MIL OPSR	20	ETMS begin LV VHF readouts. CIF antenna field provide MIL with VHF CRF information. CCS S-band is on until T-18/15/00.		
T-19/00/00	GSFC NOM ETR SRO MIL OPSR KSC ETMS	21	MIL, SRO collect LM, SLV CRF data and TWX to NOM. (LM CRF data collected during CDDT.) Complete by T-18/00/00.		
L-26/00/00	MCC Voice Recorder	22	Start Voice Rcdr Val 2A20, para 7,8,9, and 10 Complete by T-10/00/00.		
L-25/00/00	MCC Computer M&O Display	23	Start 360/75 diagnostics. Complete by by L-20/00/00. Start computer R/S Val Test 1A07. Complete by L-22/45/00.		
	MCC Bldg 48 Network	24	Begin critical power coverage. Provide system configuration status to Network.		
L-24/15/00	MCC Comm Control Voice GSFC Goddard Voice NOC M&O	25	Conference GOSS 9 to SCAMA 72 at GSFC and CASRS-CASTS Coord (GW 58246) at MCC. Complete by L-24/00/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-24/00/00	MCC	Network	26	Send Countdown Status Message		
	GSFC	Comm Mgr	27	Start WBD line alignment checks. Complete by L-12/00/00.		
	MCC GSFC KSC	Comm Control FACS Voice Display NOC M&O ALDS	28	Start CASTS/CASRS Interface Val Test 4042. Pad countdown will be restored at termination. At test termination NOC M&O take down GOSS 9 to SCAMA 72 patch. Complete by L-23/00/00. MCC Voice take down GOSS 9 from GW 58246.		
	MCC	Comm Control FACS GCC	29	Start TTY Equipment Val Test 2A30. Complete by L-16/00/00.		
	MCC	CCATS	30	Start U-494 diagnostics. Complete by L-20/00/00.		
	MCC	Voice	31	Start Voice Recorder Val Test 2A20. Complete by L-12/00/00.		
L-23/30/00	MCC	Display	32	Start Status Module Val Test 1A04. Complete by L-22/00/00.		
L-23/00/00	MCC	Houston TM Display	33	Begin Telemetry Local Biomed Val Test 3A20. Complete by L-21/00/00.		
	MCC	Comm Control FACS	34	Start HSP Val Test 2A35. Complete by L-20/00/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-23/00/00	GSFC NOM NOC M&O	35	M&O reports CASTS/CASRS status to NOM.		
L-22/05/00	MCC Display	36	Verify C-CIM HSP ready to support. Complete by L-21/50/00.		
L-21/00/00	MCC Display Houston TM	37	Start calibration of chart recorders. Complete by L-20/00/00.		
T-11/30/00	ETR Lemon One Alfa MIL OPSR	38	ETR/RTCS play range safety trajectory to MIL. MIL verify proper acq system response (FP-3).		
T-10/30/00	GSFC Goddard Voice MCC Comm Control MIL OPSR	39	Establish Net 2 conference to MIL, NOC, and MCC.		
T-10/30/00	MIL OPSR	40	MIL onstation cals. Space vehicle S-band and VHF. Complete by T-09/30/00.		
T-10/15/00	MCC ComTech MIL ComTech	41	Verify MIL A-G longline is configured for T-10/00/00 A-G remoting checks.		
	GSFC Goddard Voice MCC ComTech MIL ComTech	42	Goddard Voice bring up GOSS Conf to MIL Net 1 for T-10/00/00 A-G remoting checks.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-20/00/00	MCC	Display Houston TM	43	Start CCATS Open Loop ORACT Val Test 1B04. Complete by L-15/00/00.		
	MCC	Display	44	Start D/TV registration alignment. Complete by L-15/00/00.		
	MCC	Voice Recorder	45	Start Voice Rcdr Val 2A20, para 5 and 6. Complete by L-12/00/00.		
T-10/00/00	MCC	Voice Recorder	46	Sangamo recorders on for A-G voice checks.		
	MCC GSFC MIL	ComTech Goddard Voice ComTech	47	Start A-G remoting checks on Net 1 and MIL A-G longline. (Radiation required on 2106.4, 296.8, 259.7 MHz.) Complete by T-09/30/00.		
T-09/30/00	MCC MIL KSC	AFD Network ComTech ComTech MSTC	48	Perform USB and VHF Duplex B A-G voice checks with backup crew. Complete by T-09/05/00.		
	MCC	Voice Recorder	49	Stop Sangamo recorder at completion of A-G voice check.		
T-09/00/00	MCC	Network	50	Send Countdown Status Message.		
	MIL	OPSR	51	MIL transmit CSM Capsule RF Measurement Message to NOM. Complete by T-08/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✔	Remarks
T-09/00/00	All	All	52	Begin built-in hold (__hours, ___ minutes duration).		
L-18/50/00	MCC	Voice	53	Start P-Tube Val Test 2A90. Complete by L-14/30/00.		
L-18/30/00	MCC	Display	54	Start Hardcopy Operator Readout Val Test 1A32 Complete by L-14/30/00.		
L-16/15/00	MCC	Comm Control FACS	55	Start STDN Decoders and Block/Error Counters Val Test 2A41. Complete by L-15/00/00.		
L-16/00/00	MCC	Network	56	Send Countdown Status Message.		
	MCC	FACS Bldg 30 Bldg 12 (CCADR)	57	Start Val 1B16, Bldg. 30. Bldg. 12 I/F. Complete by L-15/00/00.		
L-15/00/00	MCC	Comm Control FACS	58	Start WBD Recorder/Reproducer Playback Val Test 2A34. Complete by L-12/00/00.		
	MCC	COHART TC	59	Load two 360/75 for MOCR and ADEG COHART. Complete by L-14/30/00.		
	MCC	MCC TM H-TM	60	Conduct Val Test 3A05 PCM format status. Complete by L-14/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-14/30/00	MCC	Display	61	Start Hardcopy/Scanner Val Test 1B06. Complete by L-10/30/00.		
	MCC	Display	62	Start Television Projecter Val Test 1A61. (MOCR, Recovery Room, Bldg. 30 Auditorium.) Complete by L-10/30/00.		
	MCC	Display COHART	63	"Start display COHART (Val Test 1B 01/1B 03). Complete ADEG COHART (1B 03) by L-13/30/00. Complete MOCR COHART (1B 01) by L-10/30/00".		
L-13/30/00	MCC	Network CPC CISS FACS Comm Control	64	Begin loading on-line and standby CP's. Load off-line CP with CISS program. Configure WBD switch/SCU for CP/CISS closed-loop check. Complete by L-13/00/00. Remove ADEG COHART configuration.		
L-13/00/00	MCC	CPC TIC Comm Control FACS CISS	65	Start CP/CISS closed-loop check. During the run, FACS record 15 minutes of CISS wideband data. Prior to run completion, TIC coordinate a playback of the data from the WBD recorders to the CP to verify playback capability. Complete by L-11/25/00.		
L-12/15/00	MCC ETR	NC RSO	66	Network monitor cape coord and acknowledge RSO call to Retro regarding Jimsphere release.		
L-12/00/00	MCC	Network	67	Send Countdown Status Message.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-12/00/00	MCC	RTC Load Control CCATS Command Display	68	Start Command System Val Test 1A14. Hard-copiers online for abort check. Complete by L-11/25/00.		
L-12/00/00	MCC GSFC	Comm Control FACS Comm Mgr	69	Start STDN WBD Circuit Val Test 4046. Complete by L-11/25/00.		
	MCC	Display	70	Start Bldg 30 to Bldg 45 TV Video Interface Val Test 1A33. Complete by L-10/00/00.		
	MCC	Voice Recorder	71	Start historical voice recorders and Sangamo recorder.		
L-11/40/00	MCC	GCC Comm Control	72	Normal-through all text send and receive TTY lines. Start TTY Routing Val Test 2A60. Complete by L-10/40/00.		
L-11/30/00	MCC	SCU Operator	73	Select IP DCU-R to CP and CP output to RTCC. Complete by L-11/25/00.		
	MCC	Computer M&O	74	Configure 360/75 for RTCS/MIL circuit check.		
L-11/25/00	MCC GSFC	FACS CPC CCATS Command TIC Comm Control Comm Mgr	75	Configure WBD switch/SCU for STDN WBD line interface. Start WBD recorders (WBD recorders on for mission duration). Start MCC/GSFC CP WBD interface (Val Test 5041). Complete by L-10/35/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-11/25/00	MCC FACS Comm Control Computer M&O ETR Lemon One Alfa GSFC CADFISS TC	76	Start RTCS/MCC circuit check (Val Test 4044). Computer M&O verify 360/75 processing of RTCS data. Complete by L-10/30/00. Transmit RTCS and DCU test patterns to GSFC. DCU 1 and 2 will be tested. Coordinate on FP-3. Complete by L-11/00/00.		
L-11/00/00	GSFC CADFISS TC STDN All	77	Send 29-point acq messages to all stations (except MIL), and an IRV to VAN.		
L-10/35/00	MCC CPC CISS Comm Control FACS ASCATS TM KSC ALDS Data Core	78	Configure WBD switch/SCU for ALDS, STDN input compares. Configure for ALDS input to ASCATS. ASCATS begin ALDS quality checks CISS verify system configuration and loading for STDN /ALDS input compares. Complete by L-10/10/00.		
L-10/30/00	MCC COHART TC Display Computer M&O	79	Remove MOCR COHART configuration. Complete by L-9/30/00.		
	MCC Display	80	Inhibit display request capability in the ALSEP control area (314 A+B) and the SCA. Inhibit RTA control capability in SCA.		
	MCC Display	81	Start C/DAC Val Test 1A13. RTCC DDD's will be off-line until completion. At completion, TV position channels 71 and 72 for optimum. Complete by L-10/00/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-10/30/00	MCC Computer Sup	82	Begin loading MOC. System on-line by L-10/00/00.		
	GSFC Comm Mgr MIL OPSR	83	Start FE 600 line checks on Nets 4, 5, 6. Complete by L-10/15/00. MIL send complete Site Status Report Message.		
L-10/15/00	CYI OPSR VAN OPSR	84	F plus day SRT complete through phase III. Send SRT Completion Message, and complete Site Status Report Message.		
	GSFC Goddard Voice All All	85	Establish Nets 1, 2, 3, conference to all stations.		
	GSFC Comm Mgr CYI OPSR VAN OPSR	86	Start FE 600 checks on Nets 4, 5, 6. Complete by L-10/00/00.		
L-10/10/00	GSFC Goddard Voice CADFISS TC NOM	87	Patch GRTS SCAMA 46 to GOSS 3 for TIC/CADFISS TC coordination.		
	MCC CISS TIC KSC ALDS Data Core	88	Start ALDS/CISS telemetry interface. Data Core, ALDS provide pad data at test completion. Coordinate on Booster TM Monitor. Complete interface by L-10/00/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✔	Remarks
L-10/05/00	MCC	Display	89	All display equipment (except projection plotters) on-line.		
	MCC	Voice	90	Inhibit MOCR paging.		
T-09/00/00	All	All	91	Resume count.		
	MCC	Flight FCT Network	92	Flight and FCT on station. Network brief Flight on count status.		
	MCC	Computer Sup	93	MOC on line in Prelaunch 1.		
	MCC	Network	94	Send Countdown Status Message.		
L-10/00/00	GSFC STDN	Comm Mgr GCC OPSR	95	Establish network isolation. Restrict TTY message lengths to 1 minute.		
T-09/00/00	MCC	Flight Retro	96	Retro give Flight mode I abort data.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-09/00/00	MCC Houston TM Display CPC Computer TM FACS WBDR	97	Start BMDADS Val Test 3A21. Complete by T-08/30/00.		
	GSFC NOM ETR SRO STDN OPSR	98	NOM transmit C-band CRF message. Transmit VHF CRF if required. NOM transmit S-band CRF.		
L-10/00/00	MCC CISS TIC Houston TM GSFC Comm Mgr CADFISS TC NST TLM NOM MIL OPSR	99	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 3 and 8 and biomed formats 456 and 546. Complete by L-09/50/00.		
T-09/00/00	MCC TIC Guidance MIL OPSR GSFC Comm Mgr	100	MIL load backup computer system for playback of T-23/00/00 E-Memory Dump. Use BDA ID and configure for playback on Net 6. Initiate playbacks on TIC's cue. Complete playback by T-08/30/00.		
L-10/00/00	GSFC NOM CADFISS TC CYI OPSR VAN OPSR	101	Start tracking data CADFISS. Complete by L-09/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-09/55/00	MCC Flight Network MIL RTC OPSR KSC CVTS	102	Accomplish command activation sequence. (Radiation required on 2101.8, 2106.4 MHz.)		
T-08/55/00	GSFC NOM GRTS NST	103	NOM conduct status check on CCL 13.		
L-09/50/00	MCC RTC MIL OPSR	104	Start MCC/MIL command interface. Complete by L-09/30/00.		
T-08/50/00	MCC TIC Network KSC Data Core	105	TIC transmit CCATS output to KSC using MIL Format 3 data for LIEF checkout. At completion Data Core report status to Network on Cape Coord. Complete by T-08/40/00.		
L-09 /45/00	HSK OPSR NBE GWM OPSR	106	F plus day S RT complete through phase III. Send SRT Completion Message, and complete Site Status Report Message.		
	GSFC Comm Mgr HSK OPSR GWM OPSR	107	Start FE 600 line checks on Nets 4, 5, 6. Complete by L-09/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-08/40/00	MCC MIL KSC ETR GSFC	Network IST CPC Voice GCC Display Computer M&O Bldg 48 OPSR ALDS Data Core RCO Comm Mgr NOM	108	Network verify status for start of LV cryo loading: RTC ____ TIC ____ Track ____ Comm Control ____ Com Tech ____ CPC ____ Voice ____ GCC ____ Display ____ Comp M&O ____ Bldg 48 ____ MIL ____ (Cape Coord) ALDS ____ (Cape Coord) Data Core ____ (Cape Coord) RCO ____ (Cape Coord) Comm Manager ____ (GOSS 8) Goddard Ops ____ (GOSS 11/Coord Loop)		
T-08/30/00	MCC MIL KSC	Flight Network RTC OPSR CVTS	109	Accomplish command deactivation sequence.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-08/30/00	MCC Flight FCT	110	Status to Flight for start of LV cryo loading: Retro ________ INCO ________ Booster ________ Procedures ________ Cap Com ________ AFD ________ EECOM ________ Network ________ GNC ________ Computer Sup ________ TELMU ________ Recovery ________ Control ________		
	GSFC Comm Mgr MIL OPSR MCC Comm Control	111	Reconfigure MIL Net 6 for biomed. Comm Manager confirm action to Comm Control.		
L-09/30/00	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM CYI OPSR	112	Start HBR Biomed CADFISS/CISS Interface Tests using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-09/20/00.		
	GSFC NOM CADFISS TC HSK OPSR NBE GWM OPSR	113	Start tracking data CADFISS. Complete by L-08/50/00.		
T-08/25/00	KSC CVTS MCC Flight	114	Flight verify go/no-go for LV cryo loading.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-09/20/00	MCC RTC CYI OPSR	115	Start MCC/CYI command interface. Complete by L-09/10/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC VAN OPSR	116	Start HBR Biomed CADFISS/CISS interface test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-09/10/00.		
L-09/15/00	ETR SRO MCC Network GSFC NOM	117	SRO send TTY status report in preparation for start of low-speed tracking CADFISS to GCTR, GSTS, and HNET.		
L-09/10/00	MCC RTC VAN OPSR	118	Start MCC/VAN command interface. Complete by L-09/00/00.		
	MCC ComTech GSFC Goddard Voice CYI ComTech	119	Start A-G remoting checks. Complete by L-09/00/00.		
L-09/05/00	BDA OPSR HAW OPSR	120	F plus day SRT complete through phase III. Send SRT Completion Message and complete Site Status Report Message.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-09/05/00	GSFC Comm Mgr BDA OPSR HAW OPSR	121	Start FE 600 line checks on Nets 4, 5, 6 and BDA 10. Complete by L-08/50/00.		
	GSFC Goddard Voice NST Radar BDA OPSR ETR SRO	122	NST Radar establish Radar Coord loop.		
T-08/05/00	KSC CLTC	123	Start LV cryo loading.		
L-09/00/00	GSFC CADFISS TC ETR SRO	124	Start low-speed tracking data CADFISS with ETR C-band radars. Coordination on FP-3. Complete by L-08/30/00.		
	MCC ComTech GSFC Goddard Voice VAN ComTech	125	Start A-G remoting checks. Complete by L-08/50/00.		
	MCC CISS TIC GSFC NOM CADFISS TC HSK OPSR	126	Start LBR CADFISS/CISS interface testing using formats 307 and 309 with the playback bit set. Complete by L-08/50/00.		
L-08/50/00	GSFC NOM CADFISS TC BDA OPSR HAW OPSR	127	Start tracking data CADFISS. Complete by L-08/20/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-08/50/00	MCC RTC HSK OPSR NBE	128	Start MCC/HSK/NBE command interface. OPSR switch to NBE on RTC's cue. Complete by L-08/40/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM GWM OPSR	129	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 9 and 7 and biomed formats 456 and 546. Complete by L-08/40/00.		
L-08/40/00	MCC ComTech GSFC Goddard Voice HSK ComTech	130	Start A-G remoting checks. Complete by L-08/30/00.		
	MCC RTC GWM OPSR	131	Start MCC/GWM command interface. Complete by L-08/30/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM HSK OPSR	132	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-08/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-08/35/00	TEX OPSR CRO OPSR	133	F plus day SRT complete through phase III. Send SRT Completion Message and complete Site Status Report Message.		
	GSFC Comm Mgr TEX OPSR CRO OPSR	134	Start FE 600 line checks on Nets 4, 5, 6. Complete by L-08/20/00.		
L-08/30/00	MCC ComTech GSFC Goddard Voice GWM ComTech	135	Start A-G remoting checks. Complete by L-08/20/00.		
	GSFC NST Radar ETR Cat One BDA Gold Two Gold Two Alfa	136	NST Radar conduct Radar Coord loop voice checks.		
T-07/20/00	KSC CVTS MCC Flight RTC Booster Network MIL OPSR	137	Flight verify readiness to support FT-47 LV Preflight Command System Test. Network and RTC complete command activation sequence. RTC site select Booster to MIL. Complete by T-07/13/00.		
L-08/20/00	GSFC NOM CADFISS TC TEX OPSR CRO OPSR	138	Start tracking data CADFISS. Complete by L-07/50/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-08/20/00	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM BDA OPSR	139	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 3 and 8 and biomed formats 456 and 546. Complete by L-08/10/00.		
T-07/13/00	KSC CVTS CLTC MCC Booster MIL OPSR	140	Booster execute: ~~Terminate~~ General Load 1 General Load 2 ~~General Load 3~~		
L-08/10/00	MCC ComTech GSFC Goddard Voice HAW OPSR	141	Start A-G Remoting Check. Complete by L-08/00/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM HAW OPSR	142	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-08/00/00.		
L-08/05/00	ACN OPSR MAD OPSR	143	F plus day SRT complete through phase III. Send SRT Completion Message and complete Site Status Report Message.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-08/05/00	GSFC Comm Mgr ACN OPSR MAD OPSR	144	Start FE 600 line checks on Nets 4, 5, 6. Complete by L-07/50/00.		
T-07/03/00	MCC Flight Network RTC KSC CVTS	145	CVTS notify Flight that the LV command system is disabled. Network and RTC complete command deactivation sequence. RTC confirm clearance to continue command testing.		
L-08/00/00	MCC ComTech GSFC Goddard Voice BDA ComTech	146	Start A-G Remoting Check. Complete by L-07/50/00.		
	MCC RTC BDA OPSR	147	Start MCC/BDA command interface. Complete by L-07/50/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM TEX OPSR	148	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-07/50/00.		
L-07/50/00	GSFC NOM CADFISS TC ACN OPSR MAD OPSR RID	149	Start tracking data CADFISS. Complete by L-07/10/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-07/50/00	MCC HAW	RTC OPSR	150	Start MCC/HAW command interface. Complete by L-07/40/00.		
	MCC GSFC CRO	CISS TIC Houston TM NOM CADFISS TC NST TLM OPSR	151	Start HBR Biomed CADFISS/CISS interface testing using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-07/40/00.		
L-07/40/00	MCC GSFC CRO	ComTech Goddard Voice OPSR ComTech	152	Start A-G Remoting Checks. Complete by L-07/30/00.		
	MCC TEX	RTC OPSR	153	Start MCC/TEX command interface. Complete by L-07/30/00.		
L-07/30/00	MCC	Network	154	Send Countdown Status Message.		
	MCC GSFC TEX	ComTech Goddard Voice ComTech	155	Start A-G remoting check. Complete by L-07/20/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✔	Remarks
L-07/30/00	GSFC Comm Mgr BDA OPSR ETR Lemon One Alfa	156	Establish HSD circuit from BDA to RTCS for high-speed slew checks. Complete by L-07/00/00.		
	MCC RTC CRO OPSR	157	Start MCC/CRO command interface. Complete by L-07/20/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM ACN OPSR	158	Start HBR Biomed CADFISS/CISS interface using engineering formats 7 and 9 and biomed formats 456 and 546. Complete by L-07/20/00.		
L-07/25/00	GDS OPSR	159	F plus day SRT complete through phase III. Send SRT Completion Message and complete Site Status Report Message.		
	GSFC Comm Mgr GDS OPSR	160	Start FE 600 checks on Nets 4, 5, 6. Complete by L-07/10/00.		
L-07/20/00	MCC CISS TIC GSFC NOM CADFISS TC MAD OPSR	161	Start LBR CADFISS/CISS Interface Test using formats 307 and 309 with tape playback bit set. Complete by L-07/10/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-07/10/00	GSFC NOM CADFISS TC GDS OPSR PIR	162	Start tracking data CADFISS. Complete by L-06/30/00.		
	MCC ComTech GSFC Goddard Voice GDS ComTech	163	Start A-G remoting checks. Complete by L-07/00/00.		
	MCC RTC MAD OPSR RID	164	Start MCC/MAD/RID command interfaces. OPSR switch to RID on RTC's cue. Complete by L-07/00/00.		
	MCC CISS TIC GSFC NOM CADFISS TC GDS OPSR	165	Start LBR CADFISS/CISS Interface Test using formats 307 and 309 with playback bit set. Complete by L-07/00/00.		
	GSFC NOM CADFISS TC STDN OPSR	166	Start tracking CADFISS reruns. Complete by T-05/00/00.		
L-07/00/00	MCC RTC ACN OPSR	167	Start MCC/ACN command interface. Complete by L-06/50/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-07/00/00	MCC ComTech MAD ComTech GSFC Goddard Voice	168	Start A-G remoting check. Complete by L-06/50/00.		
	MCC CISS TIC Houston TM GSFC NOM CADFISS TC NST TLM MAD OPSR	169	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-06/50/00.		
	GSFC NOM NST Radar BDA Gold Two Gold Two Alfa ETR RCO Lemon One Alfa	170	BDA high-speed slew check for FPQ-6 and FPS-16. Coordinate on Radar Coord loop. Upon completion, NOM pass BDA status to RCO on Cape Coord. Complete by L-06/45/00.		
	MCC Radiation	171	Radiation on site. Space environment console manned.		
L-06/50/00	MCC CISS TIC GDS OPSR GSFC NOM CADFISS TC	172	Start HBR Biomed CADFISS/CISS Interface Test using engineering formats 13 and 8 and biomed formats 456 and 546. Complete by L-06/40/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
L-06/40/00	MCC ComTech ACN ComTech GSFC Goddard Voice	173	Start A-G remoting checks on Net 1. Complete by L-06/30/00.		
L-06/30/00	MCC RTC GDS OPSR PIR	174	Start MCC/GDS/PIR command interface. OPSR switch to PIR on RTC cue. Complete by L-06/20/00.		
	MCC CISS Network TIC ComTech Comm Control Houston TM GSFC NOM CADFISS TC Goddard Voice STDN OPSR	175	Start STDN/MCC Biomed format 40 and A-G interface reruns. Start telemetry CADFISS/CISS reruns. Complete all reruns by L-06/00/00.		
	GSFC NOM CADFISS TC ETR Lemon One Alfa MCC Computer M&O	176	Start LTDS CADFISS. Coordinate on FP-3/CAPE 123. Computer M&O monitor MCC DCUR. Complete by L-06/20/00.		
	MCC Dynamics Comp Command Select	177	Data Select, Computer Dynamics, and Computer Command on station.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
L-06/30/00	MCC GSFC ANT MIL	ComTech Goddard Voice ComTech ComTech	178	Start A-G remoting checks. MIL, ANT monitor drop CKT and report status. Complete by L-06/20/00.		
L-06/20/00	MCC GSFC STDN	RTC Network NOM OPSR	179	Start STDN/MCC command interface reruns. Complete by L-05/50/00.		
T-05/15/00	MCC	FIDO Computer Sup	180	FIDO on site. Computer Sup bring up DSC.		
	MCC	Display Computer M&O	181	Computer M&O verify SSU switch is in PDSDD position. Display put projection plotting equipment on line.		
T-05/10/00	MCC	Comm Control GCC FACS CPC	182	Normal through JJ TTY lines.		
	MCC	TIC	183	Select CMC CSM data to playback buffers. Data to remain playback until termination of FIDO trajectory run.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✔	Remarks
T-05/00/00	MCC Network Track FIDO Computer Sup Data Select TIC GSFC NOM Goddard Comps Comm Mgr KSC ALDS Data Core BDA OPSR VAN OPSR MIL OPSR	184	Start FIDO trajectory run. Track will be test conductor and coordinate tape start times on Net 2. At FIDO's direction Computer Sup write a restart tape and condition the MOC for launch and the DSC for simulated launch. Data Core play IU and CMC trajectory tape. BDA play IU and CMC tape to MCC. VAN play B sim tape to MCC. Lemon One Alfa play powered flight data to NOCC via GRTS, and to BDA and VAN. TIC enable KSC buffer to Data Core, request ALDS to do COS-4, and hand CSM decommutation over to MIL. ALDS enable 2.4-kb/sec data to RTCS. BDA report acquisition data quality to Goddard Ops. After test, MOC remain in orbit phase for boresight/ collimation checks. MIL verify reception of RTCS (Lemon One) acq data. Complete by T-04/30/00.		
	MCC CISS Network TIC GSFC NOM CADFISS TC	185	STDN CADFISS/CISS interface complete. Network release CISS.		
	MCC Guidance	186	Prepare in-flight E-Memory tapes.		
	MCC TIC BDA OPSR	187	Start S-II FM/FM parameter ID and calibrate sequence on AMQ channels ~~1-5,~~ 6-10 ~~D0013-201, D0013-202, D0013-203, D0013-204, D0013-205.~~ Data source will be Vidar Calibrator. Complete by T-04/50/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-05/00/00	MCC BDA	Comp Command Load Control OPSR	188	Transfer load XXXX to BDA. Load Control clear load and take a load inventory.		
	MCC KSC MIL	Flight Network MSTC OPSR	189	Flight give status to MSTC for CSM E-Memory verify. Network verify that MIL is standing by to record E-Memory Dump if required.		
T-04/50/00	MCC MIL	TIC OPSR	190	Start S-II FM/FM parameter ID and calibrate sequence ~~on AMQ channels~~ 1-5. D0013-201, D0013-202, D0013-203, D0013-204, D0013-205. Data source will be Vidar Calibrator. Complete by T-04/40/00.		
T-04/45/00	KSC ETR	ALDS RTCS	191	ALDS send Discretes to RTCS for Apollo 16 terminal count.		
	KSC MCC	MSTC Guidance	192	Perform E-Memory verify.		
T-04/40/00	MCC KSC	TIC ALDS	193	Start S-I/S-II FM/FM parameter ID and calibration sequence. D0008-101, D0008-102, D0008-103, D0008-104, D0008-105, D0013-201, D0013-202, D0013-203, D0013-204, D0013-205. Coordinate on Booster TM Monitor. Complete by T-04/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-04/40/00	KSC CLTC ALDS CASTS ETR SRO	194	Conduct DRSCS Closed Loop Test. ALDS CASTS monitor discretes.		
T-04/30/00	AOCC ARIA Control	195	AOCC manned.		
	MCC Network	196	Send Countdown Status Message.		
	MCC TIC KSC ALDS	197	TIC request ALDS to do COS-I. TIC hand over CSM to ALDS.		
	MCC Track Select MIL OPSR BDA OPSR ACN OPSR MAD OPSR RID CRO OPSR GWM OPSR HSK OPSR NBE HAW OPSR GDS OPSR PIR TEX OPSR CYI OPSR VAN OPSR	198	Track conduct boresight and collimation data flow checks. All tests will be run according to Val Test 3046. Stations send high- and low-speed C-band and USB data as applicable. VAN load CADFISS fixed point IRV in CDP, drive antenna to the designated point, and transmit data to MCC. MILA flow pad data. Complete by T-03/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-04/15/00	GSFC Goddard Voice	199	Conference all stations on GOSS Conf (Net 1) for T-04/00/00 status check.		
	GSFC NOM GRTS NST	200	NOM conduct status check on CCL 13.		
T-04/00/00	MCC Radiation CYI OPSR CRO OPSR	201	CYI and CRO send telescope calibration data to Radiation.		
	MCC Network ETR RCO KSC ALDS Data Core MIL OPSR BDA OPSR VAN OPSR CYI OPSR ACN OPSR MAD OPSR CRO OPSR GWM OPSR HSK OPSR HAW OPSR GDS OPSR TEX OPSR AOCC ARIA Control GSFC Comm Mgr NOM	202	Network conduct status check on GOSS Conf (Net 1): RCO__________ (Cape Coord) ALDS__________ (Cape Coord) Data Core__________ (Cape Coord) MIL__________ BDA__________ VAN__________ CYI__________ ACN__________ MAD__________ CRO__________ GWM__________ HSK__________ HAW__________ GDS__________ TEX__________ ARIA Control__________ Comm Manager__________ (GOSS 8) Goddard Ops__________ (GOSS 11/Coord Loop)		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action		✓	Remarks
T-0 3/55/00	MCC	Network IST CPC Voice GCC Display Bldg 48 Computer M&O	203	Network conduct MCC status check: RTC________ TIC________ Track________ Comm Cont________ ComTech________ CPC________	 Voice________ GCC________ Display________ Comp M&O________ Bldg 48________		
T-03/50/00	MCC	Flight FCT	204	Status to Flight for crew departure from MSOB: Guidance________ FIDO________ Retro________ Booster________ Cap Com________ Surgeon________ EECOM________ GNC________	 TELMU________ Control________ INCO________ Procedures________ AFD________ FAO________ Network________ Comp Sup________ Recovery________		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-03/30/00	All	All	205	Begin built-in hold. Duration 1 hour.		
L-04/05/00	MCC	Flight Retro	206	Retro give Flight mode I abort data.		
L-03/45/00	MCC MIL BDA VAN CYI	ComTech ComTech ComTech ComTech ComTech	207	Houston ComTech begin A-G keying checks on duplex B and USB. Conduct MIL keying and voice checks on GOSS Conf and MIL A-G longline. No MIL radiation is required. Complete by L-03/05/00.		
	ANT	ComTech	208	Houston ComTech conducts A-G keying checks on duplex B. Complete by L-03/05/00.		
	MCC	Computer Sup	209	Do a high-speed restart to MOC from DSC. Complete by T-03/40/00.		
	KSC ETR	ALDS RSO	210	ALDS send discretes to RSO recorders for Apollo 17 terminal count.		
L-03/35/00	MCC KSC	Flight CVTS	211	Flight verify go/no-go for crew departure from MSOB.		
L-03/30/00	All	All	212	Resume count.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-03/25/00	MCC	Flight	213	Flight give status to MSTC for crew departure from MSOB.		
T-03/05/00	MIL	OPSR LSC	214	Begin final antenna alignment. Complete by T-02/50/00.		
T-03/00/00	GSFC STDN	Comm Mgr GCC	215	Lift 1 minute restrictions on TTY traffic.		
T-02/50/00	MCC KSC	Comm Control FACS Houston TV Display Comm Control	216	Bring up KSC to MCC TV circuit.		
	MCC ETR	Computer M&O Track Lemon One Alfa	217	Transmit RTCS and DCU test patterns to MCC. Computer M&O verify DCU processing. Track coordinate test on Cape 123. Complete by T-02/45/00.		
	MCC	CPC	218	Recycle online and standby CP's to ensure sync. Complete by T-02/45/00.		
T-02/30/00	MCC	Network	219	Send Countdown Status Message.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-02/30/00	MIL OPSR MCC Houston TM Computer TM TIC	220	MIL put biomed data on Net 6, format 40. Houston TM and Computer TM verify BMDADS processing.		
	MIL OPSR	221	Start WBD recorders.		
	MCC Guidance Comp Command Load Control CCATS Command STDN OPSR	222	Generate and transfer prelaunch command loads if required. Complete by T-00/30/00.		
	MCC ComTech MIL OPSR	223	ComTech contact MIL on Net 2 and verify A-G configuration for T-02/20/00 voice checks.		
	MCC TIC	224	Select CMC CSM data to playback buffers. Data to remain playback until termination of FIDO trajectory run.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-02/30/00	MCC ETR GSFC BDA KSC VAN MIL	Network Computer Sup Track FIDO Select TIC SRO Lemon One Alfa NOM Goddard Comps Comm Mgr OPSR ALDS Data Core OPSR OPSR	225	Start FIDO trajectory run. Track will be test conductor and coordinate tape start times on Net 2. At FIDO's direction, Computer Sup will write a restart tape and condition the MOC and DSC for simulated launch. Data Core play IU and CMC trajectory tape. BDA play IU and CMC tape to MCC. VAN play B sim tape to MCC. Lemon One Alfa play powered flight data to NOCC, via GRTS, and to BDA. TIC enable KSC buffer to Data Core, request ALDS to do COS-4, and hand over CSM to MIL. ALDS enable 2.4-kb/sec data to RTCS. MIL verify receipt of RTCS acq data. Recheck BDA acquisition data if required. Complete by T-02/10/00.		
T-02/20/00	MCC MIL KSC	CapCom ComTech OPSR MSTC	226	Perform USB and VHF duplex B A-G voice checks.		
T-02/10/00	MCC KSC	TIC ALDS	227	TIC request ALDS to do COS-I and hand over CSM to ALDS.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-02/10/00	KSC CVTS MCC Flight Network RTC	228	CVTS notify Flight that the USB command system is armed and the AAS is enabled. Verify Flight ready to support MCC/CSM and AAS command checks. Network and RTC complete required steps of the command activation sequence. RTC site select Flight, FIDO, Booster, Guidance, INCO to MIL.		
T-02/00/00	KSC MSTC MCC Guidance INCO MIL OPSR	229	Conduct CSM command checks: Guidance executes V34, INCO execute PCM Data Rate High. Complete by T-01/55/00.		
	GSFC NOM Goddard Comps NST	230	NOM conduct status check on CCL 13.		
T-01/55/00	GSFC Goddard Voice	231	Conference all stations on Net 2 for T-01/45/00 status check.		
	KSC MSTC LOM MCC Flight	232	Conduct AAS command checks per TCP. Complete by T-01/52/00.		
T-01/51/00	KSC CVTS MCC Flight Network RTC MIL OPSR	233	CVTS notify Flight that CSM command decoder is off. Network and RTC complete command deactivation sequence.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-01/45/00	MCC Network ETR RCO KSC ALDS Data Core MIL OPSR BDA OPSR VAN OPSR CYI OPSR ACN OPSR MAD OPSR CRO OPSR GWM OPSR HSK OPSR HAW OPSR GDS OPSR TEX OPSR AOCC ARIA Control GSFC Comm Mgr NOM	234	Network conduct status check on Net 2: RCO ______ (Cape Coord) ALDS ______ (Cape Coord) Data Core ______ (Cape Coord) MIL ______ BDA ______ VAN ______ CYI ______ ACN ______ MAD ______ CRO ______ GWM ______ HSK ______ HAW ______ GDS ______ TEX ______ ARIA Control ______ Comm Manager ______ Goddard Ops ______ (GOSS 11/Coord Loop)		
T-01/40/00	MCC Network IST CPC Voice GCC Display Bldg 48 Computer M&O Houston TM	235	Network conduct MCC status check: RTC ______ Voice ______ TIC ______ GCC ______ Track ______ Display ______ Comm Control ______ Comp M&O ______ ComTech ______ Bldg 48 ______ CPC ______ Houston TM ______		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-01/40/00	GSFC BDA ETR	Comm Mgr CADFISS TC OPSR RCO	236	Verify HSD circuit from BDA radar to RTCS and establish HSD circuit to GRTS for high-speed slew checks.		
T-01/35/00	MCC	Flight FCT	237	Status to Flight for final Jimsphere release. Guidance________ TELMU________ FIDO________ Control________ Retro________ INCO________ Booster________ Procedures________ CapCom________ AFD________ Surgeon________ FAO________ EECOM________ Network________ GNC________ Computer Sup________ Recovery________		
T-01/30/00	MCC KSC	Flight CVTS	238	Flight verify go/no-go to CVTS for final Jimsphere release at T-01/20/00.		
	MCC	Network	239	Send Countdown Status Message.		
	MCC	Flight All	240	Final mission rules review.		
	MCC ETR	Retro RCO	241	Retro make voice check with RCO on Cape Coord.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-01/30/00	KSC MCC ETR GSFC	CVTS CGIC ALDS ~~CASTS~~ Flight Retro Network Comm Control FACS SRO NOM	242	First motion check. Network confirm receipt of signal with Comm Control and NOM and report results to Flight. Flight and SRO report test results to CVTS.		
	ETR GSFC VAN	Lemon One Alfa NOM NST Radar OPSR	243	Lemon One Alfa play powered flight data to VAN. Coordinate on radar coord loop (VAN Net 2 out of conference).		
	MCC GSFC VAN	Track Select Comm Mgr Computer OPSR	244	Reconfigure VAN Net 3 to HSD circuit for BDA C-band 2.4-kb/sec data to VAN. VAN enter current time in computer, set in GSFC/MCC destination codes and send HS USB C-band data and LS USB data. Track verify HSD received at Goddard Computers and at MCC. Select verify current time tag. Track request C-band LSD vice USB. Sequence complete upon receipt of C-band LSD.		
T-01/27/00	MCC KSC	Flight CVTS	245	Flight verify ready to support FT-47 LV Pre-flight Command System Test.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-01/20/00	MCC Flight Network RTC MIL OPSR	246	Flight request Network to configure the command system for launch support. Network and RTC complete command activation sequence. RTC site select Booster, INCO, Guidance, FIDO and Flight to MIL.		
	KSC CVTS ETR SRO	247	Release final prelaunch Jimsphere.		
T-01/19/00	KSC CVTS CLTC MCC Booster MIL OPSR	248	Booster execute: General Load 1 General Load 2 General Load 3 Terminate		
T-01/15/00	MCC Recovery Flight	249	Recovery give Flight mode I abort data.		
T-01/10/00	GSFC NOM NST Radar CADFISS TC ETR Lemon One Alfa RCO BDA Gold Two Gold Two Alfa MCC Track VAN OPSR	250	BDA high-speed slew check for FPQ-6 and FPS-16. Coordinate test on Radar Coord loop. At completion, NOM pass BDA range safety support status to RCO on Cape Coord. Complete by T-00/55/00. BDA transmit 2.4-kb/sec acq data to VAN. VAN confirm valid acq system to NOM and Track.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-01/00/00	MCC	Voice	251	Inhibit MOW paging until T+01/00/00.		
	MCC KSC	Comm Control FACS Houston TV Display Comm Control	252	Bring up MCC to KSC TV circuit.		
	MCC ETR	Flight FIDO RSO	253	RSO make voice check with Flight on FD loop and with FIDO on RSO loop and Cape RSO PL.		
	MCC ETR	Track ARIA Computer	254	Track make voice check with ARIA Computer on FP-6/GOSS-6.		
T-00/45/00	MCC	Network	255	Send Countdown Status Message.		
	GSFC	NOM Goddard Computers NST	256	NOM conduct status check on CCL 13.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-00/45/00	KSC MIL GSFC	ETMS MSTC OPSR NOM	257	Begin final USB and VHF-AM readouts. ETMS give CRF change/no-change to MIL. MIL TWX CRF information to NOM at completion. Complete by T-00/20/00.		
	GSFC BDA ETR	NST Radar Gold Two Alfa RCO Lemon One Alfa	258	Gold Two Alfa pass BDA bulb weather (air pressure, wet and dry bulb temperature) to NST Radar and Lemon One Alfa.		
	KSC MCC	Comm Control Comm Control	259	Patch OIS channel 153 to LM-6 and CSM-6.		
T-00/44/00	MCC KSC	TIC Data Core ALDS	260	Start RF comparison test. At completion, Data Core and ALDS return to normal support configuration and confirm status to TIC. Complete by T-00/30/00.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-00/40/00	MCC Network ETR RCO KSC ALDS Data Core MIL OPSR BDA OPSR VAN OPSR ANT OPSR CYI OPSR ACN OPSR MAD OPSR CRO OPSR GWM OPSR HSK OPSR HAW OPSR GDS OPSR TEX OPSR AOCC ARIA Control GSFC Comm Mgr NOM	261	Network verify status for launch on Net 2: RCO__________ (Cape Coord) ALDS__________ (Cape Coord) Data Core__________ (Cape Coord) MIL__________ BDA__________ VAN__________ ANT__________ CYI__________ ACN__________ MAD__________ CRO__________ GWM__________ HSK__________ HAW__________ GDS__________ TEX__________ ARIA Control__________ Comm Manager__________ Goddard Ops__________ (GOSS 11/Coord Loop)		
	KSC ALDS CASTS CLTC ETR RCO	262	Conduct DRSCS checks. ALDS CASTS monitor discretes. ETR UHF carrier coming on through launch.		
T-00/37/00	MCC Flight ETR RSO	263	Conduct Number Three Engine Out Light Check.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-00/35/00	MCC Flight FCT	264	Status to Flight for LV terminal count sequences: Guidance______ TELMU______ FIDO______ Control______ Retro______ INCO______ Booster______ Procedures______ Cap Com______ AFD______ Surgeon______ FAO______ EECOM______ Network______ GNC______ Computer Sup______ Recovery______		
T-00/30/00	KSC RLDE MCC Guidance	265	RLDE establish communications with Guidance and give a hack on CDT to establish a GRR estimate.		
	MCC Retro Network Load Control CCATS Command MIL OPSR	266	Retro give predicted GMTLO to load Control for transfer to MIL by CCATS Command. CCATS Command report transfer to Network when completed.		
	MCC Flight KSC CVTS	267	Flight verify go/no-go for launch vehicle terminal count sequences.		
	MCC TELMU	268	Monitor LM switchover to internal power.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-00/20/00	KSC	CLTC	269	Begin LV terminal count sequences.		
	MIL ETR GSFC	OPSR RCO NOM	270	MIL and RCO give CRF change/no-change to NOM on Cape Coord and confirm by TTY message to GCTR/NOM.		
	MCC	Computer Sup FIDO	271	Reset SEQ switches: L/O to NO-EVENT, LIFT to FULL, and all others to NO-EVENT.		
	MCC	Retro Flight	272	Retro give Flight mode I abort data.		
T-00/17/00	MCC KSC	Guidance RLDE	273	RLDE and Guidance establish black phone communications.		
T-00/15/00	MCC	Network IST CPC Voice GCC Display Bldg 48 Computer M&O Houston TM	274	Network conduct final status check: RTC________ Voice________ TIC________ GCC________ Track________ Display________ Comm Control________ Computer M&O________ ComTech________ Bldg 48________ Houston TM________		
	KSC	ALDS	275	Enable 2.4-kb/sec data output to RTCS.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-00/15/00	MCC INCO KSC MSTC	276	Send CTE Update.		
	MCC CapCom ComTech KSC LOM	277	Simultaneous Duplex B and USB A-G voice checks with flight crew.		
	GSFC NOM STDN All	278	Goddard Ops transmit CRF change/no-change message.		
	MCC FIDO Computer Sup	279	ESO LIFT switch to HALF.		
T-00/14/00	MCC Network	280	Announce launch azimuth on Net 2.		
T-00/13/00	GSFC NST USB NOM STDN All	281	NST USB advise Goddard Ops of correct 29-point acq messages to be used by all stations. NOM relay information to stations on Net 3.		
T-00/12/00	KSC RLDE MCC Guidance	282	RLDE provide Guidance with a CDT/GMT time hack.		
	MCC Network MIL OPSR BDA OPSR VAN OPSR CYI OPSR ANT OPSR	283	Network poll launch area stations on Net 1 and verify go/no-go status for launch.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position	Seq	Action	✓	Remarks
T-00/10/00	MCC Flight FCT	284	Status to Flight for start of automatic sequence: Guidance________ TELMU________ FIDO________ Control________ Retro________ INCO________ Booster________ Procedures________ Surgeon________ AFD________ CapCom________ FAO________ EECOM________ Network________ GNC________ Computer Sup________ Recovery________		
	MCC Track VAN OPSR	285	VAN put INITIATE POWERED FLIGHT FILTER (formerly THRUST) switch ON and confirm to Track.		
	MCC Computer Sup Flight FIDO	286	Computer Sup condition MOC and DSC for launch and report completion to Flight and FIDO.		
T-00/06/00	MCC Flight KSC CVTS	287	Flight verify go/no-go for start of automatic launch sequence.		
T-00/05/00	MCC FIDO ETR RSO	288	RSO conduct voice check with FIDO on RSO loop and on Cape RSO PL.		

Table 1-2. Apollo Terminal Count (cont)

Time	Station & Position		Seq	Action	✓	Remarks
T-00/05/00	MIL	OPSR	289	Begin transmission high- and low-speed trajectory data.		
	MCC ETR	Retro RCO	290	Retro conduct voice checks with RCO on Cape Coord.		
T-00/03/07	KSC	CVTS	291	Start automatic launch sequence.		
	MCC	Guidance Flight	292	Guidance verify "V75" entered by flight crew.		
T-00/02/00	KSC MCC	RLDE Guidance	293	RLDE conduct voice check with Guidance on OIS 153/LM6.		
T-00/01/00	MCC ETR	FIDO RSO	294	RSO conduct voice check with FIDO on Cape RSO PL.		
T-00/00/23	MCC	FIDO	295	ESO LIFTOFF switch to NORMAL.		
T-00/00/17	MCC KSC	Guidance RLDE	296	RLDE announce CDT of GRR.		
T-00/00/00	MCC	Network	297	Announce liftoff and GET clock start on Net 2, and send Apollo Liftoff Message.		

Table 1-3. CADFISS and Interface Tests

L Minus	FE 600	TLM	Biomed	Tracking	CMD	Air-Ground	Remarks
10:30	MIL 83						
	CYI VAN 86	ALDS 88					
10:00		MIL 99	MIL 99	CYI VAN 101			
	HSK GWM 107				MIL 104		
9:30		CYI 112	CYI 112	HSK GWM 113			
		VAN 116	VAN 116		CYI 115		
					VAN 118	CYI 119	
9:00	BDA HAW 121	HSK 126		ETR 124		VAN 125	
		GWM 129	GWM 129	BDA HAW 127	HSK 128		
8:30	TEX CRO 134	HSK 132	HSK 132		GWM 131	HSK 130	
						GWM 135	
		BDA 139	BDA 139	TEX CRO 138			
		HAW 142	HAW 142			HAW 141	
8:00	ACN MAD 144	TEX 148	TEX 148		BDA 147	BDA 146	
		CRO 151	CRO 151	ACN MAD 149	HAW 150		
					TEX 153	CRO 152	
7:30	GDS 160	ACN 158	ACN 158		CRO 157	TEX 155	
		MAD 161					
		GDS 165		GDS 162 & RERUNS 166	MAD 164	GDS 163	
7:00		MAD 169	MAD 169		ACN 167	MAD 168	
		GDS 172	GDS 172				
						ACN 173	
6:30		RERUNS 175	RERUNS 175	LTDS 176	GDS 174	ANT/MIL 178	
					RERUNS 179	RERUNS 174	
6:00							
5:30							
5:00				FIDO TRAJECTORY RUN 184			Boresight and collimation data flow
4:30							
4:00							

Note

Numbers in blocks refer to sequences in the terminal count, table 1-2.

1.2.3 PLUS TIME INTERFACE TESTING

1.2.3.1 General. Testing and interface counts will be performed by the network stations, MCC, and GSFC when the stations return to active support from standby configuration "A" or "B".

1.2.3.2 Return from Standby Configuration "A" Testing. Table 1-4 lists the type of testing and interface counts required to be performed when a station returns to active support after being released from standby configuration "A". Whenever possible, dual mission support requirements will be anticipated in advance (even though they do not start concurrently) and interface testing will be planned accordingly.

1.2.3.3 Return from Standby Configuration "B" Testing. Table 1-5 lists the type of testing and interface counts required to be performed when a station returns to active support after being released from standby configuration "B". If the upcoming support is different from the previous support, it will be necessary to perform applicable portions of the appropriate SRT and qualifying interface tests. Whenever possible, dual mission support requirements will be anticipated in advance (even though they do not start concurrently) and interface testing will be planned accordingly.

1.2.3.4 "Turnaround" During Active Support. When it becomes necessary to reconfigure (turnaround) to support other than the original qualifying SRT and interface testing, the station will perform the appropriate turnaround as specified in section 30 commensurate with the time allotted by MCC. Upon completion of the turnaround testing, the OPSR will inform the MCC NC that they are ready to begin support. CADFISS testing will not be performed. Telemetry and metric tracking data will be evaluated by the NST in real time when different from previous support. MCC interface testing will be at the discretion of the NC.

1.2.3.5 Interface Counts. The Apollo and Apollo/ALSEP/P&FS counts are contained in para 1.2.3.6. ALSEP/P&FS S-30 support counts are contained in the ALSEP/ P&FS NOSP. Figure 1-8 provides a quick reference to the tests involved.

1.2.3.6 Plus Time Interface Support Counts

a. Apollo/ALSEP/P&FS Dual Support H-50 Count

Time	Position	Sequence	Action
Prior to H-50 minutes	OPSR, NOM	1	OPSR transmit Return from Standby Manning Message to NOM.
	OPSR, NOM, PAO	2	Conduct station briefing.
	Comm Mgr, OPSR	3	NASCOM communications network interface tests. Coordinate on Net 3.
	OPSR	4	STDN F plus day SRT complete.
	OPSR, NOM	5	OPSR send SRT status report to NOM via TTY.

Time	Position	Sequence	Action
H-50	Comm Mgr, NOM	6	NASCOM network interface established; Comm Mgr give status report to NOM on CCL-25.
	OPSR, TLM CADFISS TC	7	Start TLM CADFISS test. Coordinate on Net 3.
	OPSR	8	Apollo HS TLM on Net 4 (CADFISS).
	NOM, ALSEP/ P&FS, NC, OPSR	9	Start MCC ALSEP/P&FS TLM/CMD interface test. Coordinate on Net 2, HS TLM data on Net 6.
H-35	NOM, NC, OPSR CADFISS TC	10	TLM CADFISS test completed. CADFISS TC pass TLM test results to NOM on NOM loop.
	OPSR	11	Apollo HS TLM off.
H-30	ALSEP/P&FS, NC, OPSR	12	ALSEP/P&FS CMD interface testing complete.
	OPSR	13	Start H-30 count.
H-25	NOM, NC	14	NOM pass results of GSFC testing to NC. NC pass results of MCC interface testing to NOM.

b. Apollo Support H-70 Count

Time	Position	Sequence	Action
Prior to H-70 minutes	OPSR, NOM	1	OPSR transmit Return from Standby Manning Message to NOM.
	Comm Mgr, OPSR	2	NASCOM communications network tests. Coordinate on Net 3.
	OPSR	3	STDN F plus day SRT complete.
	OPSR, NOM	4	OPSR send SRT status report to NOM via TTY.
	NOM, PAO, OPSR	5	Conduct station briefing.

Time	Position	Sequence	Action
H-70	Comm Mgr, NOM	6	NASCOM network interface established. Comm Mgr give status report to NOM on CCL-25.
	NOM, NC, OPSR RTC	7	Start MCC CMD interface tests. Coordinate on Net 2.
H-60	OPSR, NC, RTC	8	CMD interface testing complete.
	NOM, OPSR, CADFISS TC	9	Start CADFISS tracking test. Coordinate on Net 3. (Use "DD" for low speed.) Permission is not required for radiating ranging modulation into collimation tower except as specified in section 16.
	OPSR, TLM, CADFISS TC	10	Start TLM/Biomed format 40 CADFISS test. Coordinate on Net 3.
	OPSR	11	HS TLM on Net 4; Biomed on Net 6 (CADFISS).
H-45	NOM, NC, OPSR, CADFISS TC	12	TLM/Biomed CADFISS test complete. Pass TLM test results to NOM on NOM loop.
	OPSR	13	HS TLM and biomed off.
	NC, OPSR, Houston ComTech	14	Start A-G remoting tests on Net 1 (boresight testing must be completed before starting).
H-30	NOM, CADFISS TC	15	CADFISS tracking test complete. TC pass results to NOM on NOM loop.
	NC, OPSR Houston ComTech	16	A-G remoting tests complete. ComTech pass results to NC on Network loop.

Time	Position	Sequence	Action
H-30 (cont)	NOM, NC	17	NOM pass results of GSFC testing to NC. NC pass results of MCC interface testing to NOM.
	OPSR	18	Start H-30 count.

c. Apollo Support H-45 Count

Time	Position	Sequence	Action
Prior to H-45 minutes	Comm Mgr, OPSR	1	NASCOM communications test. Coordinate on Net 3.
H-45	Comm Mgr, NOM	2	NASCOM communications interface established. Comm Mgr give status report to NOM on CCL-25.
	OPSR, Houston ComTech	3	Start A-G remoting tests on Net 1.
H-35	RTC, OPSR	4	Start MCC CMD interface test. Coordinate on Net 2.
H-30	NC, RTC, OPSR	5	MCC CMD interface test complete.
	NC, OPSR, Houston ComTech	6	A-G remoting tests complete. ComTech pass results to NC on Network loop.
	NOM, NC	7	NOM pass results of GSFC testing to NC. NC pass results of MCC interface testing to NOM.
	OPSR	8	Start H-30 count.

Table 1-4. Return from Standby Configuration "A"

Testing and Interface / Support Required	Apollo SRT	ALSEP/ P&FS SRT	Apollo/ ALSEP/ P&FS H-50 Count	Apollo H-70 Count	ALSEP/ P&FS S-30 Count Receive & Record	ALSEP/ P&FS S-30 Count Real Time	Line No.
Apollo	X			X			1
ALSEP/P&FS Real Time		X				X	2
ALSEP/P&FS Receive Record		X			X		3
Apollo/ALSEP/P&FS Real Time	X*	X*	X				4
Apollo/ALSEP/P&FS Receive and Record	X*	X*		X	X		5

*Applicable portions.

Table 1-5. Testing and Interface Requirements for Return from Standby Configuration "B"

Support: Previous	Support: Future	Testing and Interface Counts: Apollo SRT	ALSEP/P&FS SRT	Apollo/ALSEP/P&FS H-50 Count	Apollo H-70 Count	Apollo H-45 Count	ALSEP/P&FS S-30 Count Receive & Record	ALSEP/P&FS S-30 Count Real Time	Line No.
Apollo	Apollo					X			1
	ALSEP/P&FS Real Time		X(1)					X	2
	ALSEP/P&FS Receive & Record		X(1)				X		3
	Apollo/ALSEP/P&FS Real Time		X(1)	X					4
	Apollo/ALSEP/P&FS Receive and Record		X(1)			X			5
ALSEP/ P&FS Real Time	Apollo	X(1)			X				6
	ALSEP/P&FS Real Time							X	7
	ALSEP/P&FS Receive & Record						X		8
	Apollo/ALSEP/P&FS Real Time	X(1)		X					9
	Apollo/ALSEP/P&FS Receive & Record	X(1)			X				10
ALSEP/ P&FS Receive & Record	Apollo	X(1)			X				11
	ALSEP/P&FS Real Time		X(1)					X	12
	ALSEP/P&FS Receive & Record						X		13
	Apollo/ALSEP/P&FS Real Time	X(1)	X(1)	X					14
	Apollo/ALSEP/P&FS Receive & Record	X(1)			X				15

(1) Applicable portions.

Table 1-5. Testing and Interface Requirements for Return from Standby Configuration "B" (cont)

Support: Previous	Support: Future	Testing and Interface Counts: Apollo SRT	ALSEP/P&FS SRT	Apollo/ALSEP/P&FS H-50 Count	Apollo H-70 Count	Apollo H-45 Count	ALSEP/P&FS S-30 Count Receive & Record	ALSEP/P&FS S-30 Count Real Time	Line No.
Apollo/ALSEP/ P&FS Real Time	Apollo	X(1)			X				16
	ALSEP/P&FS Real Time							X	17
	ALSEP/P&FS Receive & Record						X		18
	Apollo/ALSEP/P&FS Real Time			X					19
	Apollo/ALSEP/P&FS Receive & Record	X(1)			X				20
Apollo/ALSEP/ P&FS Receive & Record	Apollo					X			21
	ALSEP/P&FS Real Time		X(1)					X	22
	ALSEP/P&FS Receive & Record						X		23
	Apollo/ALSEP/P&FS Real Time		X(1)	X				X	24
	Apollo/ALSEP/P&FS Receive & Record					X			25

(1) Applicable portions.

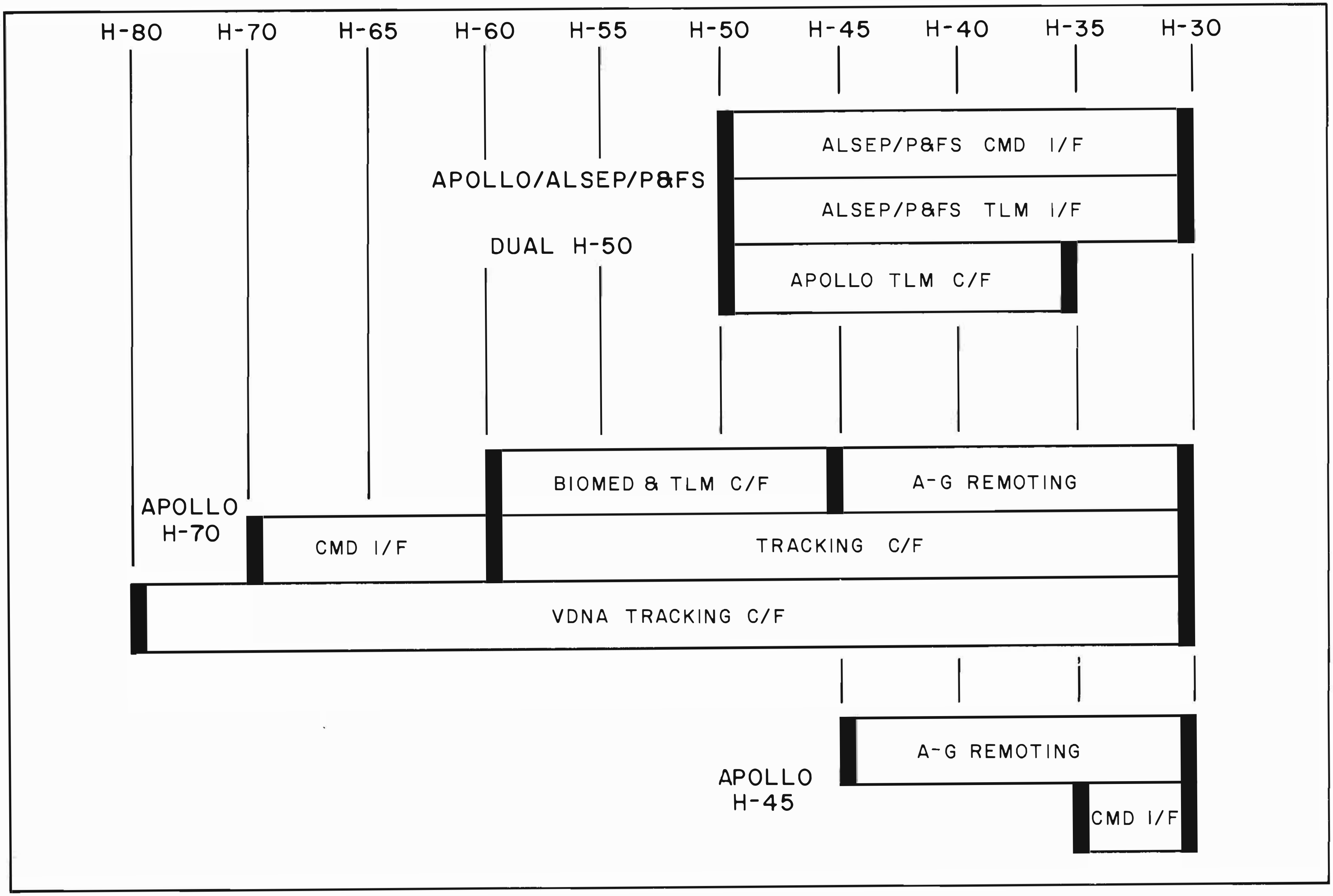


Figure 1-8. Apollo 17 Horizon Interface Counts

1.2.3.7 Plus Time Interface Test Description. The following is a description and/or sequence of events for the plus time interface tests indicated in figure 1-8.

a. Apollo Command Interface Test

(1) Command interface testing will be performed at the time specified in the Apollo H-70 count, H-45 count, or at any other time as specified by MCC NC.

(2) Sites will initialize per their mission support requirements.

(3) Nominal testing sequence is as follows:

Position	Action
NOM, NC, OPSR, RTC	Start MCC CMD interface tests on Net 2.
OPSR	Carrier(s) and CMD subcarrier(s) on, radiating into the dummy load. SAFE/OPERATE switch set to OPERATE. MAP verification not required.
RTC	Execute USB site status requests.
RTC	Execute load inventory.
RTC	Execute DCA SELF TEST (if LM/LCRU support has not been terminated).
RTC	Execute crew alarm off.
RTC	Execute CTE update.
RTC	Execute LM and/or CSM type 1 CMD histories.
RTC	Give OPSR go/no-go.
OPSR	Turn off carrier and CMD subcarrier. Execute USB site status request. Execute CMD history EOF. SAFE/OPERATE switch to SAFE.
OPSR RTC	CMD interface testing complete.

b. ALSEP/P&FS Command Interface Test

(1) General. Command interface testing will be performed at the time specified in the Apollo/ALSEP/P&FS Support H-50 or ALSEP/P&FS Support S-30 count in the ALSEP/P&FS NOSP, or at any other time specified by ALSEP NC.

(2) Nominal Testing Sequence

Position	Action
NOM, OPSR ALSEP NC	Start MCC ALSEP CMD interface test on Net 2.
OPSR	ALSEP carrier or P&FS carrier and sub-carrier on, radiating into dummy load. SAFE/OPERATE switch set to OPERATE.
ALSEP NC	Execute site status requests.
ALSEP NC	Execute RTC's 171, 172, and 174 for appropriate ALSEP vehicle or RTC's 61, 62, and 67 for P&FS.
OPSR	Remove modulation and carrier from dummy load. Execute low-speed history. When history is completed, enable critical groups requested by ALSEP NC.
ALSEP NC	Request ALSEP and P&FS RTC inventory once critical groups are enabled.

c. Engineering and Biomed CADFISS Telemetry Testing

(1) TLM CADFISS testing will be performed at the time specified in the Apollo H-70 count, Apollo/ALSEP H-50 count, or at any other time specified by the NOM.

(2) CADFISS TC will request NOM to take stations off Net 3 conference during the test period.

(3) Stations will utilize NCG-999 in the telemetry computer for all telemetry CADFISS testing prior to the start of the terminal count. NCG-742 will be utilized for all terminal count and plus-time activities.

(4) The biomed/plus-time tape positioned at T plus 4 minutes will be the data source. The 30-foot stations will use tracks 6 (CSM HBR), 11 (FM biomed), and 7 (LM HBR). The 85-foot stations will use tracks 5 (SM-6), 6 (CSM HBR), and 11 (FM biomed).

(5) TLM formats will normally be as follows (unless otherwise specified by the CADFISS TC):

Note

The format with the lowest numerical value will be the primary source code; the format with the highest numerical value will be the secondary source code.

(a) Coast Phase (TLC)

1. 85-ft Stations

a. Format 008 primary.

b. Format 016 secondary.

c. Format 006 alternate format.

d. Formats 456 and 416 biomed.

e. Format 415 alternate format.

2. 30-ft Stations

a. Format 007 primary.

b. Format 009 secondary.

c. Format 006 alternate format.

d. Formats 456 and 416 biomed.

e. Format 415 alternate format.

(b) Lunar Orbit Phase

1. 85-ft Stations

a. Format 008 primary.

b. Format 016 secondary.

c. Format 006 alternate format.

d. Formats 423 and 410 biomed. (After PLSS jettison, delete format 423; after LM jettison, use TEC formats.)

e. Format 401 alternate format.

2. 30-ft Stations

a. Format 010 primary.

b. Format 014 secondary.

c. Format 008 alternate format.

d. Formats 423 and 410 biomed. (After PLSS jettison, delete format 423; after LM jettison, use TEC formats.)

e. Format 401 alternate format.

(c) Coast Phase (TEC)

1. 85-ft Stations

a. Format 008 primary.

b. Format 016 secondary.

c. Format 006 alternate format.

d. Formats 456 and 546 biomed.

e. Format 400 alternate format.

2. 30-ft Stations

a. Format 006 primary.

b. Format 008 secondary.

c. Format 007 alternate format.

d. Formats 456 and 546 biomed.

e. Format 400 alternate format.

(d) H-50 testing will be the same as H-70 except there is no biomed testing in the H-50 count.

(6) The testing sequence is as follows:

(a) Station will perform a LOST/ROST, mount the CADFISS biomed tape, start the recorders, and output data (NOCC and CADFISS) at the time specified in the count.

Note

Do not wait for the CADFISS cue.

(b) TLM formats will be selected by the OPSR for the H-50 and H-70 counts.

(c) CADFISS TC will advise the stations of the test results and/or reruns required.

d. Tracking CADFISS Testing

(1) Tracking CADFISS will be performed at the times specified in figure 1-8 or at any other time specified by the NOM.

(2) CADFISS TC will request NOM to take sites off Net 3 conference during the testing period.

(3) Sites will utilize the 29-point acquisition message transmitted during the terminal count for the APP test.

(4) Nominal ships position (SHNOM) for CADFISS will be the TSP designated for launch.

(5) Wing station high-speed boresight testing will be conducted at the completion of prime station high-speed boresight testing. Prime station high-speed APP testing will be conducted at the completion of the wing station high-speed boresight testing. Wing station high-speed APP testing will be conducted at the completion of the prime station APP. Low-speed tracking tests for the wing and prime site may be run simultaneously for the same type of test. This method will be used when only low-speed tests are being run. Wing stations will configure in the direct drive mode for the CADFISS APP test.

(6) Low-speed tracking data will be transmitted at 1 frame per 10 seconds using a "DD" header.

(7) Requirements for high-speed tracking CADFISS will be indicated in the release message. Normally this test will only be performed for each tracking CADFISS test conducted from LOI-7 hours through TEI and with stations required for VLBI tracking. A Variate Difference Noise Analysis (VDNA) CADFISS test will be conducted with stations required for VLBI tracking at H-80.

(8) Stations will configure to as near SCM or ISP assignments as possible; however, systems 1 and 2 or 3 and 4 cannot be on the same vehicle. Under these circumstances, another vehicle will be substituted for system 2 or 4. The OPSR will advise the NOM of the station's configuration during the station briefing prior to H-70. CADFISS will be conducted in the configuration selected by the stations.

(9) The nominal CADFISS "cues" are as follows:

(a) Dual Station USB, Switchable TDP: BDA, TEX, CYI

TRKL & H/BOR-RA/U-CM

TRKL & H/POS-U/U-LM

(b) Single Station USB: ETC

TRKL & H/BOR-RA/U-CM

TRKL & H/POS-U/U-CM

(c) Dual Station USB: ACN, CRO, GDS, GWM, HAW, HSK, MAD, MIL

TRKL & H/BOR-RA/U-CM-LM

TRKL & H/POS-U/U-CM-LM

(d) Wing Station Testing: GDSX, HSKX, MADX

TRKL & H/BOR-RA/D-CM-LM

TRKL & H/POS*/D-CM-LM

*H for HSK, M for RID, G for PLA

(10) CADFISS TC will advise stations of results and/or reruns as required.

e. A-G Remoting

(1) A-G remoting will be performed at the time specified in the Apollo H-70 count, Apollo H-45 count, AOS -5 check, or at any other time specified by Houston ComTech.

(2) Nominal testing sequence for Apollo H-70 and Apollo H-45 counts is as follows:

(a) Call station ComTech and advise: "Station ComTech, this is Houston ComTech, stand by for A-G remoting test."

(b) The Houston ComTech will transmit a steady mark tone for 60 seconds. All stations will measure the tone level, record this information, and pass it to Houston ComTech as requested.

(c) The Houston ComTech will transmit a steady space tone for 60 seconds. All stations will measure the tone level, record this information, and pass it to Houston ComTech as requested.

(d) The Houston ComTech will request mark and space tone levels from each station. Those stations not having satisfactory levels will be removed from the conference and will work with Goddard Voice Controller to restore their circuit. After completion of the test and release of stations passing the test, the Houston ComTech will work with stations failing the test until they are "go."

(e) Houston ComTech will send a series of keys. At this time, station ComTechs will adjust the Quindar sensitivity control only if the receiver is not keying reliably.

(f) Houston ComTech will request all applicable stations to remote VHF Simplex A, and stand by for keying and modulation checks. The Houston ComTech will perform keying and modulation checks as follows: operate the push-to-talk switch, starting with a count of "one", deactivating and activating the push-to-talk switch between each numeral; then give a long test count with push-to-talk switch activated continuously ("one" to "five" and back to "one"). During this test count, the station ComTech will check the VHF keying and modulation level, record this information, and pass a "go" or "no go" on modulation and percent of keys to the Houston ComTech upon his request.

(g) Houston ComTech will announce for all applicable stations to remote VHF Simplex B and stand by for keying and modulation checks. Perform checks as outlined in step (f).

(h) The Houston ComTech will announce: "All stations, remote USB-CSM and stand by for keying and modulation checks." Perform checks as outlined in step (f).

(i) The Houston ComTech will announce: "All stations, remote USB-LM, and stand by for keying and modulation checks." Perform checks as outlined in step (f).

(j) The Houston ComTech will announce: "All applicable stations, remote USB-LCRU, and stand by for keying and modulation checks." Perform checks as outlined in step (f).

(k) The Houston ComTech will request results of keying test, percent of keys and modulation levels for "go/no go."

(l) The Houston ComTech will call each station individually and request the station ComTech to transmit a simulated downlink tone on USB-CSM, USB-LM, USB-LCRU (if applicable), and VHF Simplex A and B (if applicable) to MCC. The Houston ComTech will record the information and notify the station ComTech of received levels from the station.

(m) VHF checks will be omitted after TLI.

(n) 85-foot stations will remote the systems that will be active during the upcoming support period.

(3) Nominal testing sequence for AOS-5 checks is as follows:

(a) At AOS-5 minutes for each lunar rev of the CSM, ComTech performs A-G circuit interface checks on the CSM A-G circuit.

(b) Houston ComTech contacts station(s), prime and backup for CSM, on Net 2 requesting AOS-5 check on GOSS Conf/Net 1.

Note

In case of a dual A-G configuration, only the prime station assigned to the CSM will be checked.

(c) Houston ComTech performs keying and voice checks on GOSS Conf/ Net 1.

(d) In the event AOS-5 check is "no go," Houston ComTech will implement contingency procedures in accordance with para 1. 3. 5.2 of this NOSP.

(e) Houston ComTech reports results of AOS-5 check to Network.

CONTENTS

1.3.1 OPSR

1.3.1.1 Station Support Capability Reporting

a. Purpose. To keep GSFC and MCC aware of station status and configuration.

b. Participants. Operations supervisor (OPSR), Network Controller (NC), and Network Operations Manager (NOM).

c. Procedures

Note

> The following procedures apply when a station is operationally manned. At other times reporting will be done in accordance with section 16 of this NOSP.

(1) When a failure of mission-required station equipment occurs that does not affect support capability and/or for which a backup capability exists, perform the following:

(a) Reconfigure (if required) to a back-up mode as soon as possible to prevent loss of support capability.

(b) The OPSR will report the equipment failure, impact, and Estimated Time of Operation (ETO) to the NC by voice when time permits.

(c) When the problem is defined, the OPSR will transmit the appropriate status report in accordance with section 16 of this NOSP.

(2) When a mission-required station equipment failure occurs that affects support capability, perform the following:

(a) Reconfigure station equipment to provide the maximum possible support.

(b) The OPSR will immediately report to the NC the failure, impact, ETO, and corrective action being taken.

(c) When the problem is defined, the OPSR will transmit the appropriate status report in accordance with section 16 of this NOSP.

1.3.1.2 Station Readiness Testing

a. Purpose. To ensure station readiness for pass-time support.

b. Participants. OPSR and NOM.

c. Procedures

(1) General. The OPSR will conduct Station Readiness Tests (SRT's) as directed by the mission terminal count and mission prepass support counts. Additionally, the OPSR will send the appropriate SRT completion report, as described in STDN No. 502.16, at SRT termination.

(2) Prelaunch. During the SRT all telemetry data will be terminated on station. Upon completion of the SRT, stations will type in LOS T/ROS T and configure for interface testing.

1.3.1.3 Prepass Radio Frequency Interference Check

a. Purpose. To report Radio Frequency Interference (RFI) which impacts mission support.

b. Participants. OPSR and NC.

c. Procedures

(1) At H-10, the OPSR will ensure that all local signal sources of RFI are off and no outside interference is present.

(2) If RFI which will degrade the performance of station systems is present during the station's view period, the OPSR will make a verbal report of RFI to the NC and transmit the appropriate teletype (TTY) RFI message in accordance with section 16 of this NOSP. During non-view periods, the OPSR will verbally report the RFI to the NOM and follow up with the RFI TTY message.

1.3.1.4 Site Configuration Message

a. Purpose. To define the Site Configuration Message (SCM) usage.

b. Participants. OPSR, Track, and NC.

c. Procedures

(1) General. A description of the earth-orbit and post-TLI SCM's is found in section 16 of this NOSP.

(2) Real-time Configuration

(a) Track will prepare and transmit SCM's to reach the station(s) a minimum of 30 minutes before horizon time, first scheduled support time, or a configuration change. If the real-time SCM is not on-station by H-30 minutes, the station will query Track.

(b) Occasional requests for configuration changes will be made verbally by Track without transmitting an SCM. Acknowledgement of these requests will be made verbally by the OPSR. If it is necessary for Track to notify stations verbally of a spacecraft downlink mode change, the notification will be addressed to and acknowledged verbally only by the two-way and back-up stations assigned to that vehicle.

(3) Launch Phase. Prior to launch, Track will prepare and transmit four sets of SCM's, covering four launch azimuths, to each station supporting the launch phase. The SCM's will be titled and used in accordance with the launch azimuths as follows:

SCM Title (degrees)	Launch Azimuth (degrees)
72	72 to 76
80	77 to 84
88	85 to 92
96	93 to 100

(4) Earth-Orbital Phase. A "go/no-go" decision for TLI will be made immediately preceding the event. Consequently, stations will receive SCM's for both continued earth-orbit and post-TLI support. The NC will indicate to the stations on Net 2 which configuration message is to be used. In addition, the NC will send a message to all stations informing them of the TLI burn.

(5) Post-TLI Phase

(a) General

1. After TLI, and until reentry, the SCM will include only those items which are applicable to translunar distances (Very High Frequency [VHF] and C-band, if used, will be included in the notes).

2. Configuration changes will be executed at the Ground Elapsed Time (GET) specified in the SCM and will remain in effect until a new SCM or verbal change is received. For example, if the new SCM requests low-speed data and the previous one indicated no low-speed data, the low-speed data will be transmitted to MCC at the GET specified in the latest SCM.

Note

Handovers may or may not occur at the specific GET in the SCM. (Refer to Handovers, para 1.3.1.10.)

3. All post-TLI SCM's will be acknowledged via TTY to HNET. If the acknowledgement is not received prior to support time -15 minutes, Track will query the station. Verbal acknowledgement on Net 2 will be accepted if TTY lines are disabled or in use for other support.

4. Scheduled support of the MARS 210-ft antenna will be designated as GDS system 5 in the respective SCM. All support from the MARS station will be coordinated through the GDS OPSR, who will provide a verbal cue to MARS upon any mission event which requires a configuration change.

5. Scheduled support of the Parkes 210-ft antenna will be designated as HSK system 5 in the respective SCM. All support from the Parkes station will be coordinated through the HSK OPSR.

(b) TLC and TEC Phases. Prior to H-30 minutes the station will receive an initial SCM for that view period. The OPSR will receive a new SCM no later than 30 minutes before a planned station configuration change.

(c) Lunar Orbit Phase. During LO phase, the station will receive an SCM by H-30 minutes of each CSM orbit. The SCM will configure a station for all vehicles it is scheduled to support and cover the period from CSM emergence of one orbit to CSM emergence of the succeeding orbit.

1.3.1.5 Liftoff Time/Launch Azimuth Information

a. Purpose. To inform station of planned Liftoff Time (LOT) and launch azimuth, and to verify these after liftoff.

b. Participants. NC and OPSR.

c. Procedures

(1) The OPSR will monitor Net 2 at approximately T-15 minutes for the prelaunch announcement of planned LOT and launch azimuth. The launch azimuth announcement will cue the OPSR on the set of acquisition messages and the SCM to use; the pointing data will be confirmed by NST USB.

(2) The OPSR will monitor Net 2 after liftoff for the announcement of LOT, and Greenwich Mean Time (GMT) of GET clock start.

(3) The OPSR will ensure that the LOT and launch azimuth are available to station personnel so that the correct acquisition and configuration information is utilized.

(4) After liftoff, the station will receive a TTY liftoff message which contains LOT, launch azimuth and the GMT of GET clock start.

(5) The OPSR will ensure that the GET clocks are updated whenever new information is received. After liftoff, the GET clocks will be set to reflect GMT of GET start time (as determined from the liftoff announcement or TTY liftoff message). This may differ up to 1 second from GMT of Liftoff (GMTLO).

1.3.1.6 Acquisition of Signal/Loss of Signal

a. Purpose. To define the station reporting requirements during AOS and LOS times.

Note

AOS is defined as the first indication of spacecraft RF.

b. Participants. OPSR and NC.

c. Procedures

(1) AOS. All stations will announce initial AOS of each earth-orbit pass or view period. In addition, the following announcements will be required:

(a) AOS resulting from emergence from lunar occultation, return from a low-signal strength, or Passive Thermal Control (PTC) will be announced by the designated prime and back-up stations only.

(b) If early emergence from lunar occultation occurs, the first station to acquire will announce on Net 2: "(station) AOS (vehicle)." 30-ft stations, other than the designated two-way and back-up, will refrain from making a duplicate announcement.

(c) If a station is unable to acquire two-way lock within 30 seconds of local horizon break, the OPSR will report to the NC on Net 2 as follows:

1. "Downlink lock only" (downlink receiver lock with no indications of uplink lock).

2. "Intermittent downlink lock, signal strength minus XXX" (intermittent downlink receiver lock due to weak signal with no indication of uplink lock).

3. "Intermittent two-way lock, signal strength minus XXX" (intermittent uplink and downlink receiver lock due to weak signal).

4. "Negative contact with (vehicle)" (no downlink signal detected from the expected vehicle).

(2) LOS. All stations will announce final LOS of each earth-orbit pass or view period on Net 2. Final LOS of each view period (day's support will also be announced) on Net 3. In addition the following announcements will be required:

(a) LOS resulting from lunar occultation, low signal strength, or PTC will be announced only by the designated two-way and back-up stations on Net 2.

(b) Stations supporting during an abort or reentry (resulting from early mission termination) will report the following to the NC on Net 2:

1. One minute to LOS, based on OPSR estimate.

2. Actual time (GMT and GET) of Unified S-band (USB) and/or C-band LOS and azimuth at final LOS.

1.3.1.7 Pass-time Announcements

a. Purpose. To delineate the required pass-time announcements.

b. Participants. OPSR and MCC.

c. Procedures

(1) Announcements. The station OPSR will make announcements found in table 1-6 as applicable.

Note

AOS (sequence 1) and LOS (sequence 15) announcements are further defined in para 1.3.1.6.

(2) Go-for-command Requirements. A station must have two-way lock and command modulation must be on. A station need not have solid Pulse Code Modulation (PCM) or USB exciter sweep decayed to zero, in order to be "go for command."

Note

LCRU "go-for-command" requirements after LM impact requires only command uplink capability.

(3) Break-break Procedures. Stations will use "break-break" procedures, as required, to make pass-time announcements affecting station support.

(4) Prime stations will announce to MCC all AOS/LOS mode changes (FM and PM) of the LCRU downlink. Backup stations will make announcements only if different from the prime station.

(5) Acknowledgements. MCC will acknowledge all announcements concerning command capability.

Table 1-6. OPSR Pass-time Announcements

Seq. No.	Conditions	Station	Announcement on Net 2
1	Upon acquisition of first spacecraft RF signal.	All	"(Station), AOS" (Announce AOS on CSM, IU, LM, SIM, or LCRU).
2	USB system has valid two-way lock and the command subcarrier modulation is on.	All	"(Station), go for command (vehicles)." If no command uplink is required, station will announce: "(Station) has valid two-way lock."
3	If for any reason the USB/UHF system is unable to command the vehicle per the SCM.	All	"(Station) unable to command (vehicles)." Give brief reason why the station is unable to command.
4	If the USB is locked on the spurious signal or subcarrier, or the antenna is tracking on a side lobe.	All	"(Station) USB has invalid (vehicles) lock, am reacquiring."
5	When a station obtains valid USB lock after announcing "USB has invalid ------- lock, -------."	All	"(Station) has valid two-way lock; go for command on (vehicles)."
6	Station in receipt of CSM FM mode XX.	Two-way	"(Station) has lock on FM mode XX."
7	When a downrange station is within 30 sec of an expected handover and has not acquired three-way lock.	All	"(Station), unable to accept handover."

Table 1-6. OPSR Pass-time Announcements (cont)

Seq. No.	Conditions	Station	Announcement on Net 2
8	After verifying at the updata buffer that a continuous uplink is in progress (for priority CMD's only).	All	"(Station) has continuous uplink."
9	After verifying at the updata buffer that the continuous uplink has been terminated.	All	"(Station) continuous uplink terminated."
10	When a station is approximately 30 seconds away from entering the USB antenna keyhole.	30', 85'	"(Station) in keyhole -30 seconds."
11	When antenna enters keyhole.	30', 85'	"(Station) is entering the keyhole."
12	When a station goes out of the key-hole.	30', 85'	"(Station) out of keyhole."
13	If the ship is positioned so that the USB antenna will go into the radiation hazard zone or the max EL is greater than 85 degrees. (This announcement will not be made if no uplink configuration is called for on the SCM.)	VAN	"VAN in rad haz -30 seconds," or "VAN is max EL -30 seconds."

Table 1-6. OPSR Pass-time Announcements (cont)

Seq. No.	Conditions	Station	Announcement on Net 2
14	When the ship USB antenna is out of the radiation hazard zone or max El of 85 degrees or greater zone. (This announcement will not be made if no uplink configuration is called for on the SCM.)	VAN	"VAN out of rad haz," or "VAN out of max EL."
15	Upon receipt of the CSM or LM 29-point acq message for an upcoming rev, the station OPSR should evaluate the validity of the predicted LOS based on the station's antenna masking. If the masking will cause an LOS more than 30 seconds early, OPSR will make this announcement in addition to other LOS announcements.	All two-way stations	"(Station) LOS -1 minute."
16	When a spacecraft RF link is lost prematurely.	All	"(Station), premature LOS on (vehicle)."
17	When the last spacecraft RF link is lost coincident with the end of a stations view period or pass.	All	"(Station) final LOS on (vehicle)."

1.3.1.8 Reporting of Spacecraft Anomalies

a. Purpose. To inform MCC of spacecraft anomalies.

b. Participants. NOM, MCC, OPSR, and system supervisors.

c. Procedures

(1) Each system supervisor will inform the OPSR of any spacecraft anomalies observed from his area.

(2) The OPSR will verbally report the anomaly in real time to the NC followed by an Operations Message (OPN) to the NOM (GCTR) and NC (HNET).

1.3.1.9 OPSR Typical Pass Activities

a. Purpose. To provide a quick reference to nominal pass activities.

b. Participants. MCC, OPSR, and stations.

c. Procedures

(1) Typical Activities (Except Lunar Orbit)

Time	Station	Activities
H-30	All	Announce on PA system: "All personnel man your positions; stand by on the OPSR loop for voice and status check."
	All	Announce: "Voice recorders on; begin pre-pass checklist and configure per SCM DTG_________Z." (Query Track if the SCM is not on station.)
	All	Select CAM for command parameter listing and verify computer mode 2, Load Enable, as applicable. Confirm other constants. Confirm TLM formats selected as per NOSP. Perform LOS T/ROS T for the first support period.
	All	Set horizon clocks to expected AOS.
	All	Check each system for a "go" indication. Log all "red" items.
H-28	All	Verify all tracking systems can autotrack boresight towers.
H-20	All	On paging system, announce station at H-20 minutes. Give prepass briefing from SCM.
H-15 (pre-TLI)	All	Confirm system status, recorders loaded, and prepass cals and prepass checklists are completed. Receive acq message. Check each position for receipt of acq message. Query Track or NOM, as applicable, if acq message is not on station. High-speed telemetry on to NOCC only (biomed on to NOCC upon request only).
H-15 (post-TLI)	All	Confirm system status, recorders loaded, and prepass cals and prepass checklist are complete. Receive acq message. Check each position for receipt of acq message. Query Track or NOM, as applicable, if acq message is not on station.

Time	Station	Activities
H-15 (post-TLI) (cont)	Two-way and backup	High-speed telemetry on to NOCC only (biomed on to NOCC upon request only).
H-10	All	Confirm via negative reporting from systems that they are configured per the SCM and all local signal sources of RFI are off and no outside interference is present. Clear operating areas of all non-operating personnel.
H-8	30'	Confirm that acq bus is configured.
	All	Confirm that all antennas are pointing to initial point.
Carrier on -3	All	Set SAFE/OPERATE switch to OPERATE if CMD carrier is to be brought up.
H-5	All	Give time check on paging system: "Station is at H-5." Query TIC if HSD has not been turned on (earth orbit only).
H-3	All	Confirm with GCC that data links are configured.
H-2	All	Announce to systems: "Carriers on" or "Stand by for handover cue." Verify that status display shows systems are radiating (if applicable). On paging system announce: "Two minutes to acquisition, all recorders to flight speed."
By direction of SCM or MCC	All	Remote A-G to Net 1.
AOS	All	Make AOS announcements on Net 2. Log contact times.
	All	Monitor HS printer for CMD's to change PCM bit rate. Announce all bit-rate change CMD's on OPSR loop.
Passtime	All	Make appropriate dump announcements.
H+1	All	Reconfirm with GCC that data is on line. Monitor status lights and loops for problems.
PCA	All	Log PCA time (if applicable).
LOS (premature)	Two-way and backup	Announce LOS of any link on Net 2. Log GMT and GET. Attempt to reacquire the spacecraft signal.
LOS (final)	All	Announce LOS on Net 2. Log GMT and GET.

Time	Station	Activities
By direction of SCM or MCC	All	Go local on A-G.
LOS+2	30'	Obtain CRF inputs.
	All	Announce to data recorders on the OPSR loop: "Data recorders off." Obtain system status from system supervisors. Start preparation of CRF message if applicable.
Carriers down	All	Announce on the OPSR loop: "Carriers off."
Carriers down +3	All	Execute appropriate CMD histories.* Set SAFE/OPERATE switch to SAFE.
LOS+5	All	Upon receipt of TLM off indication, verify HS TLM data terminated. If no TLM off indication, initiate TLM/biomed off.
LOS+10	All	Announce: "Voice recorders off." Lift station security. Write EOF. Execute log tape dump.
End-of-view period +10	All	If requested, verify that RSDP executes OUCH for the day's activities.

*These CMD histories are not applicable at HO + 3 for intrastation handover.

(2) Typical Activities (Lunar Orbit)

Time	Station	Activities
At time given by SCM, approximately AOS-15	All	Confirm that all positions are manned.
	Two-way and backup	Confirm that low-speed tracking data is on. High-speed telemetry on to NOCC only (biomed on to NOCC upon request only).
	Two-way	Confirm that R&E tech has begun sweeping uplink.
AOS-5	Two-way and backup	Perform A-G keying and modulation checks on Net 1.
AOS-2	All	Confirm that APP tech has selected computer drive (CSM or LM acq message), loaded nominal acq message into APP, and begun operation.
	All	Confirm that low-speed tracking data is on.
	All	Announce: "Two minutes to acquisition, all recorders to flight speed."
AOS	Two-way and backup	Make AOS announcement.
Passtime	Two-way	Make go-for-CMD announcements as applicable.
LOS (occultation)	Two-way and backup	Make LOS announcement.
LOS +2	All	Confirm low-speed tracking data is off.
	All	Announce: "Data recorders off."
	Two-way	Confirm that R&E tech has the modulation inhibited.
		Note During CSM crew sleep periods in lunar orbit, MCC will direct the two-way station to bring down the CSM uplink carrier prior to CSM LOS (approximately 4 to 5 minutes). This will prevent the CSM high-gain antenna from tracking into its stops and thereby oscillating, as well as enhancing the next acquisition.
	85'	Confirm that servo tech has selected program mode (lunar track tape).
	Two-way	Confirm that ComTech has inhibited downlink voice.

Time	Station	Activities
LOS +3	Two-way	Execute appropriate CMD histories.
LOS +10 or at MCC request	Two-way	Write EOF. Execute log tape dump.
	All	Set the horizon clocks for the next expected AOS.

Note

Unless otherwise directed, only the two-way and backup stations should be transmitting engineering TLM data to NOCC. This data should start at two-way or backup support minus 15 min and end at two-way or backup support plus 5 min.

1.3.1.10 Handovers

a. Purpose. To define the various types of handovers and interfacing procedures.

b. Participants. OPSR, USB, Real-time Command (RTC), and NC.

c. Procedures

(1) General

(a) In these procedures, the term "outgoing station" refers to the current two-way controlling station and the term "incoming station" refers to the current three-way station receiving the handover.

(b) MCC-initiated handovers will be conducted on Net 2. However, the handover will be conducted on Net 1 if only Net 1 is available to one of the stations involved in the handover.

(c) When applicable, the OPSR will ensure that the VHF A-G capability is handed over at the same time as the USB capability.

(2) Launch/EO/Entry Phase (Omni Antenna)

(a) Handovers scheduled by SCM will be conducted at the time specified in the SCM without cue from RTC.

(b) If for any reason MCC desires a handover either not scheduled in the SCM or at a time other than that specified in the SCM, it will be conducted upon verbal cue from RTC.

(c) Refer to section 4 for omni handover procedures.

Note

Entry phase begins at entry interface minus 30 minutes.

(3) Post-TLI Phases

(a) General

1. All post-TLI handovers will be conducted by RTC count. Although the handovers will normally occur at the time specified in the SCM, stations will not hand over unless an RTC countdown is received.

Note

If the handover occurs while the spacecraft is out of view, such as during lunar occultation, RTC may direct the stations to hand over per SCM without a countdown.

2. Prior to the handover, RTC will provide the station the following information on Net 2 as outlined in the handover sequence.

a. The station handing over.

b. The station going two-way.

c. The GET of handover (if time permits).

d. The SC involved.

e. The USB uplink mode required.

f. The handover procedure to use.

(b) LCRU Handovers

1. Prior to LM impact the LCRU will be handed over with the LM vehicle using the appropriate LM handover procedures.

2. After LM impact, the LCRU vehicle will be identified on the SCM. No handovers are anticipated. The normal non-coherent acq procedure will be used (refer to para 4. 3. 3. 3).

(c) Omni Handover. Refer to STDN No. 502.4 for omni handover procedures.

(d) CSM/LM High-gain Antenna Handover, LM and IU Offset Frequency Handovers

1. RTC announces: "(Outgoing station), (Incoming station), standby for vehicle handover at (GET). Use (handover type) procedure. Uplink mode X required."

2. Thirty seconds prior to handover RTC confirms that the stations are prepared to hand over.

3. RTC announces: "Handover on my mark, 5-4-3-2-1, mark." (RTC will count down to a mark for the handover.)

4. Incoming station announces: "(Incoming station) go for command (vehicle)." If no command capability is required station will announce: "(Incoming station) has valid two-way lock."

(e) LM FM High-gain Antenna Handover

1. Handover Procedures. Refer to section 4 for LM FM high-gain antenna handover procedures.

2. Handover Sequence

a. RTC announces: "(Outgoing station), (incoming station), stand by for LM handover at (GET). Use LM FM high-gain antenna handover procedure. Uplink mode X required."

b. Thirty seconds prior to the handover, RTC confirms that the stations are prepared to hand over.

c. RTC will count down to a mark for the handover. RTC announces: "Hand over on my mark, 5-4-3-2-1, mark." At the count of "3", the station accepting the handover will turn the uplink carrier on. At the count of "mark" the station handing over will turn the uplink carrier off.

d. Incoming station announces: "Handover complete" and if command capability is required, "(Incoming station) go for command, LM."

(f) Station-initiated Handover (System-to-system Including Prime-to-wing and Wing-to-prime)

1. If an equipment failure occurs which prevents a designated system from completing its two-way commitment, the OPSR will hand over to a system that is unassigned or is passively tracking the same vehicle. The system accepting the handover will assume the full configuration requirements of the malfunctioned system. Upon completion of the handover, the OPSR will announce the command capability, as required, and the vehicle. Also, the OPSR will inform the NC of the following:

a. Time (GMT) of handover (to the nearest second).

b. System receiving the handover.

c. Nature of failure(s).

d. ETO of "red" equipment.

e. Status of system which caused the handover (i.e., able/unable to three-way track the vehicle).

2. If a backup system is not available, the OPSR will notify the NC of the failure and wait for further instructions.

3. Should the problem be corrected prior to the termination of the station's two-way support requirement, the OPSR will not perform a handover back to the original system without the concurrence of the NC.

(g) Unscheduled Handovers

1. High-gain and Frequency Offsets. All unscheduled high-gain and frequency offset handovers will be at a specified GET as directed by RTC, using the same procedure as outlined in para 1.3.1.10 c (3) (d).

2. Omni. Whenever possible, RTC will conduct unscheduled omni handovers at a specified GET. Refer to STDN No. 502.4 for omni handover procedure.

3. Urgent Handovers. When it is necessary to hand over as soon as possible, the following omni procedure handover sequence will apply:

a. RTC announces: "(outgoing station), (incoming station), stand by for (vehicle) handover as soon as possible. Use (handover type) procedure, uplink mode X required. Confirm when you are ready for handover."

b. Both stations confirm when they are ready for handover.

c. RTC announces: "Hand over on my mark: 5-4-3-2-1 mark." (RTC will count down to a mark for the handover.)

d. Incoming station announces: "(Incoming station) go for command, (vehicle.)" If no command capability is required, station will announce: "(incoming station) has valid two-way lock (vehicle.)"

1.3.1.11 Acquisition Messages

a. Purpose. To define the use of acquisition messages.

b. Participants. OPSR, acq computer, tracking systems, Track, NC, and NOM.

c. Procedures

(1) General. Acquisition messages are transmitted to STDN stations by GSFC or MCC and are of three types: USB 29-point X-Y, 6-point az-el, and Inter-range Vector (IRV). If the station acquisition message from MCC is not received by H-15, or if conflicting messages are received, the OPSR will query Track. If acquisition messages are required to be transmitted from GSFC and are not received by H-15 or they are garbled or conflicting, the OPSR will query the NOM. Acquisition message formats are contained in section 16 of this NOSP.

(2) USB 29-point X-Y (30', 85'). The 29-point acquisition message is transmitted to all USB stations.

(a) Prelaunch. The nominal 29-point acquisition messages will be generated by GSFC and transmitted to each station approximately 7 days prior to the mission. These acquisition messages will be for various launch azimuths in 4-degree increments through the first revolution.

(b) Real-time. The real-time 29-point acquisition message will be transmitted to all USB stations. The 29-point acquisition messages generated by MCC will reflect the station masking due to keyhole and terrain. It will be generated either by GSFC or by MCC and transmitted approximately 30 to 60 minutes prior to predicted acquisition. The Doppler predict portion of the message will be supplied to the RE tech for setting the acquisition zone selector.

(c) No-burn Acquisition Messages

1. General. No-burn acquisition messages for major events will be generated by MCC. These messages will be labeled "LM No-Burn" which distinguishes them from the CSM acquisition messages containing the burn maneuver. The NC will announce on Net 2 the success or failure of the burn maneuver and the acquisition message to be used. Acquisition messages subsequent to an abnormal maneuver will be labeled "CSM".

2. TLI. "LM no-burn" acquisition messages will be transmitted to those stations having AOS within 30 minutes of the scheduled TLI. These messages will be used if TLI does not occur. If the first TLI opportunity is bypassed, the procedure will be repeated for the second TLI opportunity.

3. LOI. "LM no-burn" acquisition messages will be transmitted to all stations scheduled to support the emergence following LOI. Moon I and early emergence pointing data will not be used.

4. TEI. "LM no-burn" acquisition messages will be transmitted to all stations scheduled to support the emergence following TEI.

5. Confirmation. Track will announce on Net 2 when the no-burn acquisition messages are transmitted and will confirm receipt at the prime and backup stations. All other stations scheduled to support will report to Track, on Net 2, if not in receipt of the message 15 minutes after the announcement.

(d) Forced Acquisition Messages. Any MCC acquisition message not generated on program cue will be labeled "Forced." This will include retransmission of mission or garbled messages, lunar stay messages, and any other out-of-sequence messages. All "Forced" acq messages will be acknowledged.

(e) S-IVB. Acquisition messages will be generated by MCC and transmitted to all stations scheduled to support the S-IVB until CCS transponder battery depletion (approximately 85 hours or lunar impact). These messages will be designated "LM FORCED" and will be acknowledged.

(3) 6-point Az-El (VAN and 30' Stations). The 6-point acquisition message is provided primarily for C-band radar and VHF telemetry systems, but can be used as a backup for stations with a 30-foot USB antenna. Upon receipt of the 6-point acquisition message, az-el to X-Y conversion charts may be used to construct six X-Y coordinates for use by the servo operator as backup pointing data.

(4) IRV

(a) VAN. The IRV is transmitted to the VAN as an acquisition source.

(b) Land Stations. BDA, CRO, and MLA C-band radars will receive an IRV for use as an acquisition source.

(5) Operating Procedures for Acquisition (Acq) Computer

(a) General. The acq computer will be used primarily to process the 29-point acquisition messages for directly driving the USB Antenna Position Programmer (APP) and for producing a backup drive tape used with the APP. APP tapes should be processed for the following maximum intervals:

		Word/Intervals (sec)	
From	To	30-ft	85-ft
Launch	TLI + 1 hour	10	10
TLI + 1 hour	LOI	50	25
LOI	TEI + 1 hour	100	50
TEI + 1 hour	EI - 4 hours	50	25
EI - 4 hours	Splash	10	10

Note

These times were calculated on the premise that the tape mode of operation is the third order tracking mode when utilizing RAPID, which is capable of driving the APP real time while processing a 29-point acq message. At station option any acq message may be processed at faster word intervals for any phase when deemed necessary.

(b) Processing of Acquisition Messages

1. Nominal 29-point Acquisition Messages. These messages should be processed to produce APP drive tapes and tabulations for use during simulations and station coverage analysis and as a nominal backup to real-time 29-point acquisition messages.

2. Real-time 29-point Acquisition Message. Immediately upon receipt, the operator should first produce a backup APP drive tape from the 29-point acquisition message TTY tape, then reconfigure for direct drive operation. A listing of the APP drive tape may be produced at station option.

Note

The 85-foot wing station APS (SDS 910) computer will be configured for direct drive operation. Stations will have the option, if time permits, to produce an APP drive tape prior to AOS. When autotrack has been established by the wing's 85-foot antenna, the station has the option to take the APS off-line and produce a backup APP drive tape, or produce the drive tape utilizing the DIS/XDS 920 computer. Operating procedures for the SDS 910/XDS 920 computers are provided in section 5 of this NOSP.

3. Conflicting Acquisition Messages. If conflicting messages are received, notify the OPSR before processing a backup drive tape. The OPSR, after querying GSFC or MCC, will inform the operator as to the correct message. If necessary, a new APP drive tape will be processed from the correct message.

4. Late Receipt of Acquisition Messages. If time is not available to provide a backup APP drive tape, configure for direct drive operation.

5. Post-TLI APP/Acq Computer Interface Procedures

a. Before the spacecraft enters lunar orbit, the acq computer operator will cut APP tapes (for moon tracking) for the day(s) that the spacecraft will be in lunar orbit. Each APP tape will be tagged with the correct date.

b. When the acquisition message is received for the next AOS, the acq computer operator will cut an APP drive tape and then select the message for real-time drive.

6. Acquisition Messages After LM/CSM Separation. When acquisition messages are received for both vehicles, the operator, after informing the OPSR, will generate an APP drive tape for the two vehicles. The OPSR will instruct the operator as to which vehicle has priority. After both APP drive tapes have been generated and properly annotated, the operator will select the priority vehicle acquisition message for real-time drive.

(6) Contingency Procedures for the 1218 Computer. If the DAPP 1218 computer becomes inoperative, the station OPSR will report to TIC/Track on Net 2 and request permission to use the TAM 1218 computer to process 29-point acq messages for APP drive tapes. Upon completion of the processing, the station OPSR will return the TAM 1218 computer to its original configuration and will report this action to TIC on Net 2.

(7) Typical Pass Activities for 1218 Computer Operator

Time	Activities
H-30	Monitor applicable loops; load program.
H-25	Produce APP drive tape.
H-15	Reconfigure for direct drive operation.
AOS	Monitor operations. Process 29-point acquisition messages as received.
LOS+2	Brief OPSR on system status. Report all "red" items and ETO.

(8) Operating Procedures for USB

(a) General. The USB supervisor will notify the OPSR if the acquisition message has not been received by 15 minutes prior to the scheduled pass, or end of acquisition message, as applicable.

(b) 29-point Acquisition Message (30', 85'). The USB supervisor will have the individual points of the 29-point acquisition message time annotated and use the hard copy as a backup for the APP and as a spot check on the 1218 computer listing (if a listing is generated). The Doppler predict portion of the message will be supplied to the RE tech for use in setting the acquisition zone selector.

(c) Lunar Track Acquisition Messages (85-foot)

1. GSFC will generate and transmit the lunar tracking acquisition messages for 85-foot stations. The messages will be used to track the expected point of emergence for the spacecraft during the view period of the moon on each day. The acq computer operator will used the RAPID program (or DOI 5039 OP-A [APS operational program/MSFN mode] in the case of the wing sites) to produce an APP drive tape to be used in the event of any early emergence.

2. Whenever the lunar-track messages are used, USB should compare the actual antenna track with visual sightings, weather permitting. If the program track becomes erroneous, the servo tech should reposition the antenna and manually track the expected point of emergence.

(d) Lunar Track Acquisition Messages (30-foot). The 30-foot stations will use the real-time acq messages and RAPID or DOI 5039 OP-A to position the antenna for a possible early emergence (prime and/or backup station).

1.3.1.12 GET Update

a. Purpose. To define when and how GET clocks will be updated during the mission.

b. Participants. NC, Track, OPSR, and timing tech.

c. Procedures

(1) The GET clocks on board the spacecraft and at ground stations may be updated periodically during the mission. This will allow certain mission events to occur at the nominal GET as specified in the Flight Plan. Updates may occur if a delta greater than 1 minute occurs.

Note

Spacecraft CTE times will not change as a result of this clock update.

(2) The NC will advise all stations via a GET Update Message when GET clocks should be updated. The message format is specified in section 16 of this NOSP and will include the updated GET and the GMT when clocks should be updated.

(3) If necessary, Track will transmit new SCM's to reflect the updated GET.

(4) The OPSR should update GET clocks at the GMT specified in the TTY message and should advise affected positions to use updated SCM's.

Note

The OPSR should ensure that computer times are not changed to reflect the undated GET.

1.3.1.13 LM Communications Test

a. Purpose. To define the Network support required for the LM Communications Test.

b. Participants. OPSR, NC, Track.

c. Procedures

(1) At approximately 36 to 37 hours and 57 hours GET, the LM communications system will be activated and communications check will be conducted between the LM, CSM, and the Network.

(2) One station will be configured as the active station on the LM for this test and another will be configured as backup. At LM activation, Track will direct the active station to begin uplinking mode 4 with continuous clock. The LM will be on an omni antenna and the LM and IU frequency will be offset for this test.

(3) During the test, the LM crew will initiate the following sequence of downlink modes:

Mode 4 backup voice	LBR/HBR
Mode 8 backup voice	HBR/LBR
Mode 1 normal voice	LBR/HBR
Mode 2 normal voice, PRN	LBR

The two-way station should report, on Net 2, all changes in the LM downlink mode to include:

(a) Telemetry bit rate changes.

(b) Voice mode changes.

(c) Detection and loss of biomed subcarrier.

(d) Detection of clock code turnaround.

(4) The LM will be powered down and Track will direct the active station to bring down the LM carrier. The active and backup stations will then reconfigure for normal support.

(5) The active station should record the LM downlink as specified in tables 2-13 and 2-32.

1.3.1.14 EVA Support Configuration. To be supplied, if required.

1.3.1.15 LM Ascent Support Configuration. To be supplied, if required.

1.3.1.16 Real-time DSE Dump Voice Remoting

a. Purpose. To describe the Data Storage Equipment (DSE) dump voice remoting to MCC in real time.

b. Participants. OPSR, Comm Mgr, Comm Control, NC, TIC, NOM.

c. Procedures. The DSE recorder will be used extensively to record lunar farside landmark observations during crew wake periods. To provide the geologists with near real time capability to listen to and evaluate the comments, the following procedure will be implemented:

(1) In addition to being recorded on station, the DSE dump voice will be remoted to MCC from one of the 85-foot stations (as required) for all lunar orbits while the crew is awake.

(2) Stations will utilize Net 5 for remoting to GSFC. Stations will use Net 3 only if Net 5 is not available because it is being used for tracking data.

(3) Net 3 will not be configured without prior approval from the NOM.

(4) GSFC will utilize GOSS 7 for remoting to MCC (GOSS 10 will be used as backup).

(5) Comm Control will coordinate with the Comm Manager to configure the stations' Net 5 (or Net 3, as applicable) to GOSS 7.

(6) Prior to the AOS of each lunar rev for which dump voice remoting is required, TIC will instruct the station to configure to remote dump voice to Net 5 (or Net 3, as applicable).

(7) DSE dump voice to be remoted will be received at the station at a one-to-one ratio.

(8) OPSR will make the appropriate dump announcements as indicated in table 1-7.

1.3.2 TELEMETRY

1.3.2.1 Telemetry Computer Operations

a. Purpose. To define the telemetry computer operating procedures.

b. Participants. OPSR, Remote Site Data Processor (RSDP), Telemetry Instrumentation Controller, (TIC), NC, and PCM tech.

c. Procedures. For verbal reporting, the telemetry computer is the computer cycling the telemetry program.

(1) TLM Initialization Parameters. Prior to launch, the OPSR will be informed by MCC of the specific telemetry computer constants to be inserted during initialization. The 1232 Input/Output (I/O) console will input system initialization constants (mission number, station identification, GMT, LOT, etc.). If any changes to constants are made after initialization, they will be printed out on the 1232 I/O console.

(2) TLM High-speed Data Formats

(a) The TLM computer can output two different high-speed data (HSD) TLM formats on a single HSD line and one biomed format on another HSD line simultaneously. When a site first comes up for support, the formats should be selected as depicted in section 5 of this NOSP.

(b) TIC will normally execute any format changes. Should a format not change as directed by the execute, TIC will wait 5 or 10 seconds and re-execute the Program Request Matrix (PRM). If the format has not changed after three such executes, TIC will request the OPSR to execute the change via Computer Address Matrix (CAM).

(3) TLM Biomed ON/OFF

(a) Prelaunch. At T-20 minutes, TIC will execute telemetry biomed ON at launch support stations.

(b) Postlaunch. At approximately H-10 minutes, TIC will command telemetry/biomed on. If by H-5 minutes during earth orbit, the TLM HSD is not on, the OPSR will query TIC. TLM HSD will not be turned on locally unless requested by TIC. After TLI, only the two-way and backup stations will query TIC if the data is not turned on. If by LOS +5 minutes TIC has not executed telemetry "off," the OPSR will execute high-speed data "off." TIC has the option to command the HSD lines (engineering data and/or biomed Format 40) either ON or OFF.

(4) TLM Computer Contingency Procedures

(a) If the telemetry computer faults and Dump and Reload the System (DARTS) instantly reloads, the telemetry program will automatically start to cycle. The OPSR will verify via the high-speed printer that the TLM program is configured as it was prior to the fault and will report by voice to the NC.

(b) If the telemetry computer faults and DARTS or the telemetry recovery programs do not reload, the computer operator will immediately make three additional attempts to manually reload DARTS. The OPSR will notify the NC immediately after the manual loading attempt and report whether or not the attempt was successful. If the manual DARTS loading attempt was not successful, the station will immediately reload the telemetry program from the systems tape and inform NC of the telemetry computer status.

(c) When the TLM program fails, high-speed engineering data, including command CAP's and high-speed FMT 40 biomed data, will no longer be available for output to MCC. If directed by NC, the OPSR will configure the remaining computer for the TLM program. Refer to STDN No. 502.5/Apollo.

(d) If the TLM Magnetic Tape Unit (MTU) fails completely, telemetry capability may be restored with NC concurrence by use of the errata to operate the telemetry program from the channel 11 MTU. (Refer to section 5 of this NOSP.)

(5) LOS T/ROS T Typeins. At the completion of all prepass testing and interfacing, the station will enter LOS T/ROS T and configure for real-time support. Prior to typing in LOS T/ROS T, all PCM data must be inhibited to the telemetry program.

(6) Special Telemetry Procedure (85-ft/210-ft Antennas). When in view, the 210-foot antenna is the prime source of telemetry data for the CSM during the pass following DOI and for the LM during the descent/landing pass and ascent phases. The data will be interfaced as follows:

(a) At emergence, the OPSR will ensure that both 85-foot and 210-foot data are being input to the telemetry computer. The OPSR will inform TIC which data source is being transmitted to MCC.

(b) Should the 85-foot data be valid before the 210-foot data, and the 85-foot data is being transmitted to MCC, the OPSR will monitor for indications that the 210-foot data is valid. When the 210-foot data becomes valid, the OPSR will ensure that the 210-foot data is manually selected for processing by the telemetry computer. After the 210-foot data has been manually selected, the OPSR will verify that the 85-foot data is again being input to the telemetry computer, to provide continuity of data should the 210-foot data become invalid.

(c) Should the 210-foot data be valid prior to the 85-foot data, the OPSR need only ensure that both sources are being input to the telemetry computer.

1.3.2.2 Erasable Memory Octal Dump and Playback

a. Purpose. To define the interfacing procedures for playing back an Erasable Memory Octal Dump (EMOD) between the station and MCC.

b. Participants. OPSR, RSDP, TLM, and TIC.

c. Procedures

(1) EMOD. Prior to an EMOD, TIC will normally advise the OPSR of the impending dump. EMOD's are usually initiated by the crew. When initiated from MCC, EMOD commands can be observed by the execution of VERB SEVEN FOUR ENTER at the two-way site on the high-speed printer. PCM will announce to the OPSR the start and stop of EMOD and continuously monitor the data quality. The CSM decom will indicate lock on subframe No. 3 during the CMC EMOD downlink; the LM decom will indicate lock on subframe No. 2 when the LGC EMOD is being downlinked. The high-speed telemetry output will indicate static for the CMC and LGC status words during each EMOD. If EMOD is not received satisfactorily, the OPSR will advise TIC.

(2) Real-time EMOD Processing. MCC may request the EMOD to be processed in real-time. The procedures for real-time EMOD processing are as follows:

(a) The OPSR will instruct the PCM operator to set the playback bit (CSM/LM) to playback on the proper PCM ground station and inhibit the real-time decom.

(b) The OPSR will instruct the TLM computer operator to load the EMOD program. The OPSR will notify TIC when the program is loaded.

(c) The OPSR will notify TIC of EMOD validity and await TIC's cue to start transmission of high-speed data.

(d) TIC will notify the OPSR when EMOD processing is complete. The OPSR will then return to normal configuration.

(3) Playback EMOD Processing. Procedures for non-real-time processing are as follows:

(a) The station should continue to track the spacecraft and provide tracking data or any other support required by the SCM and this NOSP.

(b) Configure for TLM magnetic tape playback (CSM/LM) in accordance with voice instructions from MCC. Load the EMOD program into the computer designated by MCC. The playback bit at the PCM ground station should be set to playback, and data should be inhibited until the computer is loaded and ready to accept the playback.

(c) When the computer is loaded and ready, the OPSR will instruct the PCM operator to remove the inhibits and the recorder operator to start the tape. The EMOD program automatically validates EMOD data and prints out the EMOD status on the high-speed printer.

(d) The OPSR will notify TIC of data validity and await TIC's cue to start transmission of high-speed data.

(e) TIC will notify the OPSR when EMOD playback is complete. The OPSR will then reconfigure for real-time support.

(f) If an EMOD occurs during lunar phases, the station (normally a three-way station) may be instructed by TIC to discontinue real-time telemetry remoting to MCC, make an EMOD playback to MCC, and then reconfigure for real-time remoting to MCC.

Note

Only two passes of the EMOD will be transmitted from the CSM/LM; however, the confidence tape will continue to have four passes.

1.3.2.3 S-IVB/IU Redundant Parameter Source Changes (COS Routine)

a. Purpose. To define the conditions and procedures for implementing the COS Routine procedure.

b. Participants. OPSR, RSDP, NC, and TIC.

c. Procedures

(1) If S-IVB or IU data is lost, the OPSR will report to the NC.

(a) If the station reports no IU downlink, but has valid S-IVB data, TIC will instruct the OPSR to initiate the COS-4 Routine.

(b) If the IU downlink is good, but there is a station ground system problem, the OPSR will use any redundant systems available.

(2) If the IU link becomes valid at some time after the COS-4 Routine has been initiated, TIC will instruct the OPSR to make the COS-I entry for returning to the IU (normally after the end of the pass during earth orbit).

d. Information. The IU data link is the prime source for parameters which are redundant within the S-IVB and IU links. If the IU link is lost, an entry can be made into the TLM 642B computer to output redundant S-IVB and IU parameters from the S-IVB link in the high-speed TLM format. An entry must also be made to return to the IU link for the redundant parameters (COS-I/COS-4).

1.3.2.4 Telemetry Data Playback

a. Purpose. To define the interfacing procedures for playback of previously recorded data.

b. Participants. OPSR, RSDP, PCM tech, and TIC.

c. Procedure

(1) TIC will contact the station on Net 2 and pass the following information:

(a) Revolution, GET, and dump number.

(b) Time frame of playback for tape cue points (CTE/MET).

(c) Dump/playback configuration. (PCM tech refer to applicable tables in section 2 of this NOSP.)

(2) The station OPSR will notify TIC when the playback is ready. TIC will instruct the OPSR to start the playback. After the playback is completed the station will reconfigure to normal telemetry processing.

(3) TIC will contact the station on Net 2 in-conference when the station is supporting the real-time pass. If the station is not in acquisition, they will be contacted on Net 2 out-of-conference.

1.3.2.5 Spacecraft Data Storage Equipment Dump Reception

a. Purpose. To define the station/MCC interface and the on-station operating procedures for DSE dump reception.

b. Participants. OPSR, USB, TLM, and TIC.

c. Procedures

(1) DSE Downlink. All DSE data dumps are received at the ground station on the CSM Frequency Modulation (FM) downlink as follows:

(a) CSM PCM: 1024-kHz subcarrier (CSM FM modes 01, 02, 11, 13, 14, 15).

(b) LM PCM: baseband (CSM FM modes 03, 10).

(c) SIM PCM: 576-kHz subcarrier for SM-6, 64 kb/sec (CSM FM mode 11).

The SCM (TTY or verbal) will give the appropriate USB FM downlink mode.

(2) DSE Dump Sequence Voice Reporting. When a station is scheduled by the SCM for a dump,the OPSR will make dump announcements as indicated in table 1-7, using the following guidelines:

(a) Only the station in two-way (CMD) configuration will report DSE dump sequences by voice (on Net 2).

(b) The three-way station should inform MCC if the two-way station makes announcements that do not agree with the three-way station's observations.

(c) MCC may query the three-way station(s) on Net 2 if a two-way station is unable to achieve FM subcarrier lock and/or PCM ground station lock.

(3) Dump Monitoring and Processing. The quality of dump data will be monitored and reported to the OPSR.

(a) All dump data should be input to a decom if available (refer to section 2 for decom priorities), and processed into the computer system as it is received. (Refer to telemetry codes in section 2 for the description of this configuration.) The telemetry program will print out the start/stop times of the dump (Central Timing Equipment [CTE] or Mission Elapsed Time [MET]) as an automatic function. Real-time transmission of dump data to MCC will occur if TIC selects a high-speed dump telemetry format to be output from the telemetry computer. Do not set playback bit. CTE information is unavailable in the SIM downlink.

(b) If a PCM decom is not available, the dump telemetry will be monitored for data quality using a bit conditioner.

(c) Downlink data bit rate should be monitored to ensure that the proper format is selected at the bit conditioner and the decom. The OPSR will keep MCC informed of the bit rate and FM mode being received. The PCM should note approximate times of any data bit format changes during the dump so that the proper tape speed can be selected for voice quality verification.

(d) All dumps will be numbered sequentially for the entire mission.

Table 1-7. Dump Announcements

No.	Station OPSR Cue	OPSR Confirm	OPSR Announce
1	HS printer indicates DSE TP RWD.	Station configured for dump.	
2	HS printer indicates FM ON.	After approximately 90 seconds, verify that USB has lock on FM carrier.	"(Station) has FM carrier present, signal strength ________dBm."
3	HS printer indicates DSE EL PBK.		
4	HS printer indicates DSE TP STP.		
5	Subcarrier present (CSM and SIM dump only).	SDDS and/or TLM subcarrier lock.	"(Station) has lock on FM subcarrier(s)."
6	TIC announces: "30 seconds to dump modulation for dump No. ___" and indicates whether the dump will exceed 15 minutes.	Dump recorders started per section 2 of this NOSP.	
7	HS printer indicates DSE TP FWD.	Decom locked on PCM.	"(Station) decom locked on FM mode XX."
8	HS printer indicates DSE TP FWD (no decom on dump).	Station has dump modulation.	"(Station) has dump modulation."
9	Ground station drops out of lock due to bit-rate change.	Ground station changes format.	"(Station) dump now (HLBR, HBR, MLBR)."
10	Ground station lock is intermittent or data drop occurs.		(Report signal strength and status of ground station lock.)
11	HS printer indicates DSE TP STP.	Loss of modulation on FM downlink. Confirm recorders off.	"(Station) has loss of dump modulation."

Table 1-7. Dump Announcements (cont)

No.	Station OPSR Cue	OPSR Confirm	OPSR Announce
12	HS printer indicates DSE TP RWD.		
13	HS printer indicates SLVO RST 2 or FM OFF.	Loss of FM carrier.	"(Station) has loss of FM carrier."

Note

1. In addition to these announcements, the OPSR will inform TIC of any abnormal presence or loss of carrier, subcarrier, or modulation.
2. All CSM FM mode 11 DSE dumps will exceed 15 minutes when SIM data is included.
3. The FM transmitter will not be turned off during lunar operations. The scientific data subsystems will be on during all lunar operations except when TV is being transmitted.
4. Two-way stations with DSE dump requirements will make those announcements applicable to their capability.

(4) Postpass Activity

(a) CSM Spacecraft DSE Voice Dump. During any CSM data dump, the SC voice will be dumped simultaneously with the data. After an EO pass, and immediately following the dump for post-TLI operations, the station will make a spot check of the voice that has been recorded. The station will replay the voice track locally at the proper speed, monitor the quality of the voice playback, and take appropriate action as follows:

1. If the voice is intelligible, the station will store the tape and will comment in the DSE dump report on voice quality.

2. However, if there is difficulty understanding what was recorded, the OPSR will contact TIC and report the problem.

(b) Dump TTY Reporting. After a dump is received, any station that was scheduled by SCM to support the dump will send a DSE dump report message (refer to section 16). If the dump start/stop times were not printed out on the 1232 I/O console, the station will play back dump telemetry data into an available decom at the proper speed (postpass for EO or immediately after the dump post-TLI) and check the CTE word (CT-0145) or the MET word (GL-0501) at the start and stop of the data. If more than one start/stop time is noted on the tape, all start and stop times will be included in the message.

1.3.2.6 PCM Parameter Verification

a. Purpose. To define the types of readouts which can be requested and the station/MCC interfacing procedures.

b. Participants. OPSR, PCM tech, and TIC.

c. Procedures

(1) TLM Readout

(a) When requesting a TLM parameter readout during the pass, MCC will give the measurement number and vehicle identification. Readouts will be given in decimal unless otherwise specified by MCC.

(b) The OPSR will direct the PCM tech to dial up the requested parameter at the TLM station, convert it, and read it back. The OPSR will pass the readout to MCC.

(c) Readouts will be 8 bits in length for CSM, LM, and SM-6 telemetry, and 10 bits in length for SLV telemetry.

(2) CTE or MET Word Readouts

(a) When a station is requested to verify the CTE or MET words, the PCM tech will dial each syllable, note the binary readout, and convert it to days, hours, minutes, and seconds or read directly from the display.

(b) CTE and MET will be read in actual time unless MCC requests binary readout.

(3) Command Module Computer of LM Guidance Computer Word Readout

(a) Command Module Computer (CMC) and LM Guidance Computer (LGC) words consist of 40 bits (five 8-bit syllables) containing two registers each. If TIC requests a readout of any CMC or LGC word and associated register number (i.e., CMC word 4, register A), these words will be read out to TIC in octal. However, if TIC asks for an event, the CMC or LGC word number, register number, and bit number should be given.

(b) Each register consists of 15 data bits. Care should be exercised not to include the parity bit or word order code in the readout.

(4) LM Abort Guidance System Word Readouts. When Abort Guidance System (AGS) data is requested by TIC, it will be read out as three 8-bit octal syllables.

(5) Bi-level Word Readouts. When a parameter readout is requested, the alphanumeric listing will be checked to determine if the parameter is bi-level. If a bi-level is requested, the readout will be given as a "1" or a "0".

(6) LCRU Temperature and Voltage Readouts. Periodically during the mission MCC will request a readout of temperature and voltage. RT-8000 is the LCRU parameter number for LCRU radiator temperature and subsystem voltage (time-shared).

(7) TV Camera Temperature Readouts. Line 18 of the TV Raster contains information as to LCRU TV camera temperature. This information is in a pulse with a width of between 10 and 40 μsec. When TV temperature is requested by MCC the station video operator will read out the temperature pulse width per the procedure in section 2.

d. Information

(1) Verification of CTE (CSM) Time Word. The CTE word is 32 bits in length, divided into four 8-bit syllables:

Syllable 1 = seconds
Syllable 2 = minutes
Syllable 3 = hours
Syllable 4 = days

Note

The binary display at the MSFTP-2 PCM ground station always reads Most Significant Bit (MSB) to the operator's left, Least Significant Bit (LSB) to the right. The binary display at the MSFTP-1 PCM ground station always reads LSB to the operator's left, MSB to the right. Analogs in the CSM format are downlinked MSB first, and the ground station will be adjusted so that they are displayed properly. However, the CTE word is LSB first, causing the syllables of the time word to read in reverse. Thus, for the "first syllable", the bits will actually be displayed as follows:

Binary:(CTE LSB)	0	1	1	0	0	0	1	0	(CTE MSB)	MSFTP-2
BCD:	1	2	4	8	10	20	40	0		

(This display represents 46 seconds)

Binary: (CTE MSB)	0	1	0	0	0	1	1	0	(CTE LSB)	MSFTP-1
BCD:	0	40	20	10	8	4	2	1		

(This display represents 46 seconds)

(2) Verification of MET Word (LM). The MET word is 32 bits in length, divided into four 8-bit syllables, and consists of 26 data bits and 6 fill zeros in the following format:

<table>
<tr><td>Syllable</td><td colspan="8">MSB 33 LSB</td><td colspan="8">MSB 34 LSB</td><td colspan="8">MSB 35 LSB</td><td colspan="8">MSB 36 LSB</td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td></tr>
<tr><td>Bit Wt.</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>20</td><td>10</td><td>8</td><td>4</td><td>2</td><td>1</td><td>20</td><td>10</td><td>8</td><td>4</td><td>2</td><td>1</td><td>40</td><td>20</td><td>10</td><td>8</td><td>4</td><td>2</td><td>1</td><td>40</td><td>20</td><td>10</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>Content</td><td colspan="6">Zeros</td><td colspan="6">Days</td><td colspan="6">Hours</td><td colspan="7">Minutes</td><td colspan="7">Seconds</td></tr>
</table>

Note

Unlike the CTE word, the MET word is downlinked in the normal MSB-first format.

(3) LM AGS Word Readouts (MSFTP-1 Decom). AGS data is located in words 126, 127, and 128; a complete downlist is 50 frames long. The AGS words are not synchronized with the subframe counter in word 4; however, it is not expected that the AGS words will shift with respect to the word 4 frame count once the AGS is turned on. In order to find the location of an AGS word, a station must first determine the location of the AGS frame count, i.e., the first 6 bits of word 126, with respect to the main frame count, and translate for proper address.

Note

The preceding applies to MSFTP-1 station readouts. Words 126, 127, and 128 are downlinked words. For the MSFTP-2 decoms, the AGS words are programmed and can be read out by dialing up the correct address provided in the alphanumeric listing.

1.3.2.7 Spacecraft Bit-rate Changes

a. Purpose. To provide the stations with operational and reporting procedures to be followed during spacecraft bit-rate changes.

b. Participants. OPSR, TLM, and USB.

c. Procedures

(1) M&O Monitoring for Bit-rate Change. The OPSR will monitor the high-speed printer (two-way station only) for a command to the CSM to change the bit rate. In addition, he should monitor the A-G circuits and flight plan for other cues to the CSM and LM which change the bit rate. He should inform the station of any change by announcement on the OPSR loop.

(2) Uncued Bit-rate Change. The PCM tech will monitor the PCM decoms and signal conditioners for loss of sync and the monitor scope for indications of a bit-rate change. If a change is observed, he should announce the change on the OPSR loop and switch to the appropriate bit rate and decom format.

(3) Signal Data Demodulator System IF Bandwidth Setting (No DSCC). The USB supervisor should monitor the OPSR loop for the bit-rate change cues so that he may ensure that the IF bandwidth switch on the Signal Data Demodulator System (SDDS) is set to the appropriate setting.

(4) Decom Use. Data from an assigned vehicle may be routed into two decoms on opposite bit-rate formats if a decom is available.

d. Information

(1) Earth Orbit

(a) Station with No Overlapping Coverage. The bit rate will be low at AOS. During the pass, the CSM will be commanded by MCC to CSM high-bit rate. At 30 seconds before LOS, MCC will command the CSM bit rate back to low.

(b) Stations with Overlapping Coverage. The first station to acquire will receive the CSM in low-bit rate at AOS. The bit rate will then be changed to high either by command, the MCC voice direction to the spacecraft crew, or according to the flight plan. The bit rate will be changed from high to low at LOS -30 seconds of the last station. Stations with overlapping coverage on both AOS and LOS can expect to have high-bit rate throughout the entire pass.

(2) Post TLI

(a) After TLI, the CSM bit rate is a function of the downlink signal strength (low-bit rate with low signal strength, and high-bit rate with high signal strength).

(b) The LM bit rate will be manually changed by the LM crew upon voice direction from MCC, or as directed in the flight plan. The bit rate will be changed to high after AOS and back to low prior to LOS.

(c) Because of the requirement to transmit and record SIM data in HBR, the CSM will be in the HBR configuration for the majority of the lunar orbit phase.

1.3.2.8 PCM Decommutator Failure

a. Purpose. To delineate the contingency procedures to be followed in the event of a decom failure.

b. Participants. PCM tech, OPSR, TIC, and NC.

c. Procedures

(1) The input patching of the PCM decoms should be in accordance with section 2. The operator should be prepared to reconfigure his decoms (as indicated in section 2 of this NOSP) in the event of a prime decom loss. If a failure occurs, the PCM tech should make the reconfiguration and inform the OPSR who will in turn notify the NC.

(2) If there is a configuration change, the following should be checked:

(a) The failed decom computer buffer should be inhibited.

(b) If required, change patchboards as indicated in section 2 of this NOSP.

(c) The on-station displays (control room displays, USB meters , and recorders) should be repatched at the Decommutation System Distribution Unit (DSDU) using a prepatched contingency board.

(3) The mission patching of the PCM decoms should be planned so that a decom reconfiguration for any contingency can be accomplished without breaking the path to the data recorders.

1.3.2.9 Loss of LM TLM During Extra-vehicular Activity

a. Purpose. To define the procedure for enabling a continuous flow of LM data to MCC during EVA and preventing loss of PLSS and LCRU data processing by RTCC.

b. Participants. OPSR, PCM, and TIC.

c. Procedures. All stations covering the EVA of a mission should be prepared to output LM simulator data to the LM decom in case of an abnormal loss of LM telemetry. In such cases:

(1) During EVA support, load the PCM simulator with LM program sequence 54, which will be used at the direction of the TIC if the LM PCM data link fails.

(2) TIC will direct the station to input the LM simulator data to the LM decom and set the playback bit.

(3) TIC will change HSD format to an LM playback format.

(4) If the LM telemetry returns, the station personnel should immediately switch to the real-time LM data and notify TIC. (Do not reset the tape playback bit unless directed by TIC.)

1.3.2.10 Apollo Range Instrumentation Aircraft Data Transfer

a. Purpose. The following procedures will be used to transfer recorded spacecraft data from an Apollo Range Instrumentation Aircraft (ARIA) to a STDN station.

b. Participants. OPSR, MCC, TLM, USB, and ARIA.

c. Procedures

(1) General. The OPSR will be notified by MCC of an impending ARIA data transfer and will be given aircraft bearing, heading, altitude, and Estimated Time of Arrival (ETA), and desired data links (LM, CSM, IU, S-IVB). MCC will also inform the OPSR of data processing requirements. (Equipment configuration is given in section 4 of this NOSP.)

(2) VHF Telemetry

Note

The following VHF telemetry procedures do not apply to 85-foot stations.

(a) When notified by the OPSR of an ARIA data transfer, the TLM acquisition aid technicians will determine rough pointing-angle data from the information given by MCC.

(b) The ARIA will turn on the VHF transmitter (245.3 MHz) with CW modulation when approaching the station. At ETA the TLM technicians will manually scan for the aircraft until autotrack is obtained.

(c) The antenna technician will inform the OPSR when autotrack has been obtained.

(3) USB

(a) The USB supervisor, when notified by the OPSR of an ARIA data transfer, will ensure that the USB antenna is pointed at the approximate Initial Point (IP).

(b) After full autotrack is obtained by the VHF telemetry antenna(s), the USB antenna can be slaved to the telemetry antenna for acquisition. Eighty-five foot stations must acquire without acquisition aids.

(4) OPSR

(a) The OPSR will configure the station as instructed by the NC and the ARIA data transfer procedures in STDN No. 502.2, STDN No. 502.10, and section 4 of this NOSP.

(b) The OPSR should reconfigure the station with as few changes to actual mission configuration as possible.

(c) The OPSR may communicate with the ARIA via VHF A-G (296.8-MHz) when the ARIA is within line of sight.

(d) The OPSR will advise the ARIA when to begin data transfer.

(e) Eighty-five foot stations will request that the NOM have the Goddard Comm Manager patch the station's Net 3 to the AOCC. The OPSR can then talk to the ARIA through Net 3 to AOCC interface.

(5) Typical ARIA Data Transfer Activities

Time	Personnel	Activity
H-5	MC	Turn on VHF carrier (USB for 85-foot stations) without modulation.
AOS (100% radio horizon)	MC	Initiate VHF (HF on 85-foot stations) voice contact with OPSR. Turn on S-band and VHF data transfer modulated carrier upon direction of station OPSR. Notify OPSR that data modulation is on.
	OPSR	Turn on chart recorder for signal strength test after solid lock with ARIA. Coordinate with the MC the links to be transferred; mode of transfer (VHF or USB); frequency used; time segment of data to be transferred; and verify with MC altitude, headings, and speed.
AOS +5 min (approx 90% line-of-sight)	OPSR	Confirm ground station equipment is functioning satisfactorily and notify MC to stop modulation and prepare for data transfer. Turn off chart recorder.
	MC	Turn off modulation of VHF and S-band carriers. Ensure tapes are keyed to the proper start time. Inform OPSR that ARIA is ready for data transfer.
AOS +8 min. (approx 175 to 180 miles from ground station)	OPSR	Give go/no-go condition for the transfer. Inform MC: "The data transfer will be initiated on my mark."
	MC	Acknowledge receipt of message and stand by.
AOS +	OPSR	Start ground recorders; count down: "3...2...1...mark,"
	MC	Turn on recorder in playback mode.
	MC	Inform OPSR that data has been transferred.
	OPSR	Stop ground recorders; verify that all data has been received and if no further data is needed, terminate the data transfer and release the ARIA.
Data transfer completed	MC	Secure the system and proceed to next TSP or to recovery base.

1.3.2.11 TLM Typical Support Activities

a. Purpose. A quick reference to required actions.

b. Participants. TLM supervisor and personnel.

c. Procedures. Typical support activities for TLM personnel are as follows:

Time	Station	Personnel	Activities
H-30	All	All	Verify system configured in accordance with mission supplements and SCM.
		TLM supervisor	Brief OPSR on system status. Report all "red" items and ETO.
		Recorder tech	Start voice recorders.
H-15	All	TLM supervisor	Verify mission decom tapes loaded and/or patching completed and calibrations and prepass checklist completed. Report status to OPSR.
H-2	All	Recorder tech	Bring recorders to flight speed.
H-1	All	PCM techs	Monitor scope for AOS. Confirm the desired formats are selected in the decoms.
AOS	All	PCM techs	If necessary, adjust Input Voltage P-P switch for nominal reading on input level meter. Adjust the VCO control for 0 indication. Monitor the incoming signal and report abnormal conditions to the PCM supervisor. If applicable, switch formats and bit conditioners and inform the OPSR.
LOS +2	All	TLM supervisor	Brief OPSR on system status. Report all "red" items, ETO, and AOS/LOS times etc., if requested.
		Recorder tech	Stop data recorders.
LOS +10	All	Recorder tech	Stop voice recorders.

1.3.2.12 Special LM Telemetry Parameter Readouts

a. Purpose. To provide for special monitoring of LM parameters.

b. Participants. OPSR, TLM, and TIC.

c. Procedures. To be supplied, if required.

1.3.2.13 LM/IU, CSM, and LCRU AGC Remoting

a. Purpose. To define HSK, GDS, and MAD remoting requirements and real-time patching procedures for AGC.

b. Participants. OPSR, USB supervisor, and TIC.

c. Procedure

(1) The CSM and IU/LM AGC are normally processed by channels 24 and 28, respectively, of the AMQ for transfer to MCC in formats 4, 5, 8, 9, 10, and 13. The LM and IU share the same AMQ channel (28). However, MCC may request replacing the CSM or LM AGC with the LCRU AGC.

(2) Upon request from TIC the remote site will reconfigure the AMQ input, patching to any of the following three combinations:

AMQ Combinations	1	2	3
LM	28	28	
CSM	24		24
LCRU		24	28

Note

IRIG channel patching is contained in section 4 of this NOSP.

1.3.3 COMMAND

1.3.3.1 Command Computer Operations

a. Purpose. To define the command computer interfacing and operating procedures.

b. Participants. OPSR, RSDP techs, NC, Load Control, and RTC.

c. Procedures. For verbal reporting, the command computer is the computer cycling the command program.

(1) Normal Operating Modes

(a) Computer Modes. The command computer will be operated in computer mode 2 unless required to go to computer mode 1 (F/C or M&O) and perform an MCC-requested function.

(b) Message Acceptance Pulse Override. The Message Acceptance Pulse (MAP) override function will be initiated when in computer mode 1 only if requested by MCC. When returning to computer mode 2, delete MAP override unless directed otherwise by MCC.

(c) Load Enable/Disable. The OPSR will be in load enable mode at all times unless directed otherwise by MCC.

(2) Command System Constants. Prior to launch, the OPSR will be informed by MCC of command system constants. The OPSR will direct the RSDP supervisor to insert specific constants during initialization. When initialization is complete, the program will automatically dump a command parameter listing. At this time the OPSR should verify that the constants are correct. The OPSR will be notified via TLI burn message (refer to section 16 for the message format) from MCC of command constant changes to be made for certain mission phases. The OPSR will ensure that these constants are entered into the command computer at times specified. The following procedure will be used if it is necessary to change command constants after computer initialization:

(a) The two-way and backup stations will obtain clearance from the NC before going to computer mode 1 M&O. All other stations will go to computer mode 1 M&O and inform the RSDP supervisor of the constants to be changed.

(b) The 1232 will be used to input command system constants (mission number, station ID, LOT, MAP Waiting Period [MWP], RTN, etc.).

(c) After all the necessary changes have been made, the OPSR will return to computer mode 2 and request via CAM a command parameter listing to verify the corrected constants. The OPSR will inform Network that he is in computer mode 2.

(3) Command Loads. Command load numbers have four digits in the header followed by the data bits. The first two digits represent the type of load (e.g., NAV update); the last two digits represent the sequence number for the type of load.

(a) Transmission of Command Loads

1. Command loads will normally be transmitted via high-speed data lines. (The site will normally be in load enable.) If MCC does not receive a

command Validation (VAL) on the first high-speed transfer, Load Control will retransmit the high-speed load. If a VAL is not received after retransmission, Load Control will query the station by voice and determine if the load is in core.

a. If the station has received the high-speed load, Load Control will force VAL the load.

b. MCC will normally operate in the TTY inhibit mode in which the TTY English Translation (ET) is not transmitted with the high-speed load. If the load was not received via high-speed the TTY may be enabled and Load Control will have the load retransmitted. If the HS load is not received, the OPSR will request the computer tech to enter the TTY load into core. The OPSR will advise Load Control when this is completed.

2. Loads Received in Load Disable. If a load is sent from MCC when the computer is in load disable, a TEMP LOAD VAL will automatically be sent to MCC.

a. Load Control will inform the OPSR of the procedures to follow (clear the load or transfer the load to permanent storage by going to load enable).

b. The RSDP supervisor will inform the OPSR when he has received a load in temporary storage.

(b) Load Inventory. To determine if any loads are in storage, the OPSR may initiate the high-speed printer load inventory function. Any load number in storage will be printed out on the high-speed printer.

(c) Load Review. To observe the octal count of any load in storage, the OPSR will select a review of that load by CAM.

(d) Load Clear

1. Prior to establishing an interface with MCC on the terminal day or when returning from standby, the OPSR will perform a load inventory and will clear any load appearing on the printout.

2. If there are any loads in the computer after a pass, Load Control may or may not clear these loads. Load Control may ask the OPSR to clear the loads. If a load is in temporary storage and the OPSR is requested to clear it, he will initiate the temporary storage clear. If requested to clear a load in permanent storage, the OPSR will initiate the load clear function for that particular load.

(4) Command Computer Contingency Procedures

(a) If the command computer faults, DARTS instantly reloads. The OPSR will then verify that the command constants are correct, that any loads in storage have been recovered, and will report by voice to the NC.

(b) If the command computer faults and DARTS or the command recovery program does not reload, the computer operator will immediately make three additional attempts to manually reload DARTS. The OPSR will notify the NC immediately after the manual loading attempt and report whether or not the attempt was successful. If the manual loading attempt was not successful, the station will immediately reload the command program from the systems tape and inform NC of the command computer status, and load inventory status.

(c) After the command computer is manually reloaded, the channel 6 Magnetic Tape Unit (MTU) should be master cleared and the proper duplex selected.

(d) When the command program fails, all command capabilities are inoperative. Telemetry program functions will not be affected; however, command CAP words will contain all 0's. When directed by the NC, the OPSR will configure the remaining computer for the command program (refer to section 5 of this NOSP). Once the command program is configured, the OPSR will request CAM 990 and verify that the command parameter list contains data defined previously by MCC. A high-speed load inventory (CAM 982) will be performed to ensure that no loads were lost.

Note

When this contingency is exercised, CAP's cannot be processed. Therefore, MCC will request the OPSR to report the results of all commanding.

(e) If the command MTU fails completely, command capability may be restored with NC concurrence by switching MTU's by a cable change. NST Data will generate an ISI to follow up this configuration change. Telemetry capability will be limited. (Refer to section 5 of this NOSP.)

(f) The OPSR will ensure that a TTY computer fault message (described in section 7 of STDN No. 502.16) is sent as soon as possible after the fault.

1.3.3.2 GMTLO RSDP/Central Data Processor Initialization

a. Purpose. To specify GMTLO initialization procedures.

b. Participants. RSDP, OPSR, RTC, NC, and Central Data Processor (CDP).

c. Procedures

(1) During mission status testing, MCC simulations, and launch day activities preceding high-speed GMTLO updates, all stations will initialize CMD and TLM computers with LOT of year, month, day (equal to day of support), hours, minutes, and seconds (equal to 00:00:00), unless otherwise specified.

(2) MIL GMTLO will be updated by MCC via high-speed data lines at T-30 minutes. All other CMD and TLM computers will be updated via high-speed data lines at the first opportunity after EO insertion. As soon as possible, stations should verify by negative reporting that, with the exception of hundredths of seconds, the high-speed update agrees with GMTLO in the liftoff message.

(3) When the NC reports GMTLO on Net 2, or upon receipt of the TTY liftoff message, the VAN will enter GMTLO by manual I/O routine (including hundredths of a second) into the tracking CDP.

1.3.3.3 UDB Command Safe

a. Purpose. To define station procedures for safing the USB command system.

b. Participants. OPSR, NC, and RSDP.

c. Procedures

(1) The OPSR SAFE/OPERATE switch will normally be kept in the SAFE position.

(2) If the station is to support in a command mode, the OPSR SAFE/OPERATE switch is to be put in the OPERATE mode three minutes prior to turning the carrier on, and placed back in the SAFE position three minutes after turning the carrier off.

(3) If the OPSR is notifed by MCC to safe the command system with the carriers on, he will press the SAFE/OPERATE switch on the OPSR console and verify that the SAFE indicator light is red.

(4) The UDB computer TEST/OPERATE switch is to be kept in the OPERATE mode during periods of command support unless otherwise directed by MCC.

1.3.3.4 Contingency Command CAM Operation

a. Purpose. To define the coordination and procedure to be followed in command executions by the OPSR via the CAM.

b. Participants. OPSR and MCC Flight Controller (FC).

c. Procedures

(1) General

(a) The following scripts provide examples of the sequence of events that will occur between the station OPSR and FC when the station is directed by MCC to switch to CMD computer mode 1 F/C and uplink commands. Under no circumstances will the OPSR switch to computer mode 1 F/C to initiate a command uplink unless directed by MCC.

(b) The CAM uplink request procedure will immediately be terminated and MCC will be notified if a ground or SC reject should occur or if the vehicle TLM link is lost. No further CAM requests will be made until directed by MCC.

(c) Prior to uplinking any load or RTC, the OPSR will read the load or RTC number to the FC for his confirmation and cue for uplinking. If a confirmation is not received, the OPSR will cease further CAM activity for the duration of the pass until otherwise directed by MCC.

(2) CMC/LGC Load Update (Example Only)

Seq	Position	Actions and Remarks
1	NC	"(Station), Network go to computer mode 1 (with MAP override [on/off])."
2	(Station)	"Network (Station), Roger, in computer mode 1 (with MAP override [on/off])."
3	Guidance	"(Station), Guidance, standby to uplink CSM (LM) load XXXX via USB."
4	(Station)	"Guidance (Station), Roger, CSM (LM) Load XXXX, USB."
5	(Station)	"Guidance, (Station), load XXXX ready."
6	Guidance	"(Station), Guidance, uplink verb initiate for load No. XXXX."
7	(Station)	"Guidance, (Station, verb initiate uplinked, CMD verified."
8	Guidance	"(Station), Guidance, uplink RTC 854, DSKY enter."
9	Guidance	"Guidance, (Station), RTC 854, DSKY enter, CMD verified."

Seq	Position	Actions and Remarks
10	Guidance	"(Station), Guidance, report when ready to uplink load XXXX."
11	(Station)	"Guidance, (Station), load XXXX ready."
12	Guidance	"(Station), Guidance, uplink load XXXX."
13	(Station)	"Guidance (Station), uplinking load XXXX."
14	Guidance	"(Station), Guidance, Roger, upbuffs are loading."
		MCC will observe upbuff parameters during uplinking; if errors are noted and termination is desired MCC will request OPSR to execute: CMD term, CAM 976 followed by:
		DSKY verb RTC 851 DSKY three RTC 858 DSKY four RTC 859 DSKY enter RTC 854 (Return to seq 3)
15	(Station)	"(Station) Guidance, comparing load XXXX."
16	(Station)	"Guidance, (Station), compare OK, load XXXX." (Proceed to seq 20)
		or
		"Compare error, no TLM" (Proceed to seq 17)
		or
		"Compare error, lines XX and XX." (Proceed to seq 18)
17	Guidance	"(Station), Guidance, Roger. When TLM is valid, execute compare." (Return to seq 15)

Note

If a "no-go" comparison occurs again, MCC will make a decision to try again or to use voice update procedure.

Seq	Position	Actions and Remarks
18	Guidance	"(Station), Guidance, uplink line-by-line, CAM 972."
19	(Station)	"Guidance, (Station), uplinking line-by-line XXX." (Return to seq 15)

Seq	Position	Actions and Remarks
20	Guidance	"(Station, Guidance, uplink RTC 851, DSKY verb."
21	(Station)	"Guidance, (Station), Roger, RTC 851, DSKY verb verified."
22	Guidance	"(Station), Guidance, uplink RTC 858, DSKY three."
23	(Station)	"Guidance, (Station), Roger RTC 858, DSKY three verified."
24	Guidance & (Station)	Repeat sequences 22 and 23 for second "three" or substitute RTC 859, DSKY four, as appropriate.
25	Guidance & (Station)	Repeat sequences 22 and 23, for RTC 854, DSKY enter.
26	NC	(If applicable.) "(Station), Network, go to computer mode 2 (with MAP override off)."
27	(Station)	"Network, (Station), Roger, in computer mode 2 (MAP override off)."

(3) CSM RTC Uplink (Example Only)

Seq	Position	Actions and Remarks
1	NC	"(Station), Network, go to computer mode 1 (with MAP override [on/off])."
2	(Station)	"Network, (Station), Roger, in computer mode 1 (with MAP override [on/off])."
3	INCO	"(Station), INCO, uplink CSM RTC XXX (CSM/CAM Code)."
4	(Station)	"(Station), Roger, CSM RTC XXX."
5	INCO	"Roger, uplink command."
6	(Station)	"(Station) uplinking RTC XXX."
7	(Station)	"INCO, (Station), RTC XXX CMD verified."
8	NC	(If applicable.) "(Station), Network, go to computer mode 2 (with MAP override off)."
9	(Station)	"Network (Station), Roger, in computer mode 2 (MAP override off)."

(4) SLV RTC/Load Uplink (Example Only)

Seq	Position	Actions and Remarks
1	NC	"(Station), Network, go to computer mode 1 (with MAP override [on/off])."
2	(Station)	"Network, (Station), Roger, in computer mode 1 (with MAP override [on/off])."
3	BSE	"(Station), Booster, configure to uplink SLV RTC XXX (or load XXXX)."
4	(Station)	"(Station), Roger, SLV RTC XXX (or load XXXX). Ready for uplink."
5	BSE	"Roger, uplink command."
6	(Station)	"BSE, (Station), Uplinking RTC XXX (or load XXXX)."
7	(Station)	"BSE, (Station), RTC XXX (or load XXXX) CMD verified."
8	NC	(If applicable.) "(Station) Network, (with MAP override off) go to computer mode 2."
9	(Station)	"Network, (Station), Roger, (with MAP override off) in computer mode 2."

1.3.3.5 End-of-File/Command History Procedures

a. Purpose. To define the command history requesting and disposition procedures.

b. Participants. OPSR, Load Control, and RTC.

c. Procedures

(1) End-of-File. Prior to a station coming up for pass-time support and at the completion of CMD interface tests, an End-of-File (EOF) will be placed on the CMD history tape.

(2) Command History and EOF Requests

(a) If CMD's were uplinked through his station to the respective vehicle, the OPSR will request by CAM, low-speed SLV Type II, CSM Type I, or LM Type I CMD histories. The CMD histories will be taken 3 minutes after the station's LOS, carrier off, or lunar occultation.

(b) Upon completion of low-speed histories, the OPSR will initiate SLV Type I, CSM Type II, or LM Type II, HSP CMD histories for the same vehicle(s) commanded.

(c) The OPSR will enter an EOF 5 minutes after the completion of all histories (nominally LOS+10 minutes, carrier off +10 minutes, or lunar occultation +10 minutes).

(d) During post-TLI passes of extended duration, Load Control may request command histories at any time to prevent the command history from becoming too lengthy. The OPSR will take the required histories and execute an EOF upon the request of MCC.

(e) To support PAD protection, MIL, BDA, and the VAN (when west of 45 degrees longitude) will take Type II CMD TTY and HSP histories of all commands radiated from start of mission period until launch. Disposition of histories will be in accordance with STDN No. 502.11.

(f) During LCRU support, if the LM CMD history becomes too lengthy (i.e., time does not permit retrieval of the low-speed history), RTC may request LM Type I high-speed histories and EOF.

(3) Prelaunch Command History. MIL will provide 1218 CMD histories for all pad test support requiring CMD uplinking.

(4) Command History Magnetic Tape Distribution

(a) A new command history tape will be mounted on the MTU at the beginning of new SRT to support the SRT and the upcoming view period.

(b) Command history tapes will be labeled and stored on station until mission termination. At mission termination, each history tape will be sequentially dumped onto one history tape, using the MERCH program (SCAN control No. 6-606). The dumped command history tape will be labeled and shipped in accordance with STDN No. 502.11. The consolidated history tape will contain only the command activities of the days during which commands were uplinked to the SC.

(c) The original command history tapes will be held on station until end-of-mission +5 days in case an OUCH routine is requested during this period. After end-of-mission +5 days, the original command history tapes may be reused.

(5) Loss of Retrievable Histories. If retrievable histories are lost, the RTC may request an OPN stating specific details of command uplink activities. This OPN will be transmitted using the mission command history routing indicator DSCT.

1.3.4 TRACKING

1.3.4.1 Radar System

a. Purpose. To define the normal and contingency operating procedures for the radar system.

b. Participants. OPSR, GCC, radar supervisor, and radar transmitter operator.

c. Procedures

(1) Normal Operating Procedures

(a) Composite Radio Frequency Message

1. During the terminal count, and as required during the mission, a C-band CRF message will be sent to all stations. Upon receipt of this message, the transmitter operator will make any necessary change to the beacon interrogate frequency, and the range scope operator will, if necessary, adjust the receiver local oscillators.

2. The radar supervisor will inform the OPSR if the radar transponder frequency drifts out of tolerence (±1.0 MHz).

(b) Low-speed Data Transmission

1. Transmission of low-speed tracking data will be controlled by the GCC at the Radar Data Control Unit. GCC should also ensure the correct low-speed header was selected by the radar data technician. The radar supervisor should confirm that data transmission has been started by H-2 minutes.

2. All land-based and shipboard console operators will ensure that the VALID DATA indicator is set only for full autotrack on the assigned target.

(c) Acquisition Sources. Network radars may utilize the 6-point acquisition message, Interange Vector (IRV), and/or on-station acquisition aids. Acquisition procedures are described in STDN No. 502.3.

(d) C-Band Release. Upon receipt of a station/equipment release message from the NSC the OPSR will release the C-band equipment for an interim period during the mission, to be established in real time.

(2) Contingency Procedures

(a) Nonreceipt of Acquisition Message. If the 6-point acquisition and/or IRV message is not received by H-15 minutes, the radar supervisor will inform the OPSR.

(b) RFI. The radar supervisor will report any RFI to the OPSR.

(3) Typical Pass Activites for Radar

Time	Station	Personnel	Activities
H-30	All	All	Confirm system configured in accordance with tracking schedule.
		Radar supvr	Brief OPSR on system status. Report all "red" items and ETO. Receive acq message(s).
		Radar techs	Monitor applicable loops.
H-28	All except VAN		Verify autotracking of the boresight tower.
H-15	All	Radar techs	Confirm all recorders loaded and calibrations and prepass checklist completed.
		Radar supvr	Notify OPSR if acq message not received. Report completion of H-15 activities to OPSR.
H-13	All	Radar supvr	Read tracking schedule, acq message, SCM, and SCM update for AOS/LOS times and data requirements.
H-8	All	Console operator	Position antenna to IP.
	VAN	Console operator	Select REMOTE DESIGNATE.
H-2	All	Transmitter tech	Bring transmitter up to full power and radiate into antenna (unless otherwise directed by tracking schedule, SCM, or NST Radar.)
		GCC	Radar data on line.
H-1	All	Radar techs	Turn on all recorders.
AOS	All	Radar supvr	Announce AOS. Report autotrack to OPSR and log contact time. Confirm with GCC that radar data is being transmitted.
PCA	All	All	Record CRF data.
		Radar supvr	Report PCA to OPSR.
LOS	All	Radar supvr	Report LOS to OPSR and log time.
		Radar techs	Leave antenna at LOS point until LOS +2.

Time	Station	Personnel	Activities
LOS + 2	All	Radar supvr	Report CRF data to OPSR. Brief OPSR on system status. Report all "red" items and ETO.
		GCC	Radar data off line.
		Radar techs	Secure transmitter. Annotate recordings. Prepare for postpass cals if required.
	All, except VAN	Radar techs	Position antenna to boresight tower.

1.3.4.2 VHF TLM System

a. Purpose. To define the normal and contingency operating procedures for the VHF TLM system.

b. Participants. OPSR, RF TLM tech, and VHF servo operator.

c. Procedures

(1) Normal Operation Procedures

(a) Systems Logs. Operators should maintain systems logs for all problems encountered and activities performed during pass times.

(b) Acquisition and Tracking Procedures

1. The antennas will be positioned in accordance with the acquisition message. Both elevation and azimuth should remain in manual operation until AOS. At AOS, place az in full auto and track manually in el until multipath subsides. At no time will lock override features of the monopulse receiver be used in an attempt to prolong the station track.

Note

Normally, during the earth-orbital phases, the VHF antenna providing A-G communications support during Simplex B or Duplex A operation is slaved to the USB antenna for acquisition. On keyhole passes, where initial acquisition for USB is at keyhole exit, the VHF antenna should be positioned to the initial point, as indicated on the 6-point acquisition message, handwheeled through the keyhole, and then slaved to USB for the remainder of the pass.

2. Upon receipt of the acquisition message, and after RFI checks, position the antenna to avoid cable wrap problems during the pass.

3. RF TLM Technician. During passes the RF TLM tech will check receivers and Spectrum Display Unit (SDU) for signal quality and any spurious signals.

4. 4-2 Antenna for VHF TLM and A-G Voice Backup (VAN). The acq aid operator will ensure that the 4-2 antenna is on track during all missions as long as TLM and A-G voice (VHF) are required. The acq aid operator will coordinate with the Acquisition Bus Monitor (ABM) for the best slaving source. The 4-2 antenna should be available for VHF TLM and voice backup.

Note

The acq aid operator will query the ComTech and ABM to determine if VHF A-G is required.

5. 5-1 Antenna for VHF A-G Voice (VAN). The antenna tech will ensure that the 5-1 antenna is on track and available for voice transmission on all missions as long as VHF A-G voice is required. The antenna tech will coordinate with the ABM for the best slaving source.

6. Release of VHF Equipment. Approximately 3-1/2 hours after a successful TLI maneuver, VHF equipment will be released until approximately 5-1/2 hours prior to entry interface. Upon receipt of a station/equipment release message from the NESAC, the OPSR will release all VHF equipment from mission support for this period.

(2) Contingency Procedures

(a) TLM Link Failure

1. If the prime tracking link is lost, the operator will inform the OPSR and switch to the secondary link for the remainder of the pass.

2. If all links are lost, the antenna will be slaved to the acq bus or positioned manually.

(b) Equipment Failures

1. When a system failure disables autotrack capabilities, the system should be slaved to the acquisition bus or positioned manually using pointing data.

2. All equipment failures will be reported to the OPSR.

(c) Non-receipt of Acquisition Message. If the acquisition message has not been received by H-15, the acq aid operator will inform the OPSR.

(d) Loss of Prime Link Receiver. The telemetry receiver operator should be prepared to reconfigure the receivers if a prime link receiver fails. (Section 2 of this NOSP will specify the link priorities.) However, reconfiguration should not be attempted during a pass unless the failed receiver will cause a loss of data; e.g., if a receiver, supplying the "A" input to a combiner, fails and the "B" input of that combiner is still good, no change should be made until after the pass.

(3) Typical Pass Activities for VHF Operators

Time	Station	Activities
H-30	30', VAN	Receive acq messages. Monitor applicable loops. Brief telemetry supervisor on system status. Report all "red" items and ETO.
H-28	30'	Verify autotrack of boresight tower.
H-15	30', VAN	Confirm chart recorders loaded and calibrations and prepass checklist completed. Report completion to TLM supervisor. Notify OPSR if acq message not received.
H-8	30', VAN	Position antennas to initial point.
H-2	30', VAN	Start chart recorders (when applicable).

Time	Station	Activities
H-1	30', VAN	RF TLM tech monitor receivers and SDU.
AOS	30', VAN	Antenna operator will monitor panadapter for spurious signals on either side of carrier. Start acquisition procedures. Antenna operator report AOS to TLM supervisor and full autotrack and log time. RF TLM tech will report AOS to TLM supervisor. Make tuning adjustments and ensure that video output levels are correct.
PCA	30', VAN	Antenna operator will monitor cable wrap. Record max signal strength and max elevation for the mission log.
PCA	30', VAN	RF TLM tech will record deviation from center frequency for CRF.
LOS	30', VAN	RF TLM tech will announce LOS to TLM supervisor.
LOS	30', VAN	Antenna operator will announce LOS to TLM supervisor and log time. Leave antenna at LOS point until LOS +2.
LOS +2	30', VAN	Brief TLM supervisor on system status. Report all "red" items and ETO. Give AOS, maximum EL and LOS times. Return system to standby. Annotate recordings. RF TLM tech will report CRF data to OPSR. Prepare system report.

1.3.4.3 USB Typical Pass Activities

a. Purpose. This procedure provides a quick reference for required USB actions.

b. Participants. USB supervisor and personnel.

c. Procedures. The following sequence indicates typical support activities for USB personnel.

Time	Station	Personnel	Activities
H-30	All	All	Monitor applicable loops. Begin prepass checklist.
		Servo tech	Verify that hydraulic unit controls or amplidyne controls for both antenna axes are on. Ensure antenna is at zenith.
	Two-way & backup	ComTech	Confirm that A-G circuits are properly configured. Check input modulation levels on A-G uplink.
	All	USB supvr	Confirm that all USB subsystems are properly configured. Upon request, inform the M&O supervisor of the system status giving all "red" items and an ETO for each.
H-28	All except VAN	RE tech Servo tech	Autotrack call tower using approximately -120 dBm on both receivers. Verify proper relationship between AGC reading on both systems/receivers. Return antenna to zenith.
H-15	All	Servo tech USB supvr	Confirm to OPSR by negative reporting receipt of the acquisition message.
		All	Complete prepass checklist.
	All except VAN	APP tech	Load the APP tape, bring up the initial point (IP) and switch to computer when the 1218 or 910 is ready for computer support.
	All	USB supvr	Verify that stripchart recorders are loaded, equipment calibrations and prepass checklists are completed, and acquisition messages are processed. Report operational status to the M&O.

Time	Station	Personnel	Activities
H-10	All	All	Confirm no RFI present.
		RE Tech and PA Tech	Switch transmitter to dummy load. Bring up voltage and adjust transmitter drive to obtain required mission PA power level. Turn beam voltage and transmitter drive off and switch to antenna. Bring up beam voltage and ensure that the SCO mode is selected per the SCM.
H-8	All	Servo tech	Position antenna to the IP.
		USB supvr	Confirm that the antenna is positioned on the IP.
H-2	All	RE tech	Turn transmitter drive on as required by the SCM unless handover is in effect, in which case the carrier will be brought up on cue.
	All except VAN	USB supvr	Ensure that the radiation hazard warning is active.
	All	All	Start acquisition procedure.
		USB supvr	Start recorders (except Beckman recorders).
	All except VAN	TDP tech	Start transmission of high-speed and/or low-speed tracking data and notify the GCC of the transmission.
AOS	All	USB supvr	Announce AOS. Give tracking status. Start Beckman recorder (if available).
		Servo and RE tech	Initiate autotrack.
		Ranging tech	Start range code sequence after completion of valid RF acquisition, if applicable.
	All except VAN	APP tech	Begin continual update of APP command angles.
	All	SDDS tech	Monitor voice, speaker, telemetry data output, and 70-kHz discriminator output.
	Ships	PA/SDDS tech	Monitor voice speaker, telemetry data output, and 70-kHz discriminator output.
	Two-way	ComTech	Activate A-G modes.

Time	Station	Personnel	Activities
PCA	All	RE and/or Ranging techs	Determine PCA . Switch zone selector from ASCENT to DESCENT.
		USB supvr	Announce PCA.
LOS	All	USB supvr	Announce LOS. Stop Beckman recorder (if applicable).
		Servo tech	Leave antenna at the LOS point until LOS+2.
	All except VAN	APP tech	Stop the APP.
LOS+2	All	RE tech	Turn transmitter drive off as required by the SCM.
		PA tech	Turn beam voltage off.
	All except VAN	TDP tech	Stop the tracking data transmission.
	All	All	Stop and annotate all recordings; Prepare systems reports.
		USB supvr	Upon request, inform the OPSR supervisor of the system status giving all "red" items and ETO for each.

1.3.4.4 Ranging Procedures

a. Purpose. To define the ranging procedures for all mission phases.

b. Participants. OPSR, USB, NC, and Track.

c. Procedures

(1) EO, TLC, and TEC Phases

(a) During EO, TLC, and TEC phases, two-way stations should range when directed by the SCM USB uplink mode. If ranging becomes invalid or questionable, reinitiate ranging sequence without specific direction from MCC.

Note

When the SC is in PTC and PRN ranging is required, the two-way station will not initiate a range reacquisition until the antenna reset command is verified on the high-speed printer and the downlink signal strength on the systems monitor recorder indicates lock on the high-gain antenna with narrow beamwidth.

(b) If ranging is initiated and no ranging turnaround from the SC is observed, the OPSR should notify Track on Net 2.

(c) If for any reason the signal level is low (e.g., SC on omni antenna, two-way station is 30 foot), and ranging is felt to be detrimental to voice/telemetry, the OPSR should notify Track on Net 2. However, ranging should be terminated only upon request by MCC. Track will inform the station if it is necessary to discontinue ranging for any reason.

(2) LO Ranging

(a) During the LO phase, the two-way stations will attempt range acquisition only when specifically directed by MCC. The stations will not range unless requested, even if a ranging mode is designated by the SCM. The stations will keep the code clock switch in the "off" position until requested by Track to initiate ranging. When directed by Track to terminate ranging, the station will put the code clock switch back to the "off" position.

(b) If invalid range exists or is suspected, the station should notify MCC but should not attempt a new range acquisition.

(3) MCC Ranging Requests (All Mission Phases). If MCC requests a ranging acquisition when the station is not in a ranging mode, the OPSR, before ranging is initiated, will ask Track which USB uplink mode is required. The station will then use the relevant ranging procedure.

(4) LM Descent Ranging

(a) Upon MCC direction, the LM two-way station at AOS of the descent rev will complete a range acquisition and report "valid range acquired" to Track. The station will stand by to reacquire range on Track's direction.

(b) Clock updated ranging is to be maintained after each range acquisition until terminated upon Track's direction.

(5) LM Ranging During LCRU Operations

(a) Stations will not attempt LM range acquisition during simultaneous LM/LCRU operations.

(b) Stations should contact Track if a ranging mode is designated by the SCM.

(6) LM Deorbit (Impact) Ranging

(a) Upon direction from MCC, the LM two-way station will initiate range acquisition at approximately 2-minute intervals until three valid acquisitions have been made or until terminated by MCC.

(b) Clock updated ranging is to be maintained from the third range acquisition until terminated by MCC direction.

(c) Any additional range acquisitions will be by direction of MCC only.

1.3.4.5 Transmission of Low- and High-Speed Tracking Data

a. Purpose. To establish a procedure for station guidance when transmission of low- and/or high-speed tracking data off station is required.

b. Participants. OPSR, Track, GCC, and USB and C-band stations.

c. Procedures

(1) Non-active Mission Support Periods. Stations will not transmit static or boresight tracking data off station (high- or low-speed) except for the following:

(a) Transmission of CADFISS tracking data to GSFC.

(b) When scheduled by MCC for boresight/collimation and validation testing.

(c) When scheduled and coordinated by Track for special testing.

(2) Active Mission Support Periods. Stations will transmit high- and low-speed tracking data to GSFC and MCC as follows:

(a) Low-speed Tracking Data Transmission (USB and C-band)

1. Data Priorities

a. Stations Other than BDA. Stations having both USB and C-band tracking capability will treat USB tracking data as prime. When communications limitations exist, C-band tracking data will be sent postpass, unless otherwise specified in the SCM.

b. BDA. Low-speed data at BDA will have the following priorities: USB, FPQ-6, and FPS-16.

2. Procedure for Transmission of Low-speed Tracking Data to GSFC and MCC. Stations transmitting low-speed tracking data (in real time or postpass) to both GSFC and MCC in accordance with the SCM will use the following procedures:

a. Stations will transmit low-speed tracking data to GSFC from predicted AOS minus 2 minutes to LOS plus 2 minutes of all scheduled passes.

b. When transmitting low-speed tracking data to GSFC only, use the "DD" header.

c. When transmitting low-speed tracking data to MCC and GSFC use the "JJ" header.

d. Stations will transmit a new SOM when changing between "JJ" and "DD" headers during transmission.

3. Procedures for Transmission of Low-speed Tracking Data, by Mission Phase

a. Prelaunch. Only CADFISS, collimation/boresight, validation testing, and Network SIM's are required (except for MIL).

Note

MIL will initiate low-speed tracking data at liftoff minus 5 minutes according to the sequence at T minus 00:05:00 of the terminal count.

b. Launch to TLI

(1) Stations will transmit low-speed data from predicted AOS minus 2 minutes to LOS plus 2 minutes of any pass for which the SCM indicates a requirement for low-speed data.

(2) TDP recording will be at the real-time transmission rate from launch to TLI plus approximately 1 hour.

(3) If the SCM requires USB tracking data for two vehicles (two links) simultaneously, the station will output data in the dual TDP mode. When the SCM requires tracking data for a single vehicle, the station will output data in the single TDP mode for the vehicle and from the system assigned.

(4) During launch and earth orbit phases, low-speed data will be transmitted at the rate of 1 sample per 6 seconds.

c. TLI to LOI

(1) Stations having both USB and C-band tracking capability will treat USB tracking data as prime. When communications limitations exist, C-band tracking data will be sent postpass, unless otherwise specified in the SCM.

(2) Stations will transmit low-speed tracking data to MCC and GSFC using a "JJ" header for the times specified in the SCM.

(3) If the SCM requires USB tracking data for two vehicles (two links) simultaneously, the station will output data in the dual TDP mode. When the SCM requires tracking data for a single vehicle, the station will output data in the single TDP mode for the vehicle and from the system assigned.

(4) After TLI plus approximately 1 hour (post TD&E), MCC will request the rate of 1 sample per 10 seconds for the remainder of the mission. The switch to the 1 sample per 10 second rate will be verbally cued by Track.

(5) When switching to the 1 sample per 10 second transmission rate, the TDP recording rate will be changed from the real-time transmission rate to the 1 sample per minute rate.

d. LOI to TEI

(1) Stations will transmit USB tracking data per SCM. Stations having view of the SC, but not supporting a DOI contingency TTY configuration, will inhibit low-speed tracking data on station during the lunar orbit for which the DOI TTY configuration is scheduled. (This configuration may also be required if a DOI trim burn is required following DOI.)

(2) Stations will transmit low-speed tracking data to MCC and GSFC using a "JJ" header for the times specified in the SCM.

(3) Data will be transmitted at a 1 sample per 10 second transmission rate. The TDP recording rate will be 1 sample per minute.

(4) If the SCM requires USB tracking data for two vehicles (two links) simultaneously, the station will output data in the dual TDP mode. The dual TDP mode will be maintained during occultation of one of the vehicles. When the SCM requires tracking data for a single vehicle, the station will output data in the single TDP mode for the assigned link.

(5) After LM impact, stations will output tracking data in the single TDP mode.

e. TEI to EI Minus 2 Hours

(1) Stations will transmit USB tracking data per SCM.

(2) Stations will transmit low-speed tracking data to MCC and GSFC using the "JJ" header for the times specified in the SCM.

(3) Data will be transmitted at a 1 sample per 10 second transmission rate. The TDP recording rate will be 1 sample per minute.

(4) If the SCM requires USB tracking data for two vehicles (two links) simultaneously, the station will output data in the dual TDP mode. When the SCM requires tracking data for a single vehicle, the station will output data in the single TDP mode for the vehicle and from the system assigned.

f. EI Minus 2 Hours to Splash

(1) Stations having both USB and C-band capability will treat USB tracking data as prime. When communications limitations exist C-band tracking data will be sent postpass, unless otherwise specified in the SCM.

(2) Stations will transmit low-speed tracking data to MCC and GSFC using the "JJ" header for the times specified in the SCM.

(3) If the SCM require USB tracking data for two vehicles (two links) simultaneously, the station will output data in the dual TDP mode. When the SCM requires tracking data for a single vehicle, the station will output data in the single TDP mode for the vehicle and from the system assigned.

(4) TDP recording will be at the real-time transmission rate.

(b) High-speed Tracking Data Transmission (USB and C-band). Stations will transmit high-speed tracking data in real time to GSFC and MCC for the various mission phases in accordance with the SCM.

1. Transmission Rates

a. All USB and C-band land stations will transmit high-speed data at the rate of 10 samples per second and at the bit rate of 2.4 kb/sec.

b. VAN will transmit high-speed data at the rate of 2 samples per second and the bit rate of 1.2 kb/sec.

2. Procedures for Transmission of High-speed Tracking Data by Phase. Stations will transmit high-speed tracking data on Net 5 for the indicated mission phases using the following procedures:

a. Prelaunch. Only CADFISS, boresight/collimation and validation testing and Network SIM's are required (except for MIL).

Note

MIL will initiate high-speed tracking data at liftoff minus 5 minutes according to the sequence at T minus 00:05:00 of the terminal count.

b. Launch to TLI

(1) Stations will transmit high-speed data from predicted AOS minus 2 minutes to LOS plus 2 minutes of any pass for which the SCM indicates high-speed tracking data support.

(2) When the SCM indicates high-speed tracking data to MCC, the station will output data only in the single TDP mode.

c. TLI to LOI

(1) Stations will transmit high-speed tracking data as directed by the SCM or at the verbal direction of MCC.

(2) Normally MCC will not require high-speed tracking data during the TLC phase. If the SCM indicates an MCC requirement for high-speed data, the station will output data only in the single TDP mode.

(3) High-speed data will be required by GSFC to support TIR. When transmitting high-speed data to GSFC only, dual TDP operation is permissible.

d. LOI to TEI. High-speed tracking data support will be required by MCC during certain periods of lunar orbit. All stations supporting this requirement according to the SCM will configure for single TDP output during high-speed data transmission, although they may be configured for dual TDP operation prior to and for the remainder of their support time. The SCM will cue each configuration change.

e. TEI to Splash. High-speed tracking data is not usually required by either MCC or GSFC during the TEC phase of a mission. If such a requirement develops, high-speed tracking data will be transmitted in accordance with the SCM or at verbal direction of MCC.

(3) Tracking Data Validity. If the signal level at the station is too low to provide valid Doppler and/or ranging data and the SCM specifies tracking data output from the station, the OPSR should notify Track on Net 2.

1.3.4.6 Spacecraft Antenna Switching

a. Purpose. To provide the station with procedures to be followed during spacecraft antenna switching.

b. Participants. OPSR,USB, RTC, Track, and NC.

c. Procedures

(1) General. The CSM and LM may switch to different antennas throughout the mission (e.g., omni to high-gain).

(2) Antenna Switching

(a) Switching Cues

1. USB should monitor Net 1 for a request from MCC for the spacecraft crew to switch antennas.

2. The OPSR, at a two-way station, should monitor the high-speed printer for any MCC commands to switch antennas (CSM only). SLVO RST 2 may result in a CSM antenna switch.

(b) Reporting

1. If the two-way station cannot acquire the USB downlink, or if the signal approaches TLM threshold following an antenna switch, the OPSR will report this condition and the signal strength to Network on Net 2.

2. If it is suspected that tracking data has become invalid as a result of an antenna switch, notify Track on Net 2. (This procedure will be used whether tracking with a JJ or DD header, except by ETC which will not report to MCC at all.)

(c) LOS Due to PTC. Stations can expect periodic LOS due to PTC or when the spacecraft switches from the high-gain to the omni antenna. The OPSR should ensure that his station continues on program track until reacquisition occurs.

(3) Contingency. During periods when MCC is managing the CSM antenna system, signal strength on one antenna may decay below SC transponder threshold before MCC commands a switch to the next antenna. If this occurs, INCO may initiate the following procedure:

(a) "(Station), INCO, configure for uplink mode 3 with modulation on."

(b) Station will immediately configure for mode 3 leaving modulation on, even if LOS has occurred, and report: "(Station) mode 3 and modulation on".

(c) If the procedure is successful, signal strength will improve and Track will direct reconfiguration to normal mode.

(d) If the procedure is unsuccessful, return to normal reacquisition procedures upon MCC direction.

Note

Since mode 3 uplink improves the command circuit margin by approximately 10 dB, the command may be transmitted even if LOS has occurred.

1.3.4.7 CSM High-gain Antenna Management During Crew Sleep Periods in Lunar Orbit

a. Purpose. To prevent the CSM high-gain antenna from tracking into its stops and causing antenna oscillations, as well as to enhance the next acquisition.

b. Participants. OPSR,USB, INCO, and Track.

c. Procedures

(1) General. The CSM high-gain antenna may track into its stops and begin oscillating if allowed to track until occultation in lunar orbit. CSM AOS may also be affected if this is allowed to happen. The following procedures will apply.

Note

The HGA will be used for transmitting SIM experiment data during crew sleep periods. The CSM will be blunt end forward, local horizontal, orbit rate attitude. The HGA will be configured for REACQ TRACK mode and NARROW BEAM. The dials will be set to slew to the AOS position when the antenna drives into the scan limit just before occultation. Because of the sensitivity of the HGA, the antenna may try to reacquire the uplink. It would then cycle between the AOS and scan limit positions until the uplink is terminated or occultation occurs. Therefore, the following new procedures are required.

(a) Procedure A. Just prior to the HGA tracking into the scan limit, INCO will direct the Network two-way station to go to uplink mode 0. The HGA will stop tracking at that position and reacquire at AOS. Since the antenna will be roughly 180 degrees from earth line of sight at AOS, it may not acquire immediately. If Procedure A does not result in AOS as expected, the following procedure may be implemented by MCC.

(b) Procedure B. The INCO will tell the two-way station to stand by for LOS in one minute (plus or minus one minute). The HGA will be allowed to track into the scan limit. When it hits the limit, it will switch to wide beamwidth and start slewing toward the AOS position at the rate of 30 degrees per second. A 19-dB step decrease will be noted followed by loss of two-way lock. As soon as the USB operator sees the step decrease, he will terminate the uplink. The antenna will continue on to the AOS position and stop. It will take approximately six seconds to reach the AOS position. No damage to the antenna will result if the uplink is terminated late, but it may not be in the optimum position for AOS.

(2) Antenna Management. The scheduled CSM two-way station will bring the CSM uplink carrier back up at their discretion, after LOS and prior to scheduled AOS, in preparation for a nominal high-gain antenna acquisition.

1.3.4.8 Contingency Uplink Sweep Mode

a. Purpose. To establish the procedures to be followed if a loss of two-way lock with the spacecraft occurs and lock cannot be reacquired using normal procedures.

b. Participants. OPSR, USB, Track, and station ComTech.

c. Procedures. If a spacecraft malfunction occurs, MCC may request the station to implement a "contingency uplink sweep mode." The OPSR will ensure the A-G voice is remoted and use the following procedure:

(1) The normal USB uplink mode will be mode 7. The OPSR will have USB select mode 7 (or any other uplink mode designated by MCC). USB, while sweeping should have the subcarrier(s) on for 30 seconds and off for 30 seconds. Each time the subcarrier(s) are turned on or off, the OPSR will announce this on Net 2 (e.g., "GDS, subcarrier(s) on").

(2) The OPSR will continue this effort until notified by MCC to reconfigure or until a response is received from the crew. If the crew responds, the OPSR will maintain uplink subcarrier(s) on unless notified by MCC to reconfigure.

1.3.4.9 USB Battleshort (85-foot Stations and ACN)

a. Purpose. To establish the periods during the mission when the USB battleshort function will be enabled.

b. Participants. OPSR, USB, and NC.

c. Procedures. The USB battleshort function will be enabled and disabled at the direction of the NC during critical phases of LM maneuvers. The OPSR will confirm this configuration to the NC on Net 2. Mission phases which require this function are:

(1) CSM/LM DOI. Emergence-15 minutes of the pass following DOI until emergence +30 minutes.

(2) LM Descent. Powered Descent Initiate (PDI) -15 minutes until approximately PDI+23 minutes.

(3) LM Ascent. Ascent ignition -15 minutes until LM lunar occultation.

1.3.4.10 LM and IU/CCS Offset Frequency Tracking

a. Purpose. To provide for simultaneous operation of the LM and IU/CCS USB transponders which have the same nominal frequency.

b. Participants. MCC, OPSR, and USB.

c. Procedures

(1) General. Offset frequency tracking will be required under the following conditions:

(a) IU will be frequency offset on MCC direction for the following periods:

1. For a one-hour period during the first scheduled 2-way support with each 85-ft station following the final booster midcourse correction.

2. Approximately 1 hour prior to the LM communications test.

(b) IU may be offset earlier if a contingency arises.

(c) LM will be offset as required.

(2) Offset Initiation

(a) Track will initiate frequency offset by a call to the two-way station giving the following information:

1. Vehicle (IU or LM).

2. Offset required (±85 kHz or ±184 kHz).

(b) Two-way and three-way stations will implement offset frequency in accordance with section 4 of this NOSP.

(c) Two-way stations will report when offset is complete and report the synthesizer frequency.

(d) Track will send an OPN confirming offset frequency and vehicle.

(3) Offset Frequency Handovers. Offset frequency handovers will be conducted in accordance with section 4 of this NOSP.

1.3.4.11 LM and IU (CCS) AGC Volts Recording For Lunar Impact Determination

a. Purpose. To provide the stations with procedures for reporting LM and S-IVB lunar impact.

b. Participants. OPSR, USB, NC, and Track.

c. Prodecures

(1) During both LM and S-IVB lunar impact phases, all stations assigned by SCM to track the LM or IU (CCS) will record in accordance with section 4 of this NOSP.

(2) The coverage time (from the appropriate receiver assigned by SCM to the particular vehicle involved) will be 1-minute prior to vehicle impact; predicted impact time will be provided to the stations by MCC. Stations will start their recorders -1 minute prior to predicted vehicle impact.

(3) After observing LOS, stations will stop recorders, determine time of impact from the stripchart and record time of LOS to the nearest hundredth of a second to Network and NOM by Lunar Impact Report Message (refer to section 16). Also report by voice only when queried by MCC.

1.3.5 COMMUNICATIONS

1.3.5.1 Typical Pass Activities for GCC

a. Purpose. To provide a quick reference to GCC activities.

b. Participants. OPSR, GCC, and wire tech.

c. Procedures

Time	Station	Personnel	Activities
H-40	30', 85'	GCC	Receive 29-point acq message if generated by GSFC and start distribution.
H-30	All	GCC	Announce receipt of SCM and start distribution. Monitor applicable loops. Confirm system configured according to STDN No. 502.12. Upon request, report system status to the OPSR giving all "red" items and ETO.
	30', 85'	GCC	Call the local telephone company to confirm critical coverage of the toll test board.
	VAN	GCC	Instruct an operator to turn on the voice recorder.
H-23	VAN	GCC	Transmit the IRV to the CDP.
H-20	VAN	GCC	Confirm with navigation coordinator that the NAV update message has been transmitted.
	30', 85'	GCC	Announce receipt of 29-point acq message if generated by MCC and start distribution.
	30', VAN	GCC	Announce to OPSR receipt of 6-point acq message and begin distribution.
	All	GCC	Verify with the wire tech that A-G circuits are properly configured and excess patches are removed from the jack field.
H-15	30', 85'	GCC	Stop local vehicular traffic (if applicable).
H-3	30', 85' VAN	GCC	Reconfirm data link configured.
H-2	30', 85' VAN	GCC	Verify that biomed data is being remoted (if applicable).
AOS	All	GCC	Verify that station data is on-line and all outgoing TTY traffic is valid.

Time	Station	Personnel	Activities
LOS +2	All	GCC	Inform the OPSR of the station status giving all "red" items and an ETO for each. Transmit CRF message if required.
	30', 85'	GCC	Release traffic restrictions (if applicable).
LOS +10	All	GCC	Prepare for postpass activities and message transmissions.
	VAN	GCC	Instruct operator to turn off the voice recorder.

1.3.5.2 Air-to-Ground Voice Communications

a. Purpose. To define the configuration of the A-G communications modes and associated operating procedures.

b. Participants. OPSR, station ComTech, NOM, Houston ComTech, and CapCom.

c. Procedures

(1) General

(a) Callsigns. For all phases when only the CSM is manned, the AS-512 callsign will be "Apollo 17". When both vehicles are manned the callsigns will be ____________ for the CSM and _____________ for the LM. The callsigns for the CDR and LMP during lunar surface operations will be the astronauts' first names.

(b) Types of Normal Air-to-Ground Configurations. Configurations Alpha through Kilo are applicable for this mission (refer to section 14 of this NOSP for descriptions of these configurations). The NASCOM Comm Mgr (Voice Control) will configure the required NASCOM circuitry in accordance with the SCM for configuration Alpha, or as verbally directed by MCC for configurations Bravo through Kilo. (For the latter configurations, the NASCOM Comm Mgr/Goddard Voice Control will inform MCC that the required NASCOM configuration is completed.) At a station's LOS or at a handover from one station to another, the NASCOM Comm Mgr will "normal" Nets 1 through 6 to the outgoing station.

Note

When configuring either HSK, GWM, or HAW for A-G configurations Delta or India, Goddard Voice will, if necessary,inform all three stations of the action and simultaneously restore the Net 2 voice function of the three stations on lower priority nets. This is the worst case condition; as a minimum, this may be required at two or all three stations.

(c) Circuit Monitoring

1. The station ComTech will monitor all circuits which are scheduled for mission support and will ensure that the best voice is applied to the spacecraft/MCC interface.

2. During EVA periods of simultaneous LM and LCRU support, the downlink voice source for enabling to MCC will be dictated by the LCRU downlink mode configuration. Whenever LCRU downlink modes 1, 2, or 3 configuration is requested, the station ComTech will enable LCRU downlink voice to MCC (unless directed otherwise by Houston ComTech). Whenever LCRU downlink mode 4 is requested, the station ComTech will enable LM downlink to MCC.

3. MCC ComTech will periodically request voice quality status reports of the vehicle downlink that is not enabled to MCC.

(d) Special Monitor Requirement. During the periods when the Voice-Operated Gain-Adjusting Amplifiers (VOGAA's) are inserted in the spacecraft voice circuits, the station ComTech or wire tech will monitor the input and output. The ComTech will notify the Houston ComTech of any significant differences.

(e) Voice Status Reports. The station ComTech will report to the Houston ComTech any situation which will improve the spacecraft voice support. These reports should be made from any station regardless of the support requirements. Special attention should be given to monitoring for spacecraft downlinks which may be different than predicted, particularly backup voice or Amplitude Modulation (AM) key. All reports and interface between the station ComTech and the Houston ComTech will normally be conducted on Net 2. Use of another circuit for coordination will be directed by MCC.

(f) 210-ft Antenna Operations. During periods when the 210-ft antenna is used, the station ComTech will ensure that the recorder tech is aware of the antenna (85-ft or 210-ft) from which A-G voice is being remoted. The recorder tech will then state the A-G antenna source on the voice annotation loop of the recorder.

(2) Remoting Procedures

(a) Verification of A-G Links. Prior to H-20 minutes, the ComTech will verify that modes are configured as required by the SCM and the proper modulation levels are applied to the uplink interface. Stations designated as backup will return voice links to "local" condition. In the event that A-G communications support is required for the backup stations, specific A-G configurations will be designated in real time by the MCC ComTech.

(b) Ensuring Scheduled Remoting. The OPSR will ensure that the voice circuits are remoted at the time directed in the SCM or by the MCC ComTech.

(c) Downlink Voice to MCC. Except during the launch phase, only the two-way station will transfer downlink voice to MCC.

(d) Inhibition of Downlink Voice. The USB downlink voice will be inhibited to the voice circuits at all times that USB is out of downlink lock.

(e) Application of Remote. The term "remote" applies to uplink and downlink collectively, if not otherwise specified.

(f) VHF and USB Voice Systems Simultaneously Active. Unless directed otherwise by the SCM or Houston ComTech, when both the VHF and USB A-G voice communication systems are active, stations will uplink VHF simultaneously with their USB carrier on and will transfer the best received voice, either VHF or USB, to MCC.

Note

Approximately 3 1/2 hours after a successful TLI maneuver VHF equipment will not be required until approximately 5 1/2 hours prior to entry interface. The OPSR will release all VHF equipment from mission support during this interim upon receipt of a station/equipment release message from the NSC confirming this procedure.

(3) Contingency Procedures

(a) Loss of Communications to MCC. No voice contact will be initiated with the SC by STDN station personnel except as directed by MCC. However, if the communication link to MCC is inoperative and the SC calls, the OPSR will inform the astronauts that communications to MCC are out and the station is standing by to record comments for relay to MCC.

1. Maintaining the continuity of the spacecraft voice remoting circuitry is normally the highest priority among the STDN and data nets. When two-way communication between MCC and the spacecraft cannot be established at scheduled acquisition times, or when two-way communication in progress between MCC and the spacecraft is lost, take the appropriate actions described in subsequent subparagraphs 2. through 8.

2. The Houston ComTech will perform a rapid communications check with the remote station on GOSS Conf/Net 1 to determine if the problem is in the ground communications environment or in the A-G link. If voice validation with the station is successful, action is taken on station to resolve possible voice remoting problems and appropriate reports are made on GOSS 4/Net 2. If a voice validation check with the station is unsuccessful, the problem is in the ground communications.

3. Immediately following an unsuccessful voice validation of MCC-to-station voice link, the Houston ComTech initiates a communications check with GSFC voice control on GOSS Conference. This check will isolate the major voice link failure (i.e., GOSS Conference validation indicates a possible Net 1 failure; an invalid GOSS Conference indicates a failure in the MCC/GSFC link).

Note

Concurrent with this action, MCC Communications Control and NASCOM Comm Mgr will follow the procedures outlined in MSC/GSFC MCC Operations/NASCOM Operations Communications Control Interface Procedures.

4. MCC Communications Control contacts the GSFC Voice Controllers on GOSS 8 when the GOSS Conference validation check is complete; the results of initial troubleshooting are reported and corrections are requested.

5. If the problem is traced to failure of GOSS Conference, restoration is effected by using the GOSS Conference backup circuit (simultaneous linking action by the Houston ComTech/ Houston Voice, and the GSFC Voice Controller).

6. If the trouble is a Net 1 failure with the station in two-way acquisition of the spacecraft, Goddard Voice Control will immediately do the following:

a. Restore on alternate or spare NASCOM facilities.

b. If spare or alternate NASCOM facilities are not available, voice control and the station will restore on the lowest priority net as outlined in para 1.3.5.4c(4). Voice Control will use normal "break-break" procedures if the preemption of another voice net to the station if necessary.

c. After the restoration, Voice Control will make an end-to-end voice check with the station ComTech to ensure continuity.

d. Immediately after the restoration and verification, Voice Control will report to MCC Communications Control and NASCOM Comm Mgr: "You now have a Net 1 function to (station name)."

e. The Houston ComTech will then initiate a brief voice and keying check; normal internal MCC coordination will be used to provide for CapCom remoting.

f. Concurrently with the preceding, action will be taken to restore the failed net with the station.

g. In the event that failure occurs when in A-G configuration Delta, India, or Kilo and if restoration cannot be effected by the preceding methods, MCC ComTech will be advised by Voice Control. MCC Communications Control will then take necessary action to reconfigure A-G to one circuit, or will provide the desired restoration priorities in this situation.

h. Stations will maintain a monitor speaker at all times on the receive side of Net 3.

7. Stations not involved in two-way spacecraft acquisition or not designated as backup will be restored only by direction of the NC when spare facilities are not readily available.

8. After he has been notified that circuits are restored, the Houston ComTech will initiate a brief voice communications check on GOSS Conf/ Net 1 with the station.

Note

When making restoration on Nets 2 and 3 with HSK, GWM, and HAW, it may be necessary for Voice Control to restore two or more of these stations simultaneously. If necessary, Voice Control will inform all concerned stations of the action and simultaneously restore them, even though only one of the three was initially experiencing difficulties.

(b) Failure of Remote Capability. The station ComTech will inform the Houston ComTech and the OPSR of any failure in remote capability.

(c) Quindar Failure. The station ComTech will notify the Houston ComTech and the OPSR of a Quindar failure. He will then manually key the uplink as required. If the situation permits, he should contact the wire tech to investigate the problem. Otherwise, the following procedure will apply:

1. MCC will give the SC callsign twice. At the first announcement of the callsign, the ComTech will key the uplink locally.

2. The ComTech will release the uplink key when MCC announces "over".

(d) Failure of Quindar to Release. The ComTech should locally release the Quindar when the CapCom completes his transmission if the Quindar fails to release.

(e) Spacecraft Voice Mode Discrepancies. Should the spacecraft downlink voice differ from that predicted in the SCM, the ComTech should reconfigure to the SC mode and notify the Houston ComTech and the OPSR.

(f) LM Monitoring. During TLC or LO, when a station is configured via SCM to monitor the LM downlink, the station ComTech will monitor the LM downlink voice sources, particularly during the time when there is no voice downlink from the CSM. Should the station receive voice from the LM, the station ComTech will immediately enable the LM downlink to Net 1 and notify Houston ComTech. He should not inhibit the CSM remote to Net 1 at any time during this configuration unless directed by MCC.

(g) LCRU Monitoring

1. The LCRU will be activated during EVA-1. The down link voice source for enabling to MCC during the LM/LCRU lunar operation will be dictated by the LCRU downlink mode configuration. Whenever downlink mode 1, 2, or 3 configuration is requested, the station ComTech will enable LCRU downlink voice, unless requested otherwise by MCC ComTech. Whenever LCRU downlink mode 4 is requested, the station ComTech will enable LM downlink voice.

2. After the LCRU downlink is verified, MCC Track will direct the LM/LCRU two-way station to change to uplink mode 13 and 15 containing the LCRU voice subcarrier (124 kHz).

3. The Television Interference Subcarrier Cancellation Unit (TVISCU) configuration will also be dictated by the LCRU downlink mode. The voice subcarrier channel of the TVISCU will be enabled for LCRU downlink mode 3 and disabled for LCRU downlink mode 4.

(h) AM Key at 85-foot Stations and MIL (Prelaunch). One person on each shift during support times will be qualified to decipher International Morse Code on the SC downlink. The capability should exist to complete the following uplink procedures:

1. All stations when notified by the NC to configure for uplink Morse Code will perform the following:

a. OPSR will instruct the USB supervisor to configure for USB uplink mode 1.

b. OPSR will ensure that the ComTech has transferred (veh) downlink voice/AM key (as required) to Net 1.

c. The USB supervisor will ensure that an operator who is qualified as a telegrapher is present at the R&E console.

d. The assigned telegrapher will monitor the OPSR loop and Nets 1 and 2.

2. The NC will brief the assigned station on particular support requirements.

3. All cues directing uplink transmission will be relayed by voice from MCC to the station. The assigned telegrapher will uplink these instructions using International Morse Code in the following manner:

a. The modulation selector switches, NORMAL and OFF, will be used as a telegrapher's key. Modulation OFF will indicate a ten percent increase on the SC signal strength meter.

b. A "dash" will be represented by activating the OFF modulation PBI for a period of 10 seconds.

c. A "dot" will be represented by activating the OFF modulation PBI for a period of 5 seconds. A delay of 5 seconds will be allowed between "dot" and "dash" functions.

d. Spacing will be 10 seconds between each character in a word group and 15 seconds between word groups.

e. A series of six to eight consecutive "dots" will cancel the preceding word group.

4. All coordination and/or interrogations between MCC and station personnel will be conducted through the OPSR on Net 2.

5. All other Network stations having the spacecraft in view will closely monitor Net 2 in case an unscheduled handover is required.

(4) Special Support Requirements

(a) Prelaunch

1. Prelaunch voice communications with the SC will be limited to MCC, Launch Operations Manager (LOM), CSM Spacecraft Test Conductor (MSTC), and the Astro Communicator Panel Operator (CSTO). MIL will transfer VHF A-G receive to the MIL A-G longline and the USB A-G receive to Net 1. Also, MIL will enable simultaneous VHF and USB uplink to MIL A-G longline and, at T-4 minutes, will provide MCC with the receive side of the astro-launch circuit on the MIL A-G longline.

2. MIL will initiate constant keying to support KSC requirements according to the CSM Test and Checkout Procedure (TCP). Power output is to be limited to 100 watts nominal.

3. During the terminal count, MIL will also inhibit the uplink capability on Net 1 when constant keying is called for in the CSM TCP. This action will not inhibit monitoring of CSM S-band downlink on Net 1.

4. All A-G communication checks which do not specifically call for the use of Net 1 will be made on MIL A-G longline.

5. If Net 1 communication checks are required, the inhibit function will be removed for the duration of the communication check.

6. The inhibit function of Net 1 and the constant keying function will be removed when the launch vehicle clears the tower, or by direction of the Houston ComTech. None of the above inhibit functions involve the MIL A-G longline Duplex B until MIL LOS.

7. The MIL A-G configuration in support of MCC prelaunch operations is as follows:

a. MIL A-G longline transmit VHF (296.8 MHz) and CSM S-band.

b. GOSS Conf/Net 1 transmit VHF (296.8 MHz) and CSM S-band (when not inhibited).

c. Remote CSM S-band to MCC on GOSS Conf/Net 1.

d. Remote VHF (259.7 MHz) to MCC on the MIL A-G longline.

(b) Launch

1. Primary mode of communication will be A-G configuration Alpha. After liftoff (from AOS to LOS), MIL, BDA, VAN, CYI, and ACN will enable the best source of received A-G voice (USB or VHF) to Net 1. This will be accomplished regardless of the SCM configuration. (GSFC Voice Control will make the station voice source selection for patching to the network portion of Net 1.) Voice uplinking will be as indicated in the SCM or by the Houston ComTech. If the downlink voice of the normal SCM remoting station deteriorates, GSFC Voice Control will choose another launch station as the downlink source, preferably the next station to be remoted according to the SCM.

a. MIL ComTech will preset squelch on one A-G VHF receiver to override RFI. This receiver should be used for all VHF A-G remoting during launch to launch +1 minute.

b. MIL ComTech will select another VHF A-G receiver at launch +1 minute. This receiver should be set to normal squelch sensitivity.

2. MIL, BDA, VAN, CYI, and ACN will transmit the Postpass Launch Phase A-G Activities Message in accordance with section 16 of this NOSP.

3. During the launch phase, the CSM nominally will be configured for VHF Duplex B operations. After CYI LOS, the crew will reconfigure for VHF Simplex A. CRO should expect to acquire in this mode; however, all stations should continue to monitor the 259.7 MHz downlink, and if the spacecraft calls, the station should immediately remote the downlink to MCC. As soon as possible thereafter, the station will notify Houston ComTech that downlink is being received on 259.7 MHz.

4. After T+30 minutes, all stations will follow the A-G voice procedures as instructed for the various other phases of the mission.

5. ANT is required to support launch phase for launch azimuth of 80 degrees or greater with VHF A-G configuration Alpha, Duplex B (transmit, 296.8 MHz; receive, 259.7 MHz).

a. As specified in the terminal count, MCC ComTech will conduct a voice and keying check with ANT on Net 1. MIL ComTech will monitor the ANT monitor drop circuit during this test and will notify MCC ComTech of the results.

b. For a launch azimuth of 80 degrees or greater, the following steps will be required:

(1) At launch, ANT will enable the 259.7-MHz downlink to Net 1 while monitoring Net 2.

(2) On cue from Houston ComTech, MIL ComTech will enable the ANT monitor drop circuit to the MCC/MIL A-G longline should ANT Net 1 fail.

(3) ANT will announce station AOS on Net 2 at the first indication of SC signal.

(4) ANT will enable the VHF uplink (296.8 MHz) only on direction of MCC ComTech on Net 2.

(5) ANT will also monitor the 296.8-MHz downlink and will enable this downlink to Net 1 (if the SC is heard on this frequency) and notify MCC ComTech as soon as possible.

(c) VOGAA Operation. Unless otherwise directed by MCC, all stations will operate the A-G system with the VOGAA's bypassed. The following procedures apply to VOGAA operation:

1. In the terminal count, upon completion of station subsystem test for VOGAA adjustment, all stations will bypass the VOGAA's in the spacecraft downlink voice circuits.

2. The VOGAA will remain bypassed throughout the mission but may be called for in real time by Houston ComTech. If VOGAA operation is called for, Houston ComTech will provide a voice cue on Net 2 for applicable stations to insert the VOGAA in the CSM downlink. At the completion of VOGAA operations, Houston ComTech will provide another cue on Net 2 directing stations to bypass the VOGAA in the CSM downlink.

3. During dual vehicle operations, beginning with LM activation, the VOGAA may be inserted in the CSM A-G circuit only. Houston ComTech will provide a voice cue on Net 2 for all stations to insert the CSM VOGAA for dual operations. At the completion of dual vehicle operations, Houston ComTech will provide another cue on Net 2 directing stations to bypass the VOGAA in the CSM A-G circuit.

4. During those periods when the VOGAA is not bypassed, the station OPSR and ComTech will ensure that both the input and output of the VOGAA's are monitored. In the event that voice is degraded at the output of the VOGAA, but good at the input, the station will advise Network on Net 2. In the event of a total VOGAA failure, the station ComTech will bypass the VOGAA and the OPSR will advise the NC.

(d) VHF Re-entry Communications Test

1. Approximately 5-1/2 hours prior to entry interface, applicable stations will be instructed by SCM to activate VHF A-G equipment and configure for SIMO VHF and USB uplink capability.

2. Stations will monitor VHF downlink and will report to Houston ComTech on Net 2 when the VHF downlink signal becomes usable.

3. At 8,000 mile slant range, Houston ComTech will advise station ComTech to remote VHF downlink only on Net 1 to MCC.

4. Upon completion of the test, Houston ComTech will advise the station ComTech to continue to simultaneously uplink VHF and USB voice and remote the best source downlink on Net 1 to MCC for the remainder of the mission.

(5) Dual A-G Voice Nets

(a) When a station is directed to go to A-G configuration Delta, India, or Kilo the GCC or ComTech will announce on the paging system and the OPSR loop:

"Nets 1 and 2 are being used for A-G voice. Use Net 3 to interface with MCC and identify Net 3 as Net 2."

(b) When released from A-G configuration Delta, India, or Kilo the GCC or ComTech will announce on the paging system and the OPSR loop:

"Net 2 is released from support of A-G voice. Utilize Net 2 to interface with MCC."

1.3.5.3 NASCOM/DOD Communications Support

a. Purpose. To define the NASCOM circuit assistance provided to DOD.

b. Participants. Comm Mgr, GSFC Voice, MCC Comm Control, Network, MCC recovery coordinator, and DOD manager.

c. Procedures

(1) Release of Voice Circuit for VAN Launch Abort Contingency Support. At T-30, a spare four-wire recovery voice circuit between CTF-140 and Cape Kennedy will be extended by the Cape CLS to GSFC Voice Control via an existing NASCOM circuit to be designated by GSFC Voice Control. If a launch abort contingency occurs which involves VAN, the following procedures apply:

(a) The MCC recovery coordinator will notify the NC.

(b) The NC will instruct the MCC communications controller to connect a circuit to VAN for use by CTF-140 at Norfolk.

(c) The MCC communications controller will request GSFC Voice Control to extend CTF-140 to VAN via the circuit established at T-30 between CTF-140 and GSFC.

(d) GSFC Voice Control will use Net 3 for the interconnect to VAN. If Net 3 is impaired or is otherwise unusable, GSFC Voice Control will use an existing NASCOM HF voice link to VAN. The circuit established will be maintained until its disconnect is directed by the NC.

(e) Prior to T-30, if voice exchange of information is necessary between CTF-140 and VAN, the circuitry utilized will be four-wire voice service between CTF-140 and the Cape CLS/GSFC Voice Control on a noninterference basis with network operations. If a priority need exists for such a connection, such priority will be passed to GSFC Voice Control who, if necessary, will inform MCC and will request the release of an appropriate network circuit to the ship.

(2) NASCOM Backup Actions to Support DOD Circuits

(a) Communications for Normal Recovery Operations. Normal communication with surface forces is via single-sideband HF radio, communications satellite, or cable circuits, as available. Operational control for the Atlantic area is CTF-140 RCC (Norfolk, Virginia); for the Pacific area, CTF-130 (Kunia, Hawaii); and for the Europe-Africa area 40th ARRW RCC (Ramstein, Germany).

(b) Communications for Contingency Recovery Operations

1. NASCOM voice links are available to the RCC's at Ramstein, Germany Norfolk, Virginia; and Kunia, Hawaii. These links can only be used as a backup to DOD circuits or in the event of a contingency (see figure 1-9).

2. As a back-up, action will be taken by the DOD Manager and Flight Director to provide the service on a noninterference basis to network functions. MSC will notify GSFC to advise the switching centers to make appropriate patches into the RCC's. The RCC's will not take action from their locations to the local NASCOM facility unless advised to do so by MCC.

3. In the event of a contingency, it can be assumed that the network functions will not be required. If this is the case, all actions will start at MCC to notify the NASA communications agencies of the situation and the desired NASCOM links required to support the contingency operation.

(3) Joint Range Support

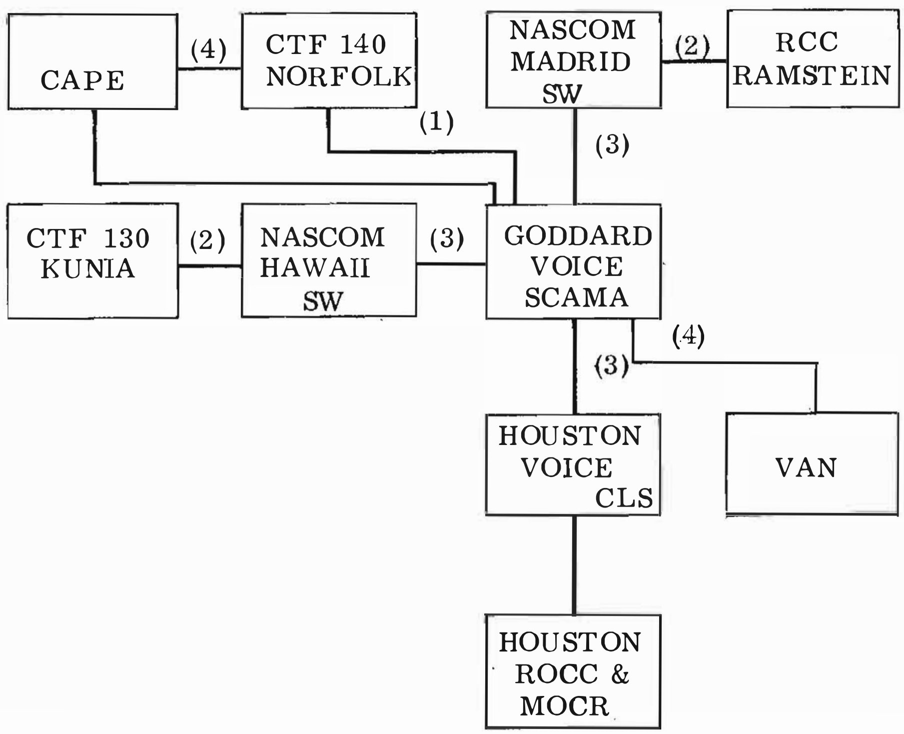
(a) The ETR and NASA/GSFC will combine existing communications circuits to form a radar coordination net (see figure 1-10). This net will be extended to GSFC/NOCC for NST control purposes. It will also be extended to MCC via CKAFS/KSC on a monitor-only basis after T-0.

(b) The Network countdown or scheduling message will specify the time when the radar coordination net is required.

(c) The Cape Communications Control will act as control for the DOD circuit segments until the net is established for operational use. At that time the DOD portion will be turned over to GSFC Voice Control for conferencing with NASCOM segments and extension to the NST Radar Controller (RC).

(d) Specific permission will be obtained from the RC in the NOCC before breaking the net unless the circuit is definitely known to be inoperative, in which case he should be so informed.

(e) Prior to the need-time specified in the network countdown or scheduling message, GSFC Voice Control will confirm with Cape Communications Control that they are prepared to interconnect with the circuit GSFC has assigned for this purpose. When interconnection is complete GSFC Voice Control will ensure satisfactory levels before interconnecting with the designated NASCOM circuit to BDA and extension to the RC in NOCC.



Legend

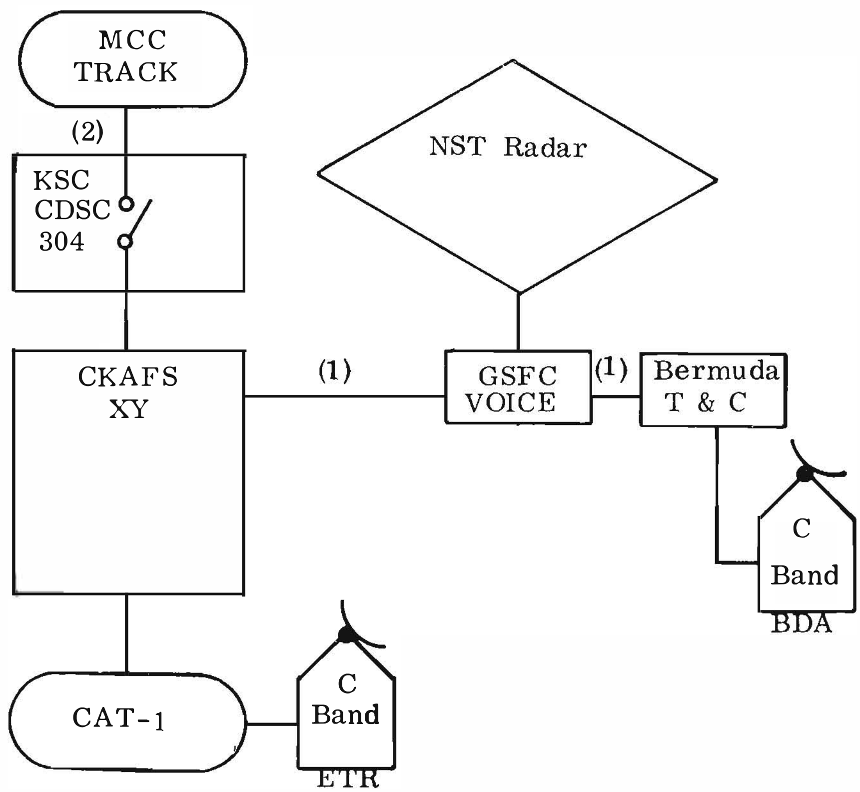
(1) Full Period MONITOR only

(2) Full Period MONITOR with TALK capability available after coordination by Houston Recovery with DOD Manager & Flight Director.

(3) Existing NASCOM capability to further support recovery after appropriate coordination with MCC

(4) Norfolk to VAN contingency voice.

Figure 1-9. NASCOM Backup Routings to Recovery Centers



(1) Circuit designated by GSFC Comm Mgr.

(2) Circuit designated by Houston Comm Control.

Figure 1-10. C-band Radar Coordination Net

1.3.5.4 Communications Restoration Procedures

a. Purpose. To prescribe actions for communications personnel in restoring impaired voice/data nets.

b. Participants. OPSR, station ComTech, Houston ComTech, GSFC Communications Manager, Houston Comm Control, and Network.

c. Procedure

(1) GSFC/Station Coordination

(a) The station normally reports communication problems on Net 3 or any spare voice circuit available.

(b) During an active spacecraft pass, if a communication problem is noted on station or by the communications manager and no other loop is available, the station and the communications manager coordinate with each other and the NC on Net 2 in real time, using "break-break" procedures.

(c) If an emergency occurs during an active spacecraft pass that must be reported to MCC and if GSFC communications cannot be contacted on Net 2 or by any other means, the station will advise the Communications Manager by sending an URGENT message via teletype to GSPA.

(2) GSFC/MCC Standard Restoration Criteria

(a) The MCC communications controller is the point of contact for the Comm Manager to coordinate the restoration of STDN nets that have failed or are impaired.

(b) When spare or backup circuitry exists that is equal to or greater than the amount of failed circuitry, the communications manager will execute restoration of the failed or impaired net without prior coordination and notify the MCC communication controller of the actions taken. Spare or backup facilities (defined as any uncommitted circuit resources available to the communications manager) include:

1. Special mission callup circuits.

2. Ground backup circuits to SATCOM services.

3. Other spare resources of this nature.

(c) Where such spare capability is of voice/data quality, restoration of telemetry data, command data, tracking data, or digital biomed data can be effected without preemption of in-use committed circuitry.

(d) Where such spare capability is below voice/data quality, but is of sufficient quality to carry voice transmission, restoration of voice circuits such as Nets 1, 2, and 3 can be effected without preemption of in-use committed circuitry.

(3) Priority Restoration Procedures. The procedures listed in the following paragraphs will take precedence when a spacecraft is in view.

(a) Restoration of Net 1 (A-G function) carries the highest priority of all voice/data nets. The special procedures to be followed in the conduct of

Net 1 troubleshooting and subsequent restoration actions are contained in paragraph 1. 3. 5. 2 of this NOSP.

(b) For phases of a mission where immediate restoral of telemetry data is required, the following procedure may be put into effect by notification from the TIC to the Comm Mgr and stations involved: TIC contacts the station and Comm Mgr on Net 2 advising the station of non-receipt of data and requesting Net 4 and Net 6 DTU inputs/outputs be reversed on station. This action will take into consideration data priority schemes that may be in effect. The Comm Mgr will not initiate any restoral action during the above DTU reconfiguration until notified by MCC Comm Control that net restoral is required.

(c) If a NASCOM systems failure involves two or more stations, the GSFC Communications Manager will first restore circuitry to the station in acquisition with the spacecraft (in two-way lock). At the same time he will coordinate with MCC communications control to determine the sequence for restoring circuitry to the other station.

(d) Stations not involved in two-way spacecraft acquisition or not designated as backup will be restored only by direction of the NC when spare facilities are not readily available.

(e) Patched "make good" circuits will be returned to normal configuration as soon as possible after the normal assigned circuits are declared usable and operational. The Communications Manager, at his discretion and after coordination with MCC, will effect the restoration to the normal configuration.

(4) Normal Net Priorities. The following nets are listed in normal order of priority.

(a) Net 1 (A-G voice loop).

(b) Net 4 (command and telemetry, high speed).

(c) Net 2 (MCC network coordination).

(d) Net 5 (tracking, high speed).

(e) Net 6 (digital biomed and command).

(f) Net 3 (GSFC Conference)

Note

If TIC has reversed the station DTU/net assignments, Net 6 is priority 2 and Net 4 is priority 5.

(5) Special Net Priorities for Lunar Descent, EVA, Lunar Stay, and Ascent Phase. There are two basic categories of net priority listings for Apollo 17. Nominal net priorities are listed in paragraph 1.3.5.4c(4) and cover the majority of mission activities where no special net configurations exist. The second category is the special net priorities that are required where special voice and/or data net configurations are required. The special net priority listing for Apollo 17 for Descent Phase, EVA, Lunar Stay, and Ascent Phase is as follows:

(a) Descent and Ascent Net Priorities

1. Prime LM Site

a. Net 1 (A-G voice).

b. Net 4 (TLM/CMD).

c. Net 5 (Tracking).

d. Net 2 (MCC coord).

e. Net 6 (Biomed).

f. Net 3 (GSFC Conf).

Note

If TIC has reversed the station DTU/Net assignments, Net 6 is priority 2 and Net 4 is priority 5.

2. Back-up LM Site

a. Net 1 (A-G voice).

b. Net 5 (Tracking).

c. Net 4 (TLM/CMD).

d. Net 2 (MCC coord).

e. Net 6 (Biomed).

f. Net 3 (GSFC Conf).

(b) Lunar Stay Net Priorities. Lunar stay net priorities are dependent upon A-G configurations.

1. A-G Configuration Juliett

a. Net 1 (A-G voice)

b. Net 4 (TLM/CMD).

c. Net 2 (MCC coord).

d. Net 6 (Biomed).

e. Net 3 (GSFC Conf).

f. Net 5 (Tracking).

2. A-G Configuration India

a. Net 1 (LM A-G voice).

b. Net 4 (TLM/CMD).

c. Net 3 (MCC Coord).

d. Net 2 (CSM A-G voice).

e. Net 6 (Biomed).

f. Net 5 (Tracking).

(c) EVA Net Priorities. To be supplied by DCN if required.

1.3.5.5 Voice and Data Net Configuration

a. Purpose. To describe supplemental usage of voice/data nets.

b. Participants. OPSR, Comm Mgr, Comm Control, TIC, Track, RTC, ComTech, and Network.

c. Procedures. Prior to CDDT (Wet) for each mission, the NASCOM Comm Mgr/technical control manager transmits, via TTY message, a communications network configuration for each station. These configurations apply upon receipt and are binding unless otherwise changed or rescinded by the NASCOM Comm Mgr/technical control manager. However, on a real-time basis, either GSFC Voice Control or GSFC Data Link, on behalf of the NASCOM Comm Mgr/technical control manager, directs rearrangements deemed necessary. These directions are relayed through the various NASCOM switching centers as required. Each configuration message normally contains, if applicable, alternate circuits in the event of a prime route failure. If a prime route fails, stations will immediately attempt to contact, via the alternate facilities, either their respective switching center or Goddard direct, depending on the station location and instructions in the configuration message.

(1) Net 1. Net 1 functions remain fixed in an air-to-ground role throughout all mission phases. All stations having one or more Voice/Data (V/D) circuits will have a GOSS Conference loop. Stations will normally be in a monitor only configuration unless a direct query is made by MCC or if the station has two-way spacecraft acquisition. The various configurations within the air-to-ground functional usage are explained in para 1.3.5.2. The only authorized supplemental usage is on a contingency basis, when Net 2 is impaired or non-operational, and allows the RTC to execute handover functions on Net 1. Also, Net 1 will be used for ALSEP Network/ALSEP GOSS out-of-conference coordination loop to the designated ALSEP/P&FS real-time station during periods when Net 5 is unavailable for this function.

(2) Net 2. The function of Net 2 is normally in- and out-of-conference voice coordination with STDN stations. The only exception is when Net 2 is seized for dual communications configuration to spacecraft (refer to section 14 of this NOSP). During such periods, the Net 2 function is restored on other facilities. AOCC will not be removed out of conference.

(a) All USB stations have an MCC coordination loop to be used for the following purposes:

1. Command handover.

2. Parameter verification.

3. Telemetry tape dump coordination.

4. Mission progress information.

5. Status reporting (voice).

(b) All stations with spacecraft acquisition will have talk capability on Net 2. During EO, stations are normally given talk capability at H-5 minutes. After TLI, acquiring stations will be given talk capability at H-30 minutes. If line noise from stations other than two-way and backup degrade the Net 2 conference, they will be advised by GSFC voice and placed in monitor only. Stations in monitor only must ring toward GSFC if they desire talk capability. Any station in monitor only will be given talk capability if called by MCC.

(c) For lengthly conferences by MCC, the following apply:

1. Call GSFC Voice Control, identifying which circuit is being used.

2. If no response is received after two calls, ring in.

3. Request that the station on Net 2 conference be removed from conference to the circuit necessary.

4. When the conversation is completed, call GSFC Voice Control and ensure that the station is returned to Net 2 conference.

(d) For OPSR's requiring non-real-time access to MCC, the following apply:

1. Ring GSFC Voice Control.

2. Station is removed from Net 2 conference.

3. GSFC Voice Control calls MCC position, identifies the position called, the circuit used, and the station calling.

4. When the conversation is completed, call GSFC Voice Control and ensure that the station is returned to conference.

(3) Net 3. Net 3 is the GSFC conference circuit provided to all USB stations and VAN. It is normally kept in a talk mode.

(4) Net 4. Net 4 (telemetry/command) is a high-speed data circuit provided to each USB station and VAN, configured for real-time 7.2 kb/sec data transmission.

(a) If SATCOM capability is lost, VAN can transmit 1.2 kb/sec data via HF.

(b) Net 4 transmit from GSFC will be the command data circuit to the station. Net 4 transmit from the station will be used for engineering telemetry data transmission. Any changes made to this configuration will be coordinated and controlled by the NASCOM Communications Manager.

(c) If the Net 4 transmission to the station is lost (except two-way and backup stations), the NASCOM Communications Manager will notify MCC Comm Control/Network Controller.

(d) The NASCOM Communications Manager will provide for dualing of commands to two-way and back-up stations on both Net 4 and Net 6. Net 4 will be considered the prime circuit and Net 6 the alternate circuit.

(e) If site receive difficulty occurs on Net 4, these stations will execute the patching to Net 6 in accordance with the following procedures without prior coordination with GSFC.

1. Observe the indicator panel and if the lamps are not lit and the carrier audio signal is present, request from the serving switching center that a retrain sequence be initiated.

2. If the lamps on the indicator panel are lit and/or audible alarm has sounded, allow sufficient time for the automatic retrain sequence to be completed.

3. During the retrain sequence in 2, observe the incoming line side for the presence of the carrier audio signal.

4. If the carrier audio signal is present, allow the retrain sequence to continue and complete its cycle.

5. If the Net 4 carrier audio signal is not present, the station will patch to the receive side of Net 6 and notify GSFC after the fact.

6. Detailed operating procedures for the 203A data set are contained in NASCOP, part 4, para 4.7.

(5) Net 5. Net 5 (tracking) is normally a high-speed data circuit (2.4 kb/sec) provided to all land-based USB stations and VAN. NASCOM circuit configuration for 7.2 kb/sec data transmission is coordinated and controlled by the NASCOM Communications Manager. Net 5 will be configured and used for ALSEP Network/ALSEP GOSS out-of-conference coordination loop to the designated ALSEP/GOSS real-time station during periods when Net 5 is not required for 2.4 kb/sec high-speed tracking or 7.2 kb/sec telemetry.

(a) USB stations and the VAN will be configured for real-time data transmission. The data rates will be 2.4 kb/sec for land-based stations and 1.2 kb/sec for VAN.

(b) Stations scheduled for high-speed radar or USB tracking data will transmit static 240-bit blocks 10 minutes prior to the scheduled test or acquisition time. VAN will send static 600-bit blocks. GSFC technical control will receive the data blocks on an ancillary piece of equipment which will constantly check the start-of-message and the polynomial resolution of each block. Stations will remove the static blocks 2 minutes prior to the start of test or acquisition time.

(c) The NASCOM Communications Manager will coordinate with the stations on Net 3 (Net 2 if necessary) except during the prelaunch phase. No USB station will output high-speed tracking data from liftoff minus 15 minutes to liftoff except as directed by MCC.

(d) The GSFC switching computer controls the destination for all tracking data. Routing will be set at the GSFC switching computer to "GSFC Only". Exceptions, as required by MCC, will be coordinated by voice from MCC Communications Control to NASCOM Communications Manager.

(e) High-speed tracking data from the Apollo wing stations will share, on a nonsimultaneous basis, the Net 5 circuit from the respective prime station, as required, and will be coordinated between MCC and the OPSR at the prime station. The standard procedure will be for the wing stations to transmit their data via the intrastation microwave system to the prime station.

(f) CRO C-band will share CRO Net 5 on a nonsimultaneous basis as requested by the MCC.

(g) High-speed Tracking for Powered Flight Monitoring. The following procedures apply for all burns which require transmission of high-speed trajectory data to MCC.

1. No later than Time of Ignition (TIG) -60 minutes, Track will inform NASCOM Communications Manager and MCC Comm Control of the station(s) and times required for high-speed trajectory data.

2. At TIG -45 minutes, Track will verify with NASCOM Communications Manager and MCC Comm Control that the required data circuits are configured and checked out and will request that MCC destination code be inserted.

3. No later than TIG -10 minutes, Track will verify receipt of required static data with NASCOM Communications Manager and MCC Comm Control.

4. Post-burn, after the high-speed trajectory requirement is satisfied, Track will request the Communications Manager and MCC Comm Control to delete the MCC destination code from the high-speed data.

(6) Net 6. Net 6 (digital biomed) is a high-speed data circuit provided to land-based USB stations and VAN.

(a) Net 6 transmit from the station will be used for digital biomed data transmission. Changes to this configuration will be coordinated and controlled by the NASCOM Communications Manager.

(b) The NASCOM Communications Manager will provide for dualing of commands on Nets 4 and 6 for the two-way and back-up stations. (Procedures are contained in paragraphs 1.3.5.5c(4)(d) and (e).)

(7) Radar Coordination Net. Paragraph 1.3.5.3c(3) applies.

(8) ARIA Coordination Circuit. At or about T +5 minutes, the Houston communications controller will coordinate with the KSC communications controller and the Cape communications controller (CKAFS) to extend the ARIA coordination circuit to MCC. This extension will utilize interconnecting CKAFS-KSC trunk circuitry and KSC-MCC operational voice longlines no longer in use for monitoring launch site activity.

(9) Contingency Procedures. A circuit request for a real-time/playback FM/FM contingency parameter from any given station to GSFC/MCC will be coordinated in real time between MCC Comm Control and the NASCOM Communications Manager (Voice Control) with net circuits and GSFC to MCC circuits determined at that time. If Net 3 is requested by MCC, the MCC NC will coordinate the release of Net 3 with the NOM prior to the MCC Comm Controller's request to NASCOM to include Net 3 as part of the configuration.

Note

In real time, the only way that GSFC Voice Control can determine if FM/FM data is normal is to determine if the composite carrier signal is present on the circuit.

1.3.5.6 Network Isolation

a. Purpose. To define the implementation actions used to establish network isolation.

b. Participants. Comm Mgr, OPSR and station GCC.

c. Procedures

(1) Network Isolation. Network isolation is accomplished by program control at the Goddard NASCOM switching computer. Selected stations are isolated from normal network contact to prevent the interference of mission traffic by nonmission-oriented traffic by reviewing the precedence levels. Only those messages bearing mission precedence (UU, SS, NN) are switched to the isolated station. Those messages bearing nonmission precedence (PP, RR) are queued at GSFC.

(2) Station Transmission Capability. There are no NASCOM restrictions on station transmission of either mission or nonmission precedence messages if a station is in mission support.

(3) Implementation and Termination of Network Isolation. Stations to be placed within isolation will be notified by service message from GSPA (the service section at NASCOM/Goddard) when they are placed in isolation. If a station does not receive GSPA notification within 10 minutes after the time specified within the countdown (providing no traffic is being received), notify the Comm Mgr on Net 3. Notification of termination of isolation will be transmitted by GSPA after the station receives its release message from NOCC.

(4) Limitations. Once a station is released from network isolation, all messages on cue for that station will be transmitted. Thus if network isolation for a station is terminated and immediately reinstated, all traffic on cue will continue to be transmitted. Conversely, any messages received in the computer with nonmission precedence after the reinitiation of the isolation console entry will be placed on cue and will not be transmitted until a subsequent console entry is made.

1.3.5.7 DOI TTY Configuration

a. Purpose. To describe the low-speed tracking TTY configuration required for the DOI phase of the mission.

b. Participants. OPSR, GCC, Communications Manager, Comm Control, NC, and Track.

c. Procedures. Following the DOI burn, low-speed tracking data is extremely critical for making a decision on the safety of the CSM/LM orbit. Therefore, the following procedure will be implemented following LOS on lunar orbit 2.

(1) After low-speed data has been taken off line, the GCC at the specified stations will reconfigure to output low-speed tracking data on both the Alpha and Bravo channels. When the reconfiguration is complete, all OPSR's will notify the NC and the Comm Manager on Net 2.

(2) In addition, the Comm Manager will configure all four Bravo channels to bypass the GSFC CP. GSFC FACS will verify patching completion with a Fox test from each station. Stations will be assigned to VFTG channels as follows:

GDS - 14 (HMDAG)	HAW - 16
HSK - 15 (HMDGH)	MIL - 2

After the required reconfiguration is made, the Comm Manager will notify MCC Comm Control on GOSS 8.

(3) At the "no-burn" AOS minus fifteen minutes, Track will request each station to put low-speed tracking data on line to verify receipt of both channels at MCC.

(4) This configuration will be maintained until LOS plus two minutes on lunar orbit three. At that time, the NC will direct all stations to return to a normal TTY configuration. The station OPSR's will confirm the reconfiguration to the NC and the Comm Manager on Net 2 when it is completed. The Comm Manager will report completion to MCC Comm Control.

1.3.6 VANGUARD

1.3.6.1 Acquisition Bus Monitor

a. Purpose. The following procedures cover responsibilities and operation of the Acquisition Bus Monitor (ABM).

b. Participants. ABM, OPSR, and all tracking systems supervisors.

c. Procedures

(1) Responsibilities. ABM will be responsible for:

(a) Establishing the acquisition plan from AOS to LOS based on the data priorities specified in the SCM and the VAN's maneuvering plan for the pass.

(b) Selecting the proper source as the prime mode of acquisition and stabilization on the Master Acquisition Bus (MAB).

(c) Comparing the real-time tracking angles with a set of predetermined look angles to ensure that no substantial errors exist.

(2) Operating Instructions

(a) Prepass Activities. The ABM will perform the following:

1. Ensure that all shipboard tracking systems receive orbital-pass look angles, from either an externally-generated 6-point acquisition message or locally-generated look angles from the IRV.

2. Prior to AOS, select a tracking system as the stabilization source on the MAB.

3. Prior to AOS, select the Central Data Processor (CDP) as master on the MAB and notify all tracking systems not to slave to the MAB at this time.

4. Select relative bearing and elevation displays on the ABM console so that bearing variations due to ship's roll can be monitored effectively.

5. Upon confirmation from the CDP that the IRV is loaded and designate data is valid, direct all tracking systems to slave to the CDP.

(b) Pass-time Activities

1. The ABM will select the best source for the MAB and direct antenna operators to slave to the MAB if required.

2. During the pass, a continual comparison of real-time tracking angles with the nominal look angles should be accomplished by the ABM. Any appreciable differences should be recorded in the ABM log and the corresponding antenna operator informed to evaluate possible side-lobe tracking.

3. When tracking cannot be obtained from any system after a reasonable length of time following AOS, the telemetry antenna should be selected by the ABM as the prime stabilization reference. The telemetry antenna operator should then manually scan the look angles.

4. Pass-time events should be recorded in the ABM log.

(c) Post-pass Activities. After LOS the ABM will notify all tracking systems to drop their slave mode, return to manual mode, and leave the antenna in the direction of LOS.

(3) Typical Pass Activities for ABM

Time	Activities
H-30	Report system status to OPSR. Select relative bearing and elevation displays.
H-25	Receive 6-point acquisition message. Compare to nominal predicts and report discrepancies noted to the OPSR.
H-24	Receive updated information from the ship's controller on required changes to the ship's maneuvering plan.
H-20	Evaluate the update acquisition plan as necessary based on inputs from the ship's controller, acquisition message, and SCM. Verify that all antenna operators have received the 6-point acquisition message.
H-15	Report system status to OPSR. Notify all antenna operators to remain in local control mode.
H-10	Brief all antenna operators on the acquisition plan for the pass and any ship's maneuvering to be conducted during the pass.
H-8	Confirm all antennas pointed to the IP.
H-6	Verify IRV is loaded and cycling. Direct all antenna operators to slave antennas to CDP. Confirm that IRV agrees with the acq message.
AOS	Initiate acquisition plan.
Pass Time	Monitor all antenna positions for indications of side-lobe tracking.
LOS	Ensure that all antenna operators leave antennas at LOS point until LOS+2.

1.3.6.2 Central Data Processor System

a. Purpose. To define the normal and contingency operating procedures for the CDPS.

b. Participants. OPSR, CDP Technician, and Navigation Supervisor.

c. Procedures

(1) Normal Operating Procedures

(a) General

1. Equipment will be set up in accordance with the prepass checklist, this NOSP, and the SCM.

2. Operators will maintain systems logs which describe all problems encountered, and activities performed during pass times.

(b) Standby Mode. At H-75 minutes, the STANDBY program will be loaded and initialized. Scratch tapes will be mounted on the MTU transports for data logging. However, operations personnel will not initiate data logging during the standby mode except as required for interface buffer testing or as directed by the OPSR. During the standby mode, error model generation will be enabled and the navigation supervisor will be advised of the results.

(c) Acquisition and Tracking Mode

1. Initialization. At H-20 minutes, the Acquisition and Tracking (ACQ/TRK) program will be loaded and initialized. The appropriate constants will be entered and a recovery tape generated.

2. High-speed Acquisition Data. The CDP technician will enable the ACCEPT 2.4 KBPS ACQUISITION DATA and ACCEPT 2.0 KBPS ACQUISITION DATA switches on the LDCP. This action will permit reception of high-speed acquisition data from either the BDA C-band radars or the ALTDS Impact Predictor computer.

3. Low-speed Acquisition Data. Upon receipt of an IRV, the CDP technician will inspect the message for correct format and checksum. If the message contains errors, the CDP technician will advise the OPSR will request a retransmission from the Houston tracking coordinator (Track). When the IRV has been verified, it will be entered into the computer. If, prior to acquisition, subsequent IRV messages are received, which contain updated acquisition vectors, the last valid message received will be entered into the computer.

4. Static Designate. In the event that high-speed acquisition data is unavailable and an IRV message is not provided prior to the anticipated acquisition time, the CDP technician will enter azimuth and elevation data from the 6-point acquisition message by use of the appropriate manual I/O entry routine. This entry will designate the tracking antennas to the anticipated area of acquisition. This procedure does not provide forward integration in the event of non-acquisition.

(d) Filter Configuration. Whenever the spacecraft engines are thrusting, the program's powered flight filter must be initialized. Upon direction from Track, the OPSR will direct the CDP technician to enable the INITIATE

POWERED FLIGHT FILTER (formally THRUST) switch on the LDCP. When initialization of the powered flight filter is confirmed by the CDP technician, the OPSR will inform Track.

(2) Contingency Procedures

(a) CDPS Failure. The CDP technician will inform the OPSR of any failure in the CDP system and provide an ETO.

(b) Navigation Failures

1. Integrated Navigation System (INS) Failure

a. If the INS fails or if its data becomes questionable, the navigation supervisor will notify the OPSR. The OPSR will then direct the CDP technician to suppress INS attitude and position data.

b. The CDP technician will suppress the INS attitude and position data and enter the dead-reckoning ship's position via the appropriate manual I/O entry routine.

2. MK-19 Gyrocompass Failure. The MK-19 Gyrocompass is the backup source of navigation data which is used only in the event of INS failure. If INS data is available, a failure of the MK-19 will have no effect upon CDP operation. However if the INS data has been suppressed for any reason, there will be no navigation data available for CDP computations.

(c) Program Recovery Procedures. If the ACQ/TRK program should stop cycling or fault for any reason, the CDP technician will advise the OPSR. The CDP technician will then attempt to reinitialize the program by reloading from the recovery tape. The OPSR will be informed of the results of this effort.

(3) Typical Pass Activities for VAN CDP Technician

Time	Activities
H-20	Load the ACQ/TRK program with constants and verify program cycling. Confirm system configured in accordance with SCM. Report status to OPSR. Monitor applicable loops. Confirm receipt of IRV message. If IRV message is invalid, request retransmission. Confirm receipt of 6-point acquisition message.
H-15	Notify OPSR that the IRV vectors have been entered and integrated. Give acquisition time T_I______GMT.
H-10	Clear area of all non-operational personnel.
H-2	Initiate log tape recording, raw data recording, and low-speed data transmission.

Time	Activities
AOS	Inform the OPSR when the CDP program begins to drive the tracking antennas.
	Verify that the high-speed printer indicates valid and on-track data is being received from the C-band and/or S-band tracking systems. Verify transmission of low-and high-speed data.
LOS+2	Inform OPSR when low-speed data transmission has terminated.

1.3.6.3 Range Link Selection

a. Purpose. To define the USB procedures for making a range link change if system 1 ranging data is lost.

b. Participants. OPSR, USB, and Track.

c. Procedures. The following procedures apply only if systems 1 and 2 are tracking the same vehicle or if the two vehicles being tracked by systems 1 and 2 are connected to each other.

(1) If the system 1 range or range rate becomes inoperative, the ranging tech will set the switch in the USB output data register to link 2.

(2) The ranging tech will immediately inform the OPSR and CDP tech that the switch in the USB output data register has been changed from link 1 to link 2 and that link 2 ranging data is being processed.

(3) Track will be notified by the OPSR on Net 2 of the change in source of ranging data.

1.3.6.4 Navigation System

a. Purpose. To define the normal operating procedures for the navigation system.

b. Participants. Navigation coordinator OPSR.

c. Procedures

(1) General Operations

(a) System Readiness. By T-15 hours the SRT should have been completed and the following systems should be operationally ready.

1. INS.

2. Dead Reckoning System (KM-10/EM Log and Data Converter).

3. AN/SRN-9.

4. Loran-C.

5. Sonar Transponder System (STS).

(b) Logs. Operators will maintain a navigation log on all activities and problems throughout the mission.

(c) Prepass Preparation. The navigation coordinator will verify that the following activities are completed by H-1 hour.

1. Error Reset. Check that the latest reset has been inserted and the latitude, longitude, and heading errors are within the prescribed limits.

2. Error Modeling. Verify that error modeling is continuing (using the Central Data Processing System [CDPS]) and the latest error model printouts are being made available to navigation for evaluation.

3. Ship Course and Speed. Check that the ship's course and speed are within the prescribed mission requirements. The ship's movement director should be informed of the current status.

(d) Navigating to the Test Support Position

1. Navigation Systems. Navigation to the Test Support Position (TSP) will be accomplished by using INS/MK-19/EM log D.R., as applicable.

2. Arrival at TSP. The VAN should be directed to arrive at the latitude and longitude of TSP by H-0 so that the ship's tracking antennas can acquire and track the target vehicle from a predetermined set of direction angles. Arriving at the TSP at exactly H-0 is desirable but not absolutely necessary because, with accurate INS/MK-19/EM log D.R. data, the tracking information can be biased for the actual latitude and longitude of the TSP.

3. Course. Each course and heading will be commensurate with mission preplanning in order to maintain a 10-mile baseline course at 5 knots to the TSP. Ship maneuvering during prepass and pass time will be limited to the baseline course and heading. Any course corrections shall be made at not more than 10-deg/min turn rate, and will be coordinated by the navigation coordinator between the bridge and navigation center.

(e) Navigation During Successive Orbital Passes. Once the first orbital pass has been completed, ship's navigation must be made ready for successive orbital passes. However, since ship positioning for successive passes cannot be determined without a knowledge of the launch window and mission profile, all normal and contingency navigation must be determined either during mission planning or during mission operations.

(2) Equipment Operations

(a) Integrated Navigation System

1. The Ships Inertial Navigation System (SINS) must be in navigate mode by at least T-12 hours.

2. The last SINS reset should be performed no earlier than H-2 hours and no later than H-1 hour. If the star tracker is working in its automatic mode and obtaining constant position fixes, resets can be made until H-0. No reset is to be made between AOS and LOS.

3. The star tracker will track stars whenever possible before, during, and after the mission. The information will be stored in the SKOR program to be used at a later time (at reset) or in 6-minute automatic resets. This is left to the discretion of the navigation coordinator.

(b) MK-19 Gyrocompass. The MK-19 gyrocompass must be in full operation by T-15 hours. All switches should be in mission configuration.

(c) Sonar Transponder System

1. The Sonar Transponder mode is used as a backup to the MST and SRN-9 for INS resets. The position fixes obtained from this mode of operation will be used as inputs to the SKOR program in the INS. Sonar transponders are not used unless the MST or SR-9 fails and there is sufficient time remaining for deployment.

2. The following procedures will be utilized if beacon sowing is required:

a. Drop one to three sonar beacons to the ocean bottom.

b. Survey the dropped beacons and determine beacon position by using the transponder location program with INS as reference.

3. The transponder location program can be used to locate the ship's position in reference to the surveyed beacon(s) and can be used as an input to the Sperry Kullman Optimum Reset (SKOR).

(d) Loran-C

1. Loran-C latitude and longitude will be used whenever the mission TSP is within a loran-C net.

2. Reduction of time delays, slaves A and B, will be accomplished using standard Loran-C charts, series VLC 30, or CDP computer program with manual I/O console inputs.

3. Time delays, slaves A and B, will be recorded on data sheet at 30-minute intervals from T-15 hours to T-1 hour. From T-1 hour to H-30 minutes, every 12 minutes, then every 6 minutes until LOS of the pass.

4. The SINS latitude and longitude errors, using loran-C as reference will be recorded on loran-C data sheets and plotted by the error plots.

5. An average may be taken of three to five loran-C versus SINS error readings for plotting to obtain smoothed loran-C data. This procedure may be advisable if loran data readings become erratic because of fringe areas, and its use will be left to the discretion of the loran-C operator.

6. In order to use loran-C data as input to the INS system the ship must be in a favorable loran-C area.

(e) Flexure Monitor. The flexure monitor should be fully operational at least 5 hours prior to the beginning of a mission. There are no operational checks to be performed on this equipment.

(f) AN/SRN-9 Satellite Tracker

1. The AN/SRN-9 should be in full operating condition at least 24 hours before VAN departure for mission support. VAN can receive signals from any one of the satellites as the satellite passes from horizon to horizon. The signals arriving at the AN/SRN-9 antenna are the same for all satellites, so switching or band changing is not necessary for receiving from different satellites.

2. Alerts will be maintained and all usable SRN-9 satellite passes will be recorded and processed enroute to TSP and throughout mission support. A continuous record of the data will be plotted to verify data quality for the INS resets if MST data is not available.

(3) Typical Pass Activities for Navigation System Operators

Time	Personnel	Activities
H-30	Nav coordinator	Confirm status with OPSR by reporting "red" items and giving an ETO. Monitor OPSR and Nav loops.
H-24	Nav coordinator	Report to OPSR and ABM if a ship's course change is necessary. Coordinate course change with bridge.
H-18	Nav tech	Confirm to Nav coordinator that synchro switchboard, data converters, FME, and loran-C are in mission configuration.
	Nav coordinator	Report to OPSR if the acq message was not received.
H-16	INS operator	Inform Nav coordinator of status.
H-15	Nav coordinator	Inform CDPS of prime source of position and attitude data.
H-10	Nav coordinator	Report any RFI to OPSR.
H-5	Nav data plotter	Inform Nav coordinator of status of error plots relative to prime source.
H-4	Nav tech	Confirm prime source of position and attitude data to CDPS (negative reporting).
H-0	Nav coordinator	Record ship's position (latitude and longitude, and heading) from prime source.
AOS	Nav coordinator	Keep close surveillance on prime data source until LOS.
LOS +1	Nav coordinator	Brief OPSR on system status (if requested).

d. Information. Optimum navigation conditions exist when:

(1) No radical ship's course changes have been made within at least 10 nmi of the TSP.

(2) The ship's velocity is constant and seas are number 3 or less.

(3) The visibility is at least 10 nmi with little or no haze or cloud cover.

1.3.6.5 Communications Support

a. Purpose. To define the normal communication procedures for mission support.

b. Participants. OPSR, SATCOM group leader, CDP supervisor, HF transmitters, RSDP, Comm Mgr, and NC.

c. Procedures

(1) General. Normal communications requirements for mission support are six voice/data and two teletype circuits via the COMSAT Corporation Atlantic satellite, and three voice/data and two teletype circuits via the shore stations at BDA. Refer to para 8.1.2 for nominal net configurations plus special configurations to receive LTDS 2.0-kb/sec data and BDA 2.4-kb/sec C-band data.

(2) Network Procedures. The communications procedures outlined in the COMSAT Maintenance Document and NASCOP will apply.

(3) Transmit and Receive Requirements. The desirable circuit requirement via HF has been relaxed to minimize the radio frequency interference to data collecting instrumentation during active spacecraft passes. During an active pass, the ship may secure all HF transmitters if interference is detected. When SATCOM is prime, the Ships Communications Operator (SCO) will monitor the prime HF receive circuit for a possible contingency due to the loss of SATCOM. Upon completion of active pass activity, the ship's HF transmitters will be restored.

(4) HF Radio Systems Configuration. Diversity operation will be used on HF data modems (Stelma) and AN/FGC-60 teletype multiplex, whenever possible.

(5) Voice/Data Net Configuration. The normal-through configuration is for simultaneous HF and SATCOM transmit and SATCOM receive. As a result of this normal-through arrangement, the SCO will be required to monitor the HF receive on the MITOC. If a contingency occurs due to a SATCOM failure the wire tech will select, via the 662A key, HF receive to the ship's internal intercom.

1.3.6.6 SATCOM System

a. Purpose. To define the normal and contingency operating procedures for the SATCOM system.

b. Participants. OPSR, SATCOM group leader, CDP supervisor, GCC, Comm Mgr, and NC.

c. Procedures

(1) General. These procedures should be followed by the operators of the SATCOM systems on the VAN. Equipment will be set up in accordance with the communications manager's configuration message and the GCC's communications patching list.

(2) Normal Operating Procedures

(a) Logs. Operators will maintain logs on all activities and problems throughout the mission.

(b) Acquisition Messages. The SATCOM system will use a position vector acquisition message, generated by the COMSAT Operations Center and transmitted via order wire to shipboard stations. A detailed description of this message is given in the Maintenance Document for NASA Communications Services for INTELSAT II. The procedure for handling the acq message is as follows:

1. The SATCOM group leader will notify the GCC of receipt of the position vector message.

2. The SATCOM group leader will retain a hard copy; the communications messenger will deliver a hard copy to the computer personnel for loading.

Note

The position vector message is in computer format and not usable by the console operator.

(c) Acquisition Source Selection. The prime mode for acquisition will be COMPUTER DESIGNATE. The CDP personnel should be instructed to load the program and the position vector for the desired time of acquisition.

(3) Contingency Procedures

(a) Loss of Track. If loss of track occurs, the SATCOM group leader will initiate either AUTOTRACK LOSS or MANUAL DESIGNATE mode. Both modes will return the system to last stored position (if necessary, initiate SCAN).

(b) No Reacquisition. If there is no reacquisition, the SATCOM group leader will request the OPSR to instruct the CDP personnel to insert another position vector for that time.

(c) Loss of Ship SATCOM Receive. At all times, voice and data will be transmitted "dual" via HF radio and SATCOM to the ship. If SATCOM receive is lost, the ship will switch to the best HF source and immediately notify GSFC Voice Control. The ship personnel will ensure that no interruption to the ship SATCOM transmit capability is initiated during the course of receive link repairs without the concurrence of the NASCOM Comm Mgr.

(d) Loss of Ship SATCOM Transmit. GSFC Voice Control will coordinate with the ship SCO to restore the desired circuits via HF radio. The ship personnel will ensure that no interruption to the ship SATCOM receive capability is initiated during the course of transmit link repairs without the concurrence of the NASCOM Comm Mgr.

(e) Complete Loss of SATCOM. The VAN has the capability of 7.2-kb/sec data transmission via SATCOM. If the SATCOM data is lost, HF data may be used by MCC at the 1.2-kb/sec rate. The 1.2-kb/sec data will be displayed in MCC at one-fourth the normal rate.

1. GSFC Voice Control will coordinate with the ship SCO to immediately restore circuits via HF radio.

2. The NASCOM Comm Mgr will inform the MCC communication controller of a switch to HF radio and the nature of the problem, if known.

3. Based upon problem evaluation and the time estimate of return to SATCOM operations, the NASCOM Comm Mgr will give the MCC Comm Controller his recommendation concerning HF and SATCOM. The MCC Comm Controller will relay the recommendation to the Network Controller for a decision and will inform the NASCOM Comm Mgr accordingly.

4. If the NC decides to shift the data rate, the NASCOM Comm Mgr upon notification by the MCC Comm Controller, will coordinate the actual data rate change with the ship and supporting NASCOM switching centers.

5. Should it become necessary to use the 1.2-kb/sec data rate, the OPSR, after notification by the NASCOM Comm Mgr and MCC, will ensure that the ship is configured as soon as possible (SPEC-1 command errata and SPET-1 telemetry errata loaded, and the data-set bit rate switches on the HF modems set to 1200 in accordance with section 5 of this NOSP), and will notify the NASCOM Comm Mgr when configuration is complete.

6. The OPSR will request CAM 990 and verify that the command parameter list contains data previously defined by MCC.

7. The OPSR will request a high-speed load inventory (CAM 982) and verify that the high-speed printer load inventory is complete.

8. The OPSR will CAM telemetry on and notify NC that the reconfiguration is completed.

1.3.6.7 Ship/ARIA Data Retransmission

a. Purpose. To transmit previously received and recorded data from the VAN to the ARIA S-band receiving system.

b. Participants. ARIA MC, VAN OPSR, NST Ships, AOCC, Recorders, and NAV.

c. Procedures

(1) Prepass Coordination. After the VAN has been released from its assigned TSP, the NST Ships will relay the ship's course and speed to AOCC. The AOCC will provide the aircraft's estimated time of arrival at the ship to NST Ships for relay to VAN. ARIA procedures are given in STDN No. 502.10. Ship procedures are given in STDN No. 502.9.

(2) Data Pass

(a) A data pass is considered to start at approximately 200 nmi and end 15 nmi from the ship.

(b) The aircraft will approach the ship on a straight-in radial pattern on an azimuth determined during prepass coordination.

(c) Data passes should start at approximately 85 percent of radio line-of-sight distance based on the following:

Altitude (ft)	Max Range (nmi)
35,000	185
30,000	175
25,000	165
20,000	145
15,000	125
10,000	105
5,000	75

Note

Although the preceding are line-of-sight distances, they should only be used as a reference. The actual data pass should start only when the aircraft is receiving solid data based on the judgement of the operating personnel.

(3) Voice Communications

(a) Lower sideband will be used, operating simplex.

(b) The VHF voice communications frequency between the ARIA and VAN will be either 296.8 MHz (primary frequency) or 259.7 MHz (secondary frequency).

(c) The HF voice communications frequency between the ARIA and VAN will be coordinated by NST ships prior to ARIA takeoff.

(4) Aircraft Instrumentation

(a) The ship will be transmitting the following data on a 2282.5-MHz PM signal.

1. Binary coded timing on a 1-kHz phase modulated 1.25-MHz subcarrier.

2. PCM phase modulated on a 1.024-MHz subcarrier.

3. FM/FM data on a 450-kHz PM subcarrier.

(b) The receiver setup is as follows:

1. IF bandwidth: 3.3 MHz.

2. Phase demodulator: 0 dB.

3. Video output: 0 dB.

4. Video output filter: 750 kHz.

(c) The ARIA tape recorder setup for the ship-ARIA transfer of data will be at the discretion of the MC. The recorder will be annotated accordingly.

(5) Data Pass Procedures

(a) Prior to each pass, the VAN OPSR will coordinate with the ARIA MC to transmit details of the recording for entry on the tape label. This will include:

1. Links to be recorded.

2. Mode of recording.

3. Time (GMT) data was originally recorded.

4. Revolution number of recorded data.

5. Geographic location of ship at time of original recording.

6. Ship letter designator (VAN).

(b) An ARIA should not start setup with less than -100 dBm signal level. Data passes should not be started with a signal level less than -90 dBm for PCM data and not less than -95 dBm for FM/FM data.

(c) After the initial setup period, the MC will notify the OPSR and allow time for the tape to be rewound.

(d) When both parties are ready, the MC will begin tape-start countdown.

(e) During the first pass, level settings will be made and, if sufficient time remains, retransmission No. 1 will be conducted. If not, the aircraft must return to the starting point and begin a new pass.

(f) The OPSR will notify the MC when the run is complete. A new run will be started as soon as possible.

(g) On the succeeding pass retransmissions No. 2 and 3 will be conducted.

(h) At completion of the transfer, the ARIA MC will make a brief report to the AOCC. This should include any problems encountered and an estimate of data quality. If any of the links were not transmitted, the AOCC should be informed and an explanation given.

(6) Typical Sequence of Events

Personnel	Activities
OPSR/MC	HF contact established at about 500 miles.
MC to OPSR	VHF carriers on for acquisition source (245.3 MHz primary and 237.8 MHz secondary).
MC to Recorders	Confirm recorders loaded.
MC/OPSR	Establish VHF communication and complete all coordination not completed at initial HF contact.
MC/OPSR	Request carrier and modulation for level adjustment.
MC/OPSR	Confirm good data; rewind for start of run.
MC/NAV	Confirm adequate time for data run.
MC/OPSR	Start data on my mark (5, 4, 3, 2, 1 mark).
OPSR/MC	Run complete.

1.3.6.8 Recovery Communication

a. Purpose. To establish the ship's internal procedure for implementing recovery communications.

b. Participants. OPSR, GCC, ComTech, wire tech, and ACO.

c. Procedures. Upon notification that VAN is needed in support of recovery operations, the OPSR will instruct the GCC to configure communications for recovery operations and will dispatch the assistant OPSR to the forward bridge to assist the captain of the VAN in communications and coordination of the operation. OPSR/bridge coordination will be accomplished on the MTC/OW loop.

(1) During normal STDN support, the OPSR will ensure that the wire tech has the forward bridge Key Selection Panel (KSP) talk capability inhibited on the following loops:

Loop 1	Net 1
Loop 4	VHF A-G 1
Loop 5	VHF A-G 2

(2) The GCC will instruct the wire tech, ComTech, and the ACO to configure recovery communications as follows:

(a) Loop 6 spare A-G to HF recovery communications.

(b) Loop 4 VHF A-G 1 to 296.8 MHz.

(c) Loop 5 VHF A-G 2 HF air control.

Note

Recovery frequencies will be furnished by the task force commander.

1.3.6.9 FIDO Trajectory Run (Terminal Count)

a. Purpose. To confirm interface validity and processing capability of launch trajectory data at MCC.

b. Participants. OPSR, CDP tech, Comm Mgr, and Track.

c. Procedures

(1) General

(a) Equipment will be set up in accordance with prepass checklists and any last minute verbal inputs from Track.

(b) Operators will maintain systems logs which describe all problems encountered during the run.

(2) Initialization

(a) The CDP technician will load with either the Apollo 14 RDR tape or the "B" sim tape as directed by Track.

(b) The initiate powered flight filter (formerly thrust) switch and the LDCP will be on.

(c) Track will pass the liftoff time, and the CDP technician will enter the time.

(d) At nominal AOS the CDP technician will ensure that the CDP outputs both high-speed C- and S-band trajectory data with the following characteristics:

1. Destination code 212.

2. Timing in GET.

3. C-band Beacon Track.

(e) During the first half of the pass, low-speed data will be output from the S-band system; during the second half of the pass, low-speed data will be output from the C-band system.

(f) At nominal SIVB cutoff Track will verbally direct that the initiate powered flight filter switch be thrown off.

(g) After the FIDO trajectory run, timing will be reconfigured to GMT.

1.3.7 TELEVISION

1.3.7.1 General

a. Purpose. To define the on-station normal operating procedures for receiving spacecraft television.

b. Participants. OPSR, station video, Houston TV, and NC.

c. Procedures

(1) Spacecraft Television

(a) The CSM/LM will carry sequential color cameras that produce standard EIA (525 line scan, 30 frames per second, interlaced) television signals.

(b) Television will be received from the SC as indicated in the SCM. Stations with remoting capability will remote video transmission to MCC. All 85-foot stations will monitor and record the transmission as indicated in section 25 of this NOSP.

(2) On-station Operating Procedures

(a) The longline video circuit to MCC will be activated approximately 30 minutes before the onboard video downlink. Immediately after circuit activation, (station) Video and Houston TV (MCC TV editor) will perform a video level check on Net 2.

(b) Upon acquisition of the downlink video signal, the station TV operator should report "acquisition of video signal" to the M&O, remove the test pattern, and remote the SC video to MCC. The M&O will announce "TV on line" on Net 2. Any loss of video signal output to MCC during the period of downlink should be immediately reported to Houston TV on Net 2.

(c) The best TV source is to be put on line to MCC.

(d) When a station is remoting TV to MCC, station personnel will not edit (inhibit) the TV downlink.

(e) Stations recording 525-line color video on VR 660 or VR 1100 recorders will also record Net 1 and station timing on the audio program tracks.

(3) Responsibilities

(a) The NC is responsible for all MCC television.

(b) The station OPSR is responsible for station video.

(c) The TV technician (station video) will coordinate TV tests and TV reception with Houston TV on Net 2 and all detailed signal analysis on TV coord.

1.3.7.2 Video Circuit Management

(To be supplied by DCN.)

1.3.8 MICROWAVE (85-FOOT STATIONS)

a. Purpose. To ensure that the microwave system operators adhere to the proper equipment operating procedures.

b. Participant. Microwave.

c. Procedures

(1) Equipment operating instructions are found in test documents SST-408C-01 and 408C-02, which will be used to verify operational capability prior to the beginning of the prime/wing SRT.

(2) Operators will maintain logs on all activities and problems throughout the mission.

(3) Prior to each pass, verify that patching meets the requirements of the SCM.

d. Information. Equipment configuration may be altered by the NOSP or the SCM.

1.3.9 SOLAR PARTICLE ALERT NETWORK SOLAR EVENT REPORTING

a. Purpose. To inform MCC of a major solar event.

b. Participants. Solar Particle Alert Network (SPAN) observer, OPSR, and NC.

c. Procedures

(1) The SPAN observer will inform the OPSR that a major solar event is in progress and request him to contact the NC in either of the following instances;

(a) A major solar event (corrected area greater than 15 square degrees) is observed.

(b) A channel "B" flux level is 500-flux units greater than the preburst level.

(2) If instructed by the OPSR, the SPAN observer will give a verbal report to the Space Environment Console (SEC).

1.3.10 TIMING SYSTEM

a. Purpose. To define the normal operating procedures for the timing system.

b. Participants. OPSR and timing tech.

c. Procedures

(1) Normal Operating Procedures. The GET displays will be set in accordance with the planned liftoff time. Upon receipt of the TTY liftoff message, the timing tech will update, if necessary, the GET displays.

(2) Time Correlation Bias. Stations will not reset their clocks if a time correlation bias is found without first obtaining permission of Network.

1.4 ARIA OPERATING PROCEDURES

1.4.1 GENERAL

ARIA operating procedures are contained in STDN No. 502.10. The following procedures are exceptions to those contained in STDN No. 502.10.

1.4.2 ARIA/MIL-GWM-HAW REAL-TIME TELEMETRY OPERATING PROCEDURES

1.4.2.1 CADFISS Testing. During ARIA CADFISS testing, the MIL, GWM, and HAW OPSR's will use normal voice procedures in communicating with the CADFISS Test Conductor. To pass information to the ARIA, the MIL, GWM, and HAW OPSR's will use off Net 3 to NST ARIA/AOCC and CADFISS Test Conductor or a direct HF link to ARIA.

1.4.2.2 TLI Coverage. Four ARIA will cover start and end of burn and may relay either IU or S-IVB data in accordance with the SCM. Since PCM data may be transmitted in either a normal or inverted format, the OPSR should contact the AOCC for the type of data being received. LES 6 will be received by GBI and transmitted via subcable to Tel IV for relay to MIL (ETR operating instructions are contained in OD 48000).

1.4.2.3 Reentry Coverage. Four ARIA will relay CSM data via TACSAT to GWM and HAW during reentry.

SECTION 2. TELEMETRY

2.1 TELEMETRY SUPPORT REQUIREMENTS

2.1.1 GENERAL

2.1.1.1 STDN TLM support will include but not be limited to:

a. Receiving, recording, and decommutating selected S-II, S-IVB, and IU VHF links.

b. Recording and decommutation of CSM, SIM, LM, IU, and LCRU USB links.

c. Receiving and recording ARIA data transfer at selected ground stations.

d. Receiving, recording, and remoting TLM dump-transmission data, including CSM-H, CSM-L, LM-L, and SIM links.

e. Receiving and remoting selected USB links from MIL to CIF.

f. Receiving, recording, and remoting the S-IC, S-II, S-IVB, and IU VHF links from MIL to CIF.

g. Receiving, recording, decommutating, and remoting the ALSEP and P&FS USB links to MCC (refer to ALSEP NOSP for support procedures).

2.1.1.2 There are three methods of data transmission from the Network:

a. 50.0 kb/sec (GSFC to MCC).

b. 7.2 kb/sec (station/ship to GSFC).

c. 1.2 kb/sec-- 7.2 kb/sec (ship to GSFC).

2.1.2 DATA TRANSMISSION

Data transmission requirements to MCC through GSFC include:

a. Selected parameters from CP-1, and DP-1 links from ACN, BDA, CRO, CYI, GWM, HAW, MIL, TEX, and VAN via 4.8 kb/sec HSD lines.

b. Selected CSM parameters from the 2287.5-MHz and/or 2272.5-MHz links (MCC real-time request); LM parameters from 2282.5 MHz; SIM parameters from the 2272.5-MHz links; LCRU parameters from 2265.5-MHz link; IU parameters from 2282.5-MHz links; from ACN, BDA, CRO, CYI, GDS, PIR, GWM, HAW, HSK, MAD, RID, MIL, VAN, TEX, NBE. Parkes and MARS will remote data via the corresponding 85-foot Network station.

c. Remoting of biomed parameters from the LM and LCRU through the AMQ at ACN, BDA, CYI, CRO, GDS, GWM, HAW, HSK, MAD, MIL, and TEX.

d. Selected S-II parameters from the BF-1, and BF-2, links from BDA and MIL through the discriminators and the Analog Multiplexer Quantizer (AMQ) via 4.8-kb/sec HSD lines.

e. Selected S-II parameters from the BP-1 link from BDA and MIL via the 7.2-kb/sec HSD lines.

f. Commercial TV from GDS, MAD, and HSK.

g. Selected EMU extra vehicular communication system (EVCS PAM) parameters from HSK, GDS, MAD, MIL, through DDF-13 via the 7.2-HSD lines. All other 30-foot stations will configure DDF-13 for EVCS PAM processing in case they are called up by the TIC to provide support.

2.1.3 VEHICLE DATA

2.1.3.1 General. The Apollo vehicles (CSM, LM, SIM, LCRU, SLV) will downlink data in accordance with table 2-1.

2.1.3.2 CSM and LM. The following information pertains to the CSM and LM:

a. High-bit Rate

(1) Bit rate = 51,200 bits/sec.

(2) Word rate = 6400 words/sec.

(3) Bits/word = 8.

(4) Words/frame = 128.

(5) 50 frames/main frame.

(6) 50 frames = 1 data cycle.

(7) 1 data cycle/sec.

(8) Data is transmitted MSB/MSS first.

(9) NRZL.

(10) The sample rates available are 1, 10, 50, 100 and 200 smp/sec. Each data parameter is assigned a channel code. For representation purposes, the most significant bit is the first bit counting left to right, (e.g., *11101110, *most significant bit) except in the case of MSFTP-1 patching instructions, when the synchronization words are printed as patched.

(11) The first four words in each frame are used for frame synchronization and identification.

b. Low-bit Rate

(1) The basic characteristics of the low-speed data mode are:

(a) Bit rate = 1600 bits/sec.

(b) Word rate = 200 words/sec.

Table 2-1. Apollo TLM Link Characteristics

Vehicle	Link Code	Frequency (MHz)	Subcarrier (MHz) RT	Subcarrier (MHz) Dump	Type of Modulation	Avg Power (watts)	Nominal Xmtr to Ant Loss (dB)	Deviation Max (kHz)	Bit Rate (kb/sec)	No. of Channel	Freq of Commutated Channel	Bit Pos Xmitted First	PCM Format	IRIG Channel
S-IC	AF-1	256.2			FM/FM	20	4.1	±137.5		27				
	AP-1	244.3			PCM/FM	20	4.1	±39				MSB	NRZL	
S-II	BF-1	241.5			PAM/FM/FM	20	5.1	±137.5		14 (2-15)	70 kHz ±30%			
	BF-2	234.0			FM/FM	20	5.1	±137.5		27				
	BP-1	248.6			PCM/FM	15	5.1	±39				MSB	NRZL	
S-IVB	CP-1	258.5			PCM/FM	15		±39	72			MSB	NRZL	
IU	DF-1	250.7			FM/FM	20	3.6	±137		27				
	DP-1	245.3			PCM/FM	15	3.0	±39	72			MSB	NRZL	
	DP-1B	2282.5			PCM/PM/PM	20			72			MSB	NRZL	
CSM		2287.5	1.024		PCM/PM/PM	20			1.6/51.2			MSB	NRZL	
		2272.5	1.024		PCM/PM/FM				1.6/51.2/12.8			MSB	NRZL	
LM		2282.5	1.024		PCM (PM/PM/PM or PCM/PM/FM)				51.2/1.6			MSB	NRZL	
									51.2			MSB	NRZL	
SIM	SM-6	2272.5	768.0	576.0	PCM PSK FM	20		410 ±15	64.0			MSB	NRZL	
LCRU		2265.5	1.25		FM/FM/PM or FM/FM/FM	20								13

Note

1. The SLV consists of S-IC, S-II, and S-IVB stages.

2. For all VHF telemetry links, the tolerance on the frequency is ±0.01% and the deviation tolerance is ±20%.

3. S-IC (AF-1), S-II (BF-1, BF-2). IRIG channels 2-18 may be modulated with 2-6 on 14, or 2-8 on 17, or 2-9 on 18 to obtain the desired channels.

4. PAM/FM/FM commutated channel is 30 channels x 120 smp/sec, submultiplexed. at a 10 x 12 rate.

5. Both IU VHF TLM transmitters are on a common antenna.

6. CSM (2272.5 MHz, 1.024 MHz subcarrier). LM dump is split phase through the CSM FM links.

(c) Bit/word = 8 bits/word.

(d) Words/frame = 200 words/frame.

(e) 1 frame = 1 data cycle.

(f) 1 data cycle/second.

(g) NRZL at all times except split phase for LM dumps.

(2) Frame sync is the same in the low-bit rate as in high-bit rate mode.

2.1.3.3 IU, S-IVB, S-IC, and S-II. The following listing describes the PCM telemetry format for IU, S-IVB, S-IC, and S-II stages.

a. The basic characteristics of the PCM telemetry are:

(1) Bit rate = 72,000 bits/sec.

(2) Word rate = 7,200 words/sec.

(3) Bits/word = 10.

(4) Words/frame = 60.

(5) Frames/master frame = 10.

(6) Master frames/master-master frame = 3.

(7) 1 master-master frame = 1 data cycle.

(8) 4 master-master frames/sec = 4 data cycles/sec.

(9) 57 data words/frame.

(10) 3 sync words/frame.

(11) Data is transmitted MSB/MSS first.

(12) NRZL.

b. The PCM telemeter is made up of a 30 x 120 multiplexer, with 10 x 12 submultiplexers. These multiplexers are programmed into the PCM telemetry in groups designated by letter. Six is the maximum possible number of multiplexers designated as follows:

(1) A0 = Group "A" one multiplexer, sampling rates 12 or 120 smp/sec.

(2) A1, A2, A3 = Group "A" first, second, third multiplexers sampling rate 4 or 40 smp/sec.

(3) B0 = Group "B" same as A0.

(4) B1, B2, B3 = Group "B" same as A1, A2, A3.

Note

Only A0 and B0 multiplexers are utilized for this mission, providing sample rates of 12, 120, and 240 smp/sec.

2.1.3.4 SM-6. The following list describes the PCM telemetry format for SM-6:

a. Bit rate = 64 kb/sec.

b. Word rate = 8000 words/sec.

c. Bits/word = 8.

d. Words/frame = 80.

e. 100 frames/main frame.

f. 100 frames = 1 data cycle.

g. 1 data cycle/sec.

h. Data is transmitted MSB/MSS first except for SL1050K and SL1055K which is transmitted LSB first.

i. NRZL.

2.1.3.5 LCRU. The LCRU downlink will contain the EVCS Composite, and IRIG channel 13. Channel 13 will contain two parameters time-shared. The data cycle is 30 seconds with temperature for 10 seconds and system voltage for 20 seconds. The channel 13 subcarrier will be discriminated and input to the AMQ as described in paragraph 2.5.4.

2.1.3.6 EVCS. The Extra Vehicular Communications System (EVCS) is composed of 4 IRIG channels. The composite signal is downlinked through the LM, and/or LCRU S-band systems. The channel assignments are as follows:

IRIG Channel	Meas No.	Assignment
9	GT8224	EVC No. 2 EKG
10	GT8124	EVC No. 1 EKG
11	GT8200 series	EVC No. 2 PAM
12	GT8100 series	EVC No. 1 PAM

2.1.3.7 SM-6 Carriers. The downlink is transmitted on the CSM 2272.5-MHz FM downlink, which is the output of the Motorola demod. SM-6, 64.0 kb/sec is downlinked on the 768-kHz subcarrier in real time and 576 kHz for dump.

2.1.3.8 MSFTP-2 Apollo Program Formats. The formats for the MSFTP-2 Apollo program are as follows:

a. CSM-HBR. CSM high-bit rate (51.2 kb/sec) real time.

b. CSM-LBR. CSM low-bit rate (1.6 kb/sec) real time.

c. CSM-HBRD. CSM high-bit rate dump (51.2-kb/sec TLM data recorded and dumped 1:1 from the spacecraft).

d. CSM-HLBRD. CSM high-/low-bit rate dump (1.6 kb/sec dumped 32:1).

e. CSM-LBRD. CSM low-bit rate dump (1.6 kb/sec). This format will be used when postpass playback is requested by MCC.

f. LM-HBR. LM high-bit rate (51.2 kb/sec) real time.

g. LM-LBR. LM low-bit rate (1.6 kb/sec) real time.

h. LM-LBRD. LM low-bit rate dump (1.6 kb/sec). This format will be used for postpass playback.

i. LM-MLBRD. LM medium-/low-bit rate dump. This format is a result of recording LM LBR 1.6 kb/sec at 7.5 in./sec on the spacecraft and playing it back to the ground station at 60 in./sec (8:1 dump). The received bit rate will be 12.8 kb/sec.

j. LM-HLBRD. LM high-/low-bit rate dump (1.6 kb/sec dumped 32:1).

k. IU. 72-kb/sec NRZL.

l. S-IVB. 72-kb/sec NRZL.

m. S-II. 72-kb/sec NRZL.

n. SIM-6 Real-time. 64-kb/sec NRZL.

o. SIM-6 Dump. 64-kb/sec NRZL.

2.1.4 CSM AND LM TAPE RECORDER DUMPS

2.1.4.1 Recording. CSM, SM-6, and LM data is recorded on the same recorder aboard the CSM. The CSM bit rate determines the recording speed of the onboard recorder. Recording speeds are as follows:

a. CSM 51.2-kb/sec data is recorded at 7-1/2 in./sec.

b. CSM 1.6-kb/sec data is recorded at 1-7/8 in./sec.

c. LM 1.6-kb/sec data is recorded at 1-7/8 in./sec; however, it is recorded at 7-1/2 in./sec when the CSM 51.2-kb/sec data is being recorded.

d. SM-6 data is recorded at 7-1/2 in./sec.

2.1.4.2 Playback. All dumps will be transmitted forward. Onboard SC playback speeds are as follows:

a. CSM HBR recorded at 7-1/2 in./sec is dumped 1:1.

b. CSM LBR recorded at 1-7/8 in./sec is dumped 32:1.

c. LM LBR recorded at 1-7/8 in./sec is dumped 32:1.

d. LM LBR recorded at 7-1/2 in./sec is dumped 8:1.

e. SM-6, recorded at 7-1/2 in./sec, is dumped 1:1.

2.2 VHF ACQUISITION SYSTEMS

2.2.1 GENERAL

Acquisition aid and other VHF telemetry receiving antennas will track the launch vehicle, provide VHF voice coverage (296.8 MHz) from the CSM, and provide pointing data to other steerable antennas as required.

2.2.2 LINK ASSIGNMENTS

The prime tracking links are:

Tracking Priority	Vehicle	Freq (MHz)	Power (watts)	Minimum Bandwidth (kHz)
1	IU	245.3	15	100
2	S-IVB	258.5	15	100
3*	S-II	248.6	15	100

*MIL and BDA during launch phase only.

2.2.3 ACQUISITION ANTENNA CONFIGURATION

Stations will conform to STDN Network Operations Procedures for Telemetry Systems, STDN No. 502.2, with respect to their individual tracking capabilities.

2.2.4 ANTENNA TRACKING REQUIREMENTS

After S-IVB/CSM separation, dual-capability stations may be required to track both vehicles simultaneously to provide VHF A-G voice remoting from the CSM and VHF TLM data from the S-IVB/IU. Stations having only one VHF system will slave to the USB antenna and provide VHF voice coverage.

2.2.5 AUTOTRACKING

Autotracking the S-IVB/IU will be done in the cross-correlation mode.

2.2.6 RECORDING AND CALIBRATIONS

Refer to STDN No. 502.2 for recorder channel (stripchart) assignments and calibration procedures.

2.2.7 EARTH ORBITAL CONTINGENCY

In the event of an earth orbital rendezvous contingency, stations will configure their station equipment with the transmit and prime VHF receive antenna assigned to the vehicle listed in column 1 of the SCM A-G section. For dual VHF antenna stations, the second VHF receive antenna will track the opposite vehicle to ensure continuous receive capability.

2.3 VHF TELEMETRY RECEIVER COVERAGE

2.3.1 STATION CONFIGURATION

2.3.1.1 The following stations will receive VHF TLM data: ACN, BDA, CRO, CYI, GWM, HAW, MIL, TEX, and VAN. Individual stations will configure their systems to receive VHF TLM data in accordance with the telemetry receiver configuration tables 2-13 through 2-30.

2.3.1.2 For the lifetime of the S-IVB/IU, stations assigned to ALSEP/P&FS will be configured via SCM to receive and record S-IVB/IU VHF telemetry.

2.3.2 VHF TELEMETRY LINKS

The VHF telemetry links are listed in table 2-2.

2.3.3 MIL SPECIAL SUPPORT REQUIREMENTS

2.3.3.1 MIL Launch Phase Remoting. During the terminal count and through MIL LOS during launch, MIL will remote to CIF on an A2A line the following links:

a. AF-1 - 256.2 MHz (S-IC)

b. AP-1 - 244.3 MHz (S-IC)

c. BF-1 - 241.5 MHz (S-II)

d. BF-2 - 234.0 MHz (S-II)

e. BP-1 - 248.6 MHz (S-II)

f. CP-1 - 258.5 MHz (S-IVB)

g. DP-1 - 245.3 MHz (IU)

h. DP-1B - 2282.5 MHz (IU)

i. CSM (2287.5 MHz)

j. CSM (2272.5 MHz)

k. DF-1 - 250.7 MHz (IU)

Table 2-2. VHF Telemetry Links

Link	Vehicle	Nominal Freq (MHz)	Terminal Count CRF Freq	Nominal Maximum Deviation (kHz)	Terminal Count CRF	Terminal Count CRF Change/ No Change
AF-1*	SIC	256.2		±137.5		
AP-1*	SIC	244.3		±39		
BF-1*	S-II	241.5		±137		
BF-2*	S-II	234.0		±137		
BP-1*	S-II	248.6		±39		
CP-1	S-IVB	258.5		±39		
DF-1	IU	250.7		±137		
DP-1**	IU	245.3		±39		

*Active only on launch.

**Identical telemetry data to 2282.5-MHz link (DP-1B).

Note

The blanks under the Terminal Count CRF columns may be useful to the VHF receiver technician in the event that the frequency and deviation are outside the tolerance specified.

2.3.3.2 MIL Launch Phase Backup Links. MIL USB will receive the following TLM links from CIF via multiplex on an A2A line:

a. 2287.5 MHz (CSM).

b. DP -1, 245.3 MHz (IU).

c. CP - 1, 258.5 MHz (S-IVB).

d. 2282.5 MHz (LM).

e. BP - 1, 248.6 MHz (S-II).

2.3.3.3 MIL Postlaunch Remoting. During certain times after launch, MIL will remote CSM data (2287.5 MHz or 2272.5 MHz) and LM data (2282.5 MHz) to CIF on an A2A line. The NC will specify the times when this data is to be remoted.

2.3.4 ARIA/MIL-GWM-HAW TELEMETRY CONFIGURATION

2.3.4.1 MIL Telemetry Configuration for TLI

a. General. MIL will receive either IU or S-IVB data (type will be determined by SCM or by direct coordination with the AOCC) from GBI by wideband cable via Tel IV and CIF. At GBI the total PCM bit stream (72.0 kb/sec) will be inserted on a FM record amplifier set to a center frequency of 432 kHz. At MIL a FM reproduce amplifier will be set to a center frequency of 432 kHz and the 72.0-kb/sec data will be fed to the PCM station for processing by the RSDP.

b. Stripchart Recorder. One stripchart recorder will be labeled DSS 551 and will be set up with pen No. 1 configured for decom lock status. Recorder speed will be 20 mm/sec. SDT will be inserted on the timing pen.

2.3.4.2 GWM and HAW Telemetry Configuration for Reentry

a. Acquisition Aids. The TACSAT 249.5-MHz signal will be received at GWM and HAW as follows:

(1) GWM Teltrac: 116 degrees azimuth, 56 degrees elevation.

(2) HAW Teltrac acquisition aid: 240 degrees azimuth, 45 degrees elevation.

b. Receivers. GWM and HAW will configure two 2074 receivers to receive the TACSAT 249.5-MHz FM link data; the receivers will be operated using VFO. Receiver No. 1 will use a 100-kHz IF plug-in and will be configured in a diversity arrangement; the output of the diversity combiner will be patched to the PCM decom. Receiver No. 2 will use a 300-kHz IF plug-in and will also be configured in a diversity arrangement; the output of the diversity combiner will be patched to an IRIG 18 discriminator. Both receivers will use a video bandwidth of 100 kHz.

c. Stripchart Recorder. One stripchart recorder (label DSS 551) will be set up as follows:

(1) Pen 1: rcvr No. 1 chan A AGC (RHC).

(2) Pen 2: rcvr No. 1 chan B AGC (LHC).

(3) Pen 3: decom lock status.

Note

Recorder speed will be 20 mm/sec and standard AGC calibration procedures will be used. SDT will be inserted on the timing pen.

d. PCM Decoms. One decom will be required to decommutate the data from the 249.5-MHz link (TACSAT). The decom format will be CSM HBR. This decom will feed the TLM RSDP.

e. Discriminators. One IRIG 18 discriminator, using a 2.1-kHz lowpass filter, will discriminate the astrovoice from the 249.5-MHz link. The discriminator output will be remoted to Cape Kennedy Air Force Station (refer to section 10).

2.3.5 VHF TLM RECEIVER PREPASS CHECKLISTS

The procedures listed in this paragraph are to be used as an equipment status check prior to support of a spacecraft.

2.3.5.1 Dual-channel R-2074 TLM Receivers

a. Prerequisites. The station readiness test and all prepass calibrations must have been completed.

Unit/Function	Indication/Setting
Multicoupler POWER switch	ON

b. RF Tuning Module

Unit/Function	Indication/Setting
(1) XTAL/OFF/VFO	XTAL if XTAL available VFO if XTAL is not available
(2) Tuning Knob	See tables 2-13 through 2-30.

c. Receiver Controls

Unit/Function	Indication/Setting
(1) AM/FM (detector)	FM
(2) 2nd LOC OSC switch	VFO
(3) AGC MAN/PULSE/AM/FM	FM
(4) VIDEO/GAIN	System operating level
(5) TUNING-250 KC/0/+250 KC	0
(6) Video filter	Tables 2-13 through 2-30.
(7) FSD module (IF bandwidth)	Tables 2-13 through 2-30.

2.3.5.2 Diversity Combiner Adder (DCA-5100A), Control Panel

Unit/Function	Indication/Setting
a. Demodulator switch	REAL TIME

Note

Use same FSD module as receiver IF module.

b. Video bandwidth	Tables 2-13 through 2-30.
c. Mode switch, PRE-D/POST-D	PRE-D
d. Record frequency	225 at 30 in./sec 450 at 60 in./sec

Unit/Function	Indication/Setting
e. Video output control	System operating level
f. RESET/MAN/AUTO switch	AUTO

2.3.5.3 TLM Receiver (DEI TR-102)

Unit/Function	Indication/Setting
a. 1st LO	XTAL if XTAL available VFO if XTAL not available
b. 2nd LO	VFO
c. CAL OSC	OFF
d. IF plug-in	Tables 2-13 through 2-30
e. FM/AM demodulator (plug-in)	FM
f. Video filter	Tables 2-13 through 2-30
g. MODE	Tables 2-13 through 2-30
h. AGC DELAY	Tables 2-13 through 2-30

2.3.5.4 Diversity Combiner Adder

a. Initial Setup

(1) Connect the video and AGC from receiver No. 1 to channel 1 and the AGC 1 terminals at the rear of the combiner.

(2) Make the same connections from receiver No. 2 to channel 2 and AGC 2 terminals at the rear of the combiner.

(3) Connect the combiner video output to its normal load.

b. Diversity Combiner Control Panel

Unit/Function	Indication/Setting
(1) Meter switch	Cal 2 position Red
(2) Chan 1 video control	Red mark on meter scale
(3) Chan 2 video control	Zero center on meter scale
(4) Meter switch	Operate position
(5) Chan 1 AGC slope	Desired sensitivity
(6) Chan 2 AGC bal	Zero center on meter scale
(7) Output control	Desired video level

2.3.5.5 Single Channel R-1071 TLM Receivers

a. Prerequisites. The station readiness test and all prepass calibrations must have been completed.

Unit/Function	Indication/Setting
Multicoupler POWER switch	ON

b. RF Tuning Module

Unit/Function	Indication/Setting
(1) XTAL/OFF/VFO	XTAL if XTAL available VFO if XTAL not available
(2) Tuning knob	Adjust to indicate crystal operating frequency on tuning dial (tables 2-14 through 2-31).

c. Receiver Controls

Unit/Function	Indication/Setting
(1) AM/FM (detector)	FM
(2) 2nd LOC OSC switch	VFO
(3) AGC MAN/PULSE/AM/FM	FM
(4) VIDEO/GAIN	System operating level
(5) TUNING - 250 KC/0/+250 KC	0
(6) Video filter	Tables 2-13 through 2-30
(7) FSD module (IF bandwidth)	Tables 2-13 through 2-30

2.3.5.6 Microdyne 2200R TLM Receiver

a. Main Chassis

Unit/Function	Indication/Setting
(1) Power	ON
(2) Audio selector	As required
(3) Audio gain	As required
(4) Video coupling	DC
(5) Video gain	As required
(6) Video bandwidth (kHz)	
(a) FM/FM	300
(b) PCM/FM	100

Unit/Function	Indication/Setting
(7) IF bandwidth (kHz)	
(a) FM/FM	500
(b) PCM/FM	300
(8) SEPARATE - COMMON (toggle)	COMMON
(9) Manual gain	As required
(10) Control	LOCAL
(11) Second LO mode	VFO
(12) AGC time constant (msec)	100
(13) Operate mode	REC

b. FM Demodulator

Unit/Function	Indication/Setting
(1) Search range	As required
(2) Fine tune	As required
(3) Deviation (kHz)	
(a) FM/FM	500
(b) PCM/FM	150
(4) AFC time constant	
(a) FM/FM	.01
(b) PCM/FM	0.1

c. RF Tuner

Unit/Function	Indication/Setting
(1) Tuning (MHz)	As required
(2) Crystal select	As required
(3) First LO mode	As required

2.3.5.7 Microdyne 3300-C Combiner

Unit/Function	Indication/Setting
a. Power	ON
b. Pre-D/Post-D mode	Pre-D

Unit/Function	Indication/Setting
c. Noise/AGC mode	AGC
d. Meter control	As required
e. Video	As required
f. Chan 1	NA
g. Chan 2	NA
h. Comb	As required
i. Tune	As required
j. Record	NA
k. AGC	NEG
l. Audio	As required
m. LOCAL/REMOTE control	LOCAL

2.3.5.8 Spectrum Display Unit, Type 362-B

a. Prerequisites. The station readiness test and all prepass calibrations must have been completed.

b. SDU Front Panel

Unit/Function	Indication/Setting
(1) Selector knob	Receiver desired
(2) Position sweep width, CTR FREQ., and GAIN control	Set to center display on scope

2.4 PCM PROCESSING REQUIREMENTS

2.4.1 DECOM CONFIGURATIONS

The link priorities are shown in table 2-3. Signal conditioners will be patched to the appropriate USB/VHF output, consistent with link processing requirements. For IU support, DP-1 will be patched to the narrowband signal conditioner and DP-1B to the wideband signal conditioner. For IU support the narrowband signal conditioner will be prime. Consistent with priorities and availability of bit-rate modules, the narrowband signal conditioner will be considered the prime signal conditioner due to the program capability of the bit-rate modules. For launch to LOS, MIL will use the CSM 2287.5-MHz FM demod as the prime data source for the CSM decom. However, the operator will monitor the PM demod output and switch to this source any time it is of better quality.

2.4.1.1 MSFTP-1 Decom Format

a. Stations with MSFTP-1 decoms will patch in accordance with figures 2-2 through 2-7 and load decom patch boards in accordance with the PCM link priorities in table 2-3.

b. After S-IVB/IU TLM battery depletion (approximately 14 hours), stations will remove their SLV boards and replace them with CSM or LM boards.

2.4.1.2 MSFTP-2 Decom Formats. Stations with MSFTP-2 decoms will load sequence 51 from launch through S-IVB/IU TLM battery depletion. Formats are listed in table 2-4. Erratas are listed in table 2-5.

Table 2-3. PCM Link Priorities

Mission Phase	Priorities 1	2	3	4
Launch to Insertion				
MIL	IU	S-II	CSM PM	S-IVB
VAN	IU	CSM PM	S-IVB	
Launch to S-II Cutoff				
BDA	IU	S-II	CSM PM	S-IVB
S-II Cutoff to LOS				
BDA	IU	S-IVB	CSM PM	S-II
Earth Orbit				
Station uplinking to IU, and dual uplink stations	IU	CSM PM	S-IVB	CSM Dump
Station uplinking to CSM	CSM PM	IU	S-IVB	CSM Dump
TLI Cutoff to IU/S-IVB/ TLM Battery Depletion				
Station uplinking to CSM and dual uplink stations	CSM PM	IU	S-IVB	CSM Dump
Stations uplinking to IU	IU	CSM PM	S-IVB	CSM Dump
Translunar Coast After S-IVB/IU TLM Battery Depletion				
Station tracking CSM	CSM PM	CSM Dump		
Station on CSM	CSM PM	CSM Dump		
Station for SPS burns	CSM PM	CSM Dump		
Translunar Coast (CSM and SIM Active)				
85' station tracking	CSM PM	CSM FM SM6	CSM Dump	
Station on CSM	CSM PM	CSM Dump		
Station on CSM	CSM PM	CSM Dump		

Table 2-3. PCM Link Priorities (cont)

Mission Phase	Priorities 1	2	3	4
Translunar Coast (CSM and LM Active)				
Station tracking LM	LM PM/FM	CSM PM	CSM Dump	
Station tracking CSM	CSM PM	LM PM/FM	CSM Dump	
Station on CSM/LM	CSM PM	LM PM/FM	CSM Dump	
Lunar Orbit (LM Not Active)				
One station	CSM PM	CSM Dump		
One station	CSM PM	CSM Dump		
85' station SIM active	CSM PM	CSM FM SM6	CSM Dump SM4	
Lunar Orbit (CSM, SIM, and LM Active)				
Station tracking LM	LM PM/FM	CSM PM	CSM Dump	
85' station tracking CSM	CSM PM	SM6 CSM FM	LM PM/FM	
Station tracking CSM	CSM PM	LM PM/FM	CSM Dump	
Lunar Stay (CSM, SIM, and LM Active) LGC On				
Station tracking LM	LM PM/FM	CSM PM	CSM Dump	
85' station tracking CSM	CSM PM	SM6 CSM FM	LM PM/FM	
Station tracking CSM	CSM PM	LM PM/FM	CSM Dump	
Lunar Stay (CSM, SIM, and LM Active) LGC Off				
85' station tracking LM/SIM	LM PM/FM	CSM FM SM6	CSM PM	
Station tracking CSM	CSM PM	LM PM/FM	CSM Dump	
Station on CSM/LM	CSM PM	LM PM/FM	CSM Dump	

Table 2-3. PCM Link Priorities (cont)

Mission Phase	Priorities 1	2	3	4
Transearth Coast (CSM and SIM Active)				
85' station tracking	CSM PM	CSM FM SM6	CSM Dump	
Station on CSM	CSM PM	CSM Dump		
Station on CSM	CSM PM	CSM Dump		
Transearth Coast (CSM Active, SPS Burns)				
Station tracking CSM	CSM PM	CSM PM		
Station on CSM	CSM PM	CSM Dump		
Station on CSM	CSM PM	CSM Dump		
Entry				
Station tracking CSM	CSM PM	CSM Dump		
Station on CSM	CSM PM	CSM Dump		

Note

1. VHF is prime for IU during launch phase through TLI. However, the best source will be sent to MCC.

2. When a station is assigned for dual support of Apollo and ALSEP during the period from lunar orbit to splashdown, the Apollo mission will have priority. One decom will be assigned to either the CSM or the LM; the vehicle will be noted in the SCM.

Table 2-4. Decom/Simulator Formats and Tapes

Seq No.	Type	Vehicle	Formats MSFTP-1	Formats MSFTP-2	Format ID
26	Simulator	CSM-HBR EMOD	See figures 2-2 through 2-7	5	NA
		CSM-LBR EMOD		6	NA
27	Simulator	LM-HBR EMOD		8	NA
50	Decom	CSM-HBR		5	06
		CSM-LBR		6	07
		CSM-HBRD		7	31
		CSM-LBRD		8	15
		CSM-HLBRD		10	33
		LM-LBRD		9	34
		LM-MLBRD		3	03
		LM-HBR		1	12
		LM-LBR		2	13
		LM-HLBRD		4	05
51	Decom	2.4 kb/sec		1	20
		S-II		2	17
		IU		3	11
		S-IVB		4	10
		CSM-HBR		5	06
		CSM-LBR		6	07
		CSM-HBRD		7	31
		CSM-LBRD		8	15
		CSM-HLBRD		10	33
52	Decom	2.4 kb/sec		1	20
		S-II		2	17
		IU		3	11
		S-IVB		4	10
		LM-HBR		5	12
		LM-LBR		6	13
		LM-LBRD		7	34
		LM-MLBRD		8	03
		LM-HLBRD		9	05
60	Decom	CSM-HBR		5	06
		CSM-LBR		6	07
		CSM-HBRD		7	31
		CSM-LBRD		8	15
		CSM-HLBRD		10	33
		SM-4 RT		2	21
		SM-4 Dump		3	27
		SM-6 RT		4	20
		SM-6 Dump		9	26
		4.8 kb/sec		1	20
53	Simulator	CSM-HBR		5	NA
		CSM-LBR		6	NA

Table 2-4. Decom/Simulator Formats and Tapes (cont)

Seq No.	Type	Vehicle	Formats: MSFTP-1	Formats: MSFTP-2	Format ID
54	Simulator	LM-HBR LM-LBR		8 9	NA NA
55	Simulator	S-II IU S-IVB 2.4 kb/sec		2 3 4 7	NA NA NA NA
56	Simulator	CSM-HBR Biomed Data CSM-HBR Biomed Cals	See figures 2-2 through 2-7	1 2	NA NA
61	Simulator	SM-6 4.8 kb/sec		6 1	

Note

1. Each sequence is on a separate tape.

2. Seq 50 and 60 CSM addresses are identical to seq 51 CSM addresses.

3. To locate the proper MSFTP-2 decom addresses for LM parameters when using tape seq 52, add the following octal numbers: LM HBR 4063, LM LBR 4100 (e.g., parameter GL0302X HBR 0275 + 4063 = 4360, LBR 3222 + 4100 = 7322.)

4. Following S-IVB/IU TLM battery depletion (approximately 14 hours), stations will load seq 50 and seq 60.

5. In seq 60, SM-4 RT and SM-4 Dump are not applicable to this mission.

Table 2-5. Decom/Simulator Erratas

Seq	Errata	Date	Description	Station
50 D	A	10-13-69	LM FM-FM remoting	All
	B	04-08-70	For use with MAD CRR 406 F-005	MAD
	D	6-2-71	Changes DAC and store assignments to conform with the PCM DDS	MIL
51 D	A	9-29-69	CSM FM-FM remoting	All
	B	10-08-69	S-II-IU-S-IVB	
			Sync validity and D.F.S. FSUI 11 and 12	All
	C	11-08-69	BDA range safety	BDA
	D	04-08-70	For use with MAD CRR 406F-005	MAD
	F	12-22-70	S-II WD 32	MIL BDA
	G	1-13-71	Add DAC 10, WD 20, FR 9	MIL BDA
	H	6-2-71	Changes DAC and store assignments to conform with the PCM DDS	MIL
	I	7-8-71	Range safety	BDA
52 D	A	04-08-70	For use with MAD CRR 406F-005	MAD
	C	12-22-70	S-II WD 32	MIL BDA
	D	1-13-71	Add DAC 10,WD 20,FR 9	MIL BDA
	E	6-2-71	Changes DAC and store assignments to conform with the PCM DDS	MIL
	F	7-8-71	Range safety	BDA
54 S	A	10-16-69	Corrects LGC word order code. Changes data value at address 1157.	All
60 D	A	6-2-71	Changes DAC and store assignments to conform with the PCM DDS	MIL
	B	6-18-71	Code select NB-S/C select-ID FMT 1	All

2.4.2 SPECIAL TELEMETRY PROCEDURES

2.4.2.1 Dump/Playback Configuration. The following configurations will be given verbally to the station by the TIC either prior to, or during, station acquisition periods, if special processing is required. The configuration should cover all possible requirements; however, in a contingency any part may be modified. The reason for setting the decom playback bit results from Flight Controller requirements for routing certain data at MCC to real-time displays and other to playback displays. Stations will follow bit rate changes or meet the ratio requirements specified by TIC. Stations will use specified decom formats and ensure that particular attention is given to the setting of playback bits if necessary. All stations will maintain normal real-time vehicle data processing as defined by the SCM unless directed otherwise by TIC. The special configuration will be given by code number to the station. The codes are contained in tables 2-6 through 2-9.

Table 2-6. CSM Codes 1-6

Code No.	Down-link	Data Description	Data Source	Bit Rate (kb/sec)	Decom Format	T/P Set
1 *	CSM-PM	CSM HBR/LBR R/T	Station Recorder	51.2/1.6	HBR/LBR	Yes
2 *	CSM-FM	CSM HBR/HLBR/ Dump	Station Recorder	51.2/12.8 ** 1.6	HBRD HLBRD/ LBRD	Yes
3	CSM-FM	CSM HBR/HLBR Dump	Data Demod	51.2	HBRD/ HLBRD	No
4*	CSM-PM	CSM HBR/LBR R/T	Data Demod	51.2/1.6	HBR/LBR	Yes
5	CSM-FM	CSM HBR/HLBR Dump	Data Demod	51.2 **	HBR/LBR	No
6	CSM-FM	CSM HBR/HLBR Dump	Station Recorder	51.2/ 12.8**/1.6	HBR/LBR	No

* Inhibit any dump decom format from processing real-time dumps to the computer.

** HLBR will require manual selection of the bit rate, and use of the LBR/LBRD decom formats.

Table 2-7. LM Codes 11-16

Code No.	Downlink	Data Description	Data Source	Decom Bit Rate (kb/sec)	Decom Format	T/P Set
11*	LM-PM/ FM	LM HBR/LBR R/T	Station Recorder	51.2/1.6	HBR/LBR	Yes
12*	CSM-FM	LM HLBR/ MLBR Dump	Station Recorder	51.2/12.8/ 1.6	HLBRD/ MLBRD/ LBRD	Yes
13	CSM-FM	LM HLBR/ MLBR Dump	Data Demod	51.2/12.8	HLBRD/ MLBRD	No
14*	LM-PM/ FM	LM HBR/LBR R/TV	Data Demod	51.2/1.6	HBR/ LBR	Yes
15	CSM-FM	LM HLBR/ MLBR Dump	Data Demod	51.2**/ 12.8**	LBR	No
16	CSM-FM	LM HLBR/ MLBR Dump	Station Recorder	51.2** 12.8** 1.6	LBR	No

* Inhibit any dump decom format from processing real-time dumps to the computers.

** HLBR will require manual selection of the bit rates.

Table 2-8. EVCS, LCRU, and Voice Codes A-K

Code Letter	Downlink	Data Description	Data Source	IRIG Subcarrier
A	CSM-FM	Dump voice	Station recorder	NA
B	CSM-FM	Dump voice	Data demod	NA
C	CSM-PM	R/T voice	Station recorder	NA
D	LM-FM/PM	R/T voice	Station recorder	NA
E	LM-PM/FM	LM R/T biomed	Station recorder	14.5k
F	LM-PM/FM	EVCS R/T Biomed	Station recorder	5.4k/3.9k
G	LM-PM/FM	EVCS R/T PAM	Station recorder	7.350k/10.5k
H	LCRU-FM	LCRU biomed	Station recorder	3.9/5.4k
I	LCRU-FM	EVCS/biomed	Station recorder	7.35/10.5/ 3.9/5.4k
J	LCRU-FM	EVCS	Station recorder	7.35/10.5k
K	LCRU-FM	EVCS-LCRU biomed	Station recorder	3.9/5.4/7.35/ 10.5/14.5k

Table 2-9. SIM Codes 1-5

Code No.	Downlink	Data Description	Data Source	Bit Rate (kb/sec)	Decom Formats	T/P Set
1	SM-6/FM	SIM R/T CSM R/T	Station Recorder	64/51.2	SM-6 CSM	No
2	SM-6/FM	SIM/RT/Dump CSM Dump	Data Demod	64/51.2	SM-6D/CSMD	No
3	SM-6/FM	SIM Dump CSM Dump	Station Recorder	64/51.2	SM-6D/CSMD	No
4	SM-6/FM	SIM R/T CSM R/T	Station Recorder	64/51.2	SM-6/CSM	Yes
5	SM-6/FM	SIM Dump CSM Dump	Data Demod	64/51.2	SM-6/CSM	No

Note

CSM is necessary for timing.

2.4.2.2 Example Usage of Special Procedure Codes

a. Example 1

TIC "MIL, TIC, configure your station for playback code 12 at 1.6 kb/sec from MET 125:00:10 to 125:11:00."

MIL "Roger TIC."

Note

The recorded dump may have been either HLBR or MLBR, adjust the tape recorder speed to playback at 1.6-kb rate.

MIL "TIC, MIL, ready to send playback code 12."

b. Example 2

TIC "Goldstone, TIC, configure your station for codes 4 and 5. Make the change at CTE 57:10:00. Go back to normal configuration upon completion of the dump."

GDS "Roger TIC, codes 4 and 5 at 57:10:00.

Note

The purpose of this configuration is to make the real-time data appear on playback displays, and the dump data on real-time displays at MCC.

2.4.3 CSM AND LM DOWNLINK ID'S

2.4.3.1 To simulate the different downlink modes for the Command Module Computer (CMC) and LM Guidance Computer (LGC), the following changes must be loaded into the CSM HBR or LM HBR simulator program. Both the CSM HBR and LM HBR programs have the Entry and Update ID programmed.

a. CMC Powered List Orbital Maneuver (LGC) - ID 77774 Octal

Address		Data
CSM	LM	
1116	1140	01111111
1117	1141	11111100
1120	1142	01111110

b. CMC and LGC Rendezvous and Prethrust - ID 77775 Octal

Address		Data
CSM	LM	
1116	1140	01111111
1117	1141	11111101
1120	1142	11111110

c. CMC and LGC Coast and Align - ID 77777 Octal

Address		Data
CSM	LM	
1116	1140	01111111
1117	1141	11111111
1120	1142	01111110

d. CMC Entry and Update or LGC Initialization and Update ID 77776 Octal

Address		Data
CSM	LM	
1116	1140	01111111
1117	1141	11111110
1120	1142	11111110

e. CMC Program 22 or LM Descent/Ascent ID 77773 Octal

Address		Data
CSM	LM	
1116	1140	01111111
1117	1141	11111011
1120	1142	11111110

f. LGC Lunar Surface Align - ID 77772 Octal

Address	Data
LM	
1140	01111111
1141	11111010
1142	01111110

2.4.3.2 The LGC and CMC EMOD downlinks have separate simulation programs. The proper ID is repeated 8 times in LGC or CMC WD 1A for each of the downlinked EMOD banks in the sequence 26 and 27 programs.

2.4.4 DSDU/DDS PATCHING

On the exciter console, the following measurements will be patched by groups to the USB systems monitor in real time. The group to be used is determined by the vehicle or vehicles to which the USB will be uplinking per SCM.

a. Uplinking to the CSM

AGC: CSM-H and CSM-L measurement No. CT0620E from DAC 9.

SPE: CSM-H measurement No. CT0640F from DAC 10.

CSM decom lock: SPE will not be downlinked in the CSM-L bit stream.

b. Uplinking to the S-IVB/IU

AGC: IU measurement No. J0076-603 from DAC9.

SPE: IU measurement No. J0075-603 from DAC 10.

IU decom lock.

c. Uplinking to the LM

AGC: LM-H and LM-L measurement No. GT0994V-2 from DAC 9.

SPE: LM-H and LM-L measurement No. GT0992BA-2 from DAC 10.

LM decom lock.

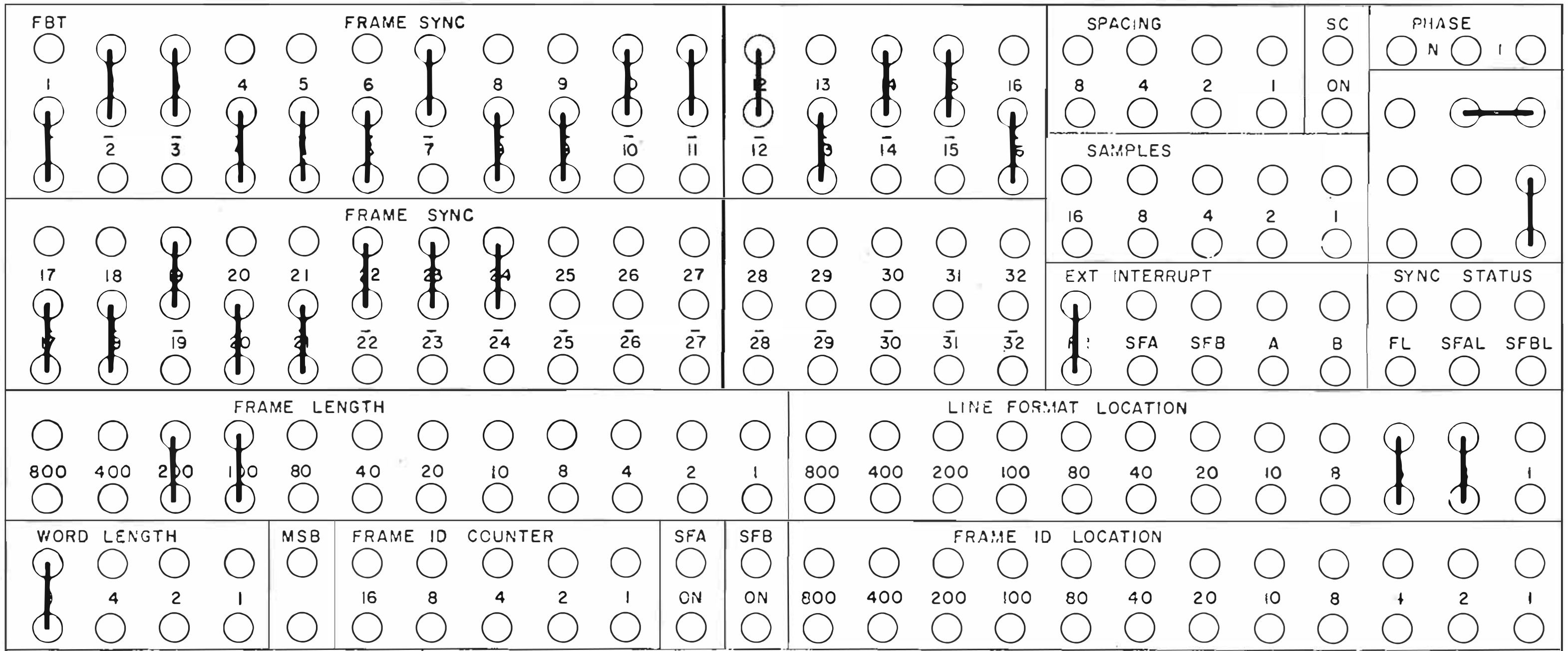
2.4.5 MONITOR 400 DECOM

The Monitor 400 decom will be used to input the station's engineering HSD output into the ASTAM system. (See figure 2-1 for patchboard patching.) The monitor 400 will not lock on the biomed HSD using 6-bit words because of the dummy NASCOM block that has been added to make the 7.2-kb/sec format. (Refer to section 5 for procedures for switching from command to biomed monitor in the ASTAM computer.) The front panel switch settings will be as follows:

Function	Setting
NRZ	L
Polarity	Plus

2.4.6 MSFTP-1 PATCHING

MSFTP-1 patching instructions are shown in figures 2-2 through 2-7.



*Patch as required

Note

1. Use BR-015 - 7.2 bit rate card.

2. A3A12 patching will be per EI 4745 (interleaved).

Figure 2-1. Apollo Patching (7.2 kb/sec) (Engineering Data)

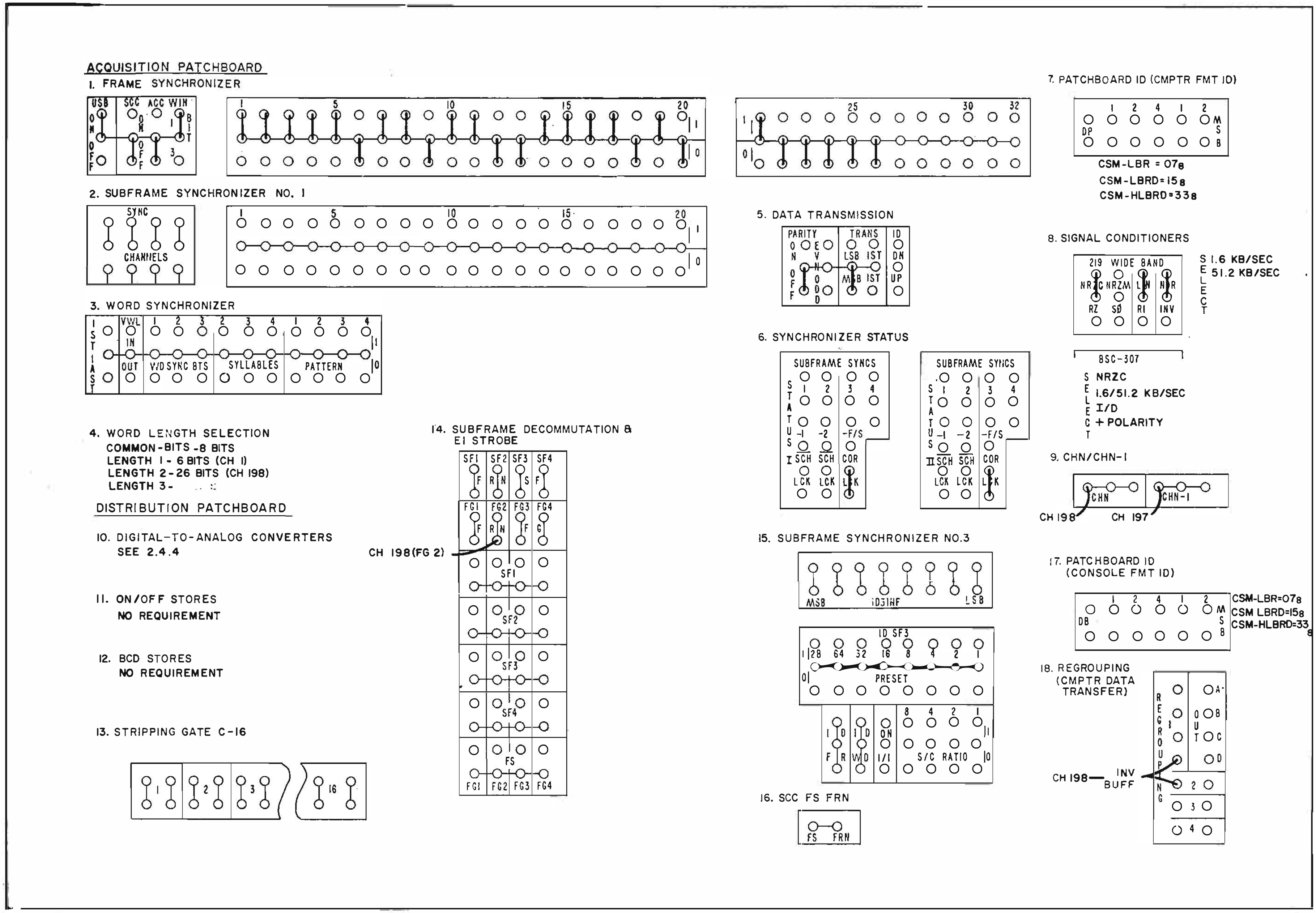


Figure 2-2. MSFTP-1 Patching for CSM, LBR, LBRD, and HLBRD

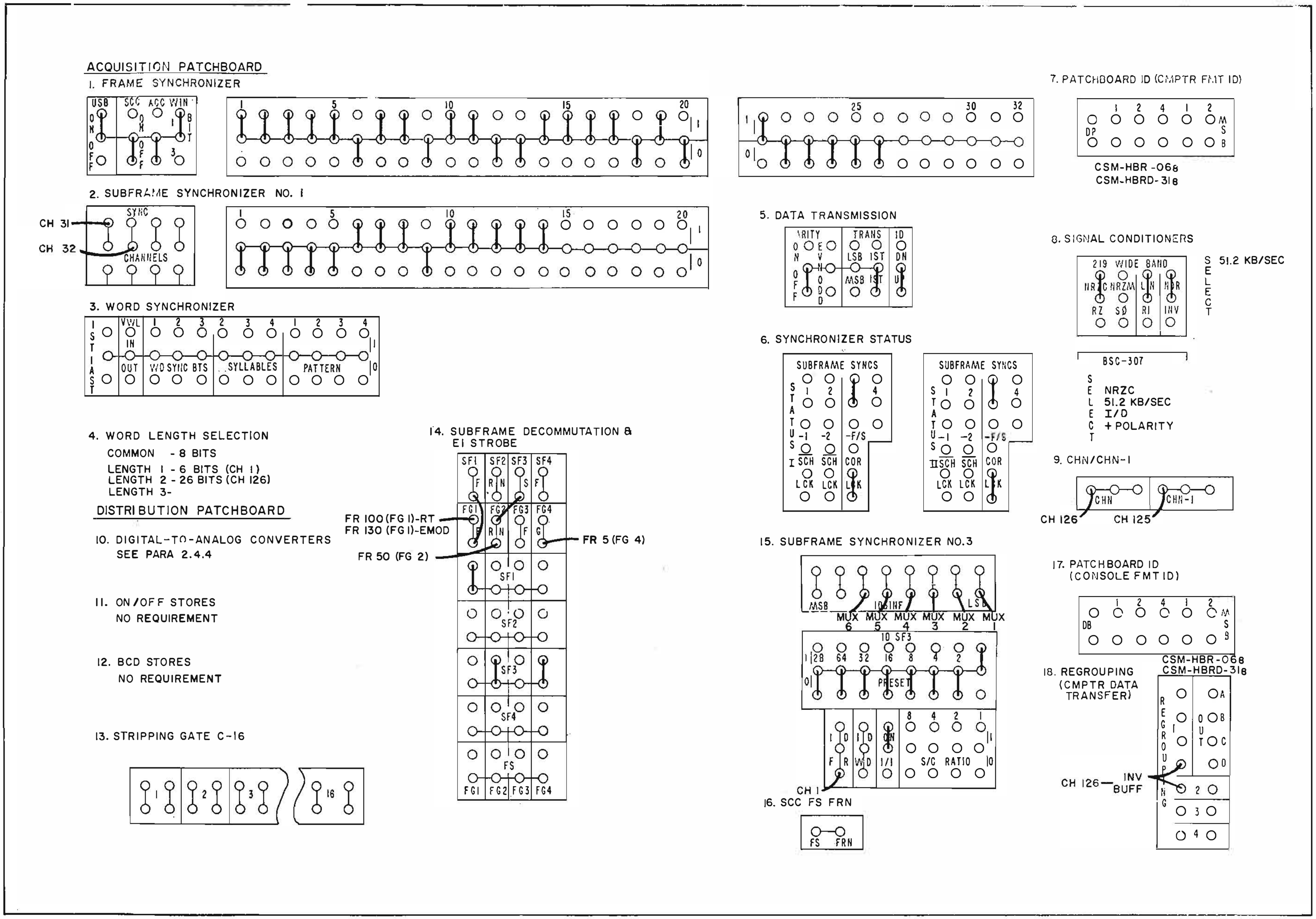


Figure 2-3. MSFTP-1 Patching for CSM, HBR, and HBRD

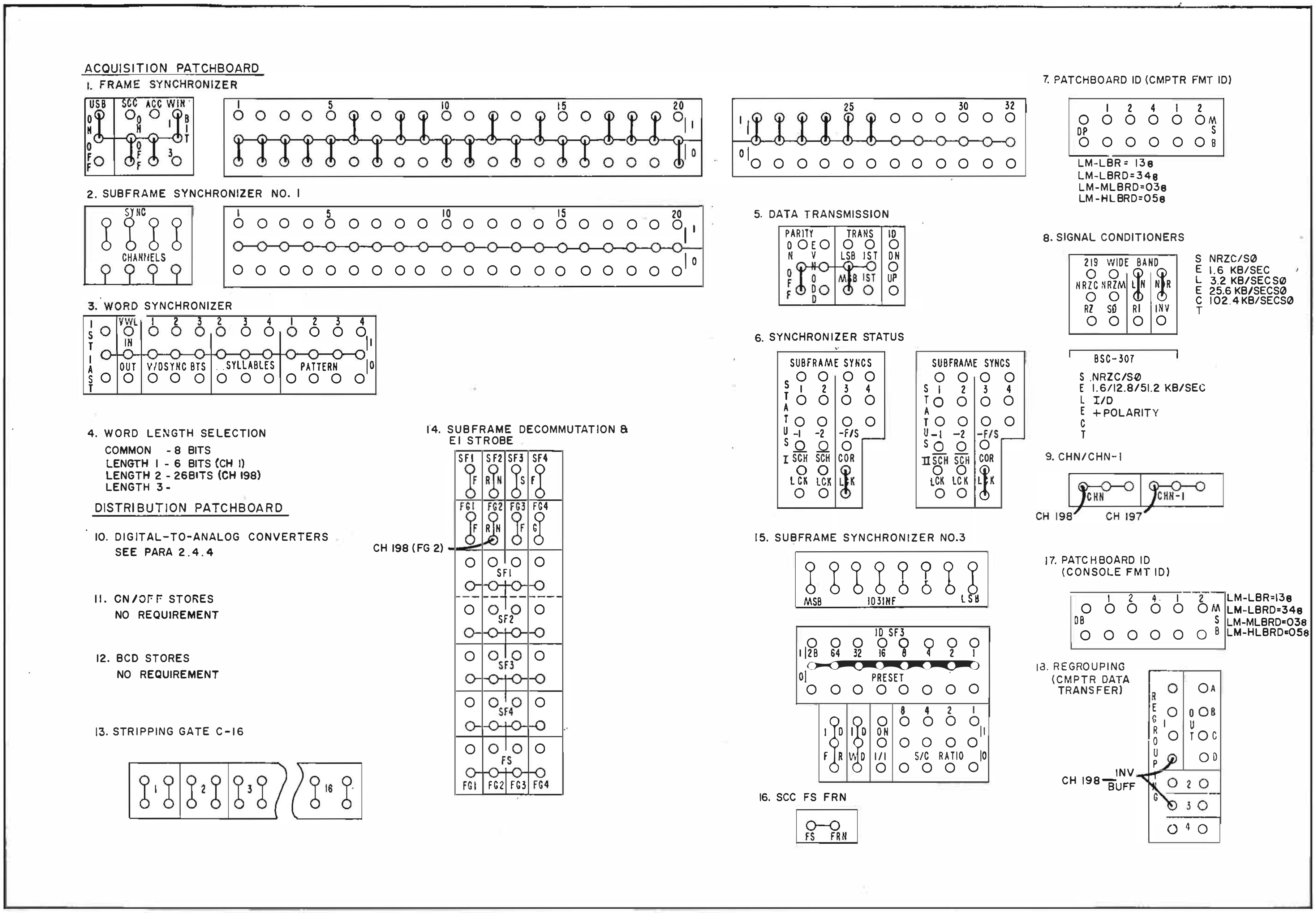


Figure 2-4. MSFTP-1 Patching for LM, LBR, LBRD, MLBRD, and HLBRD

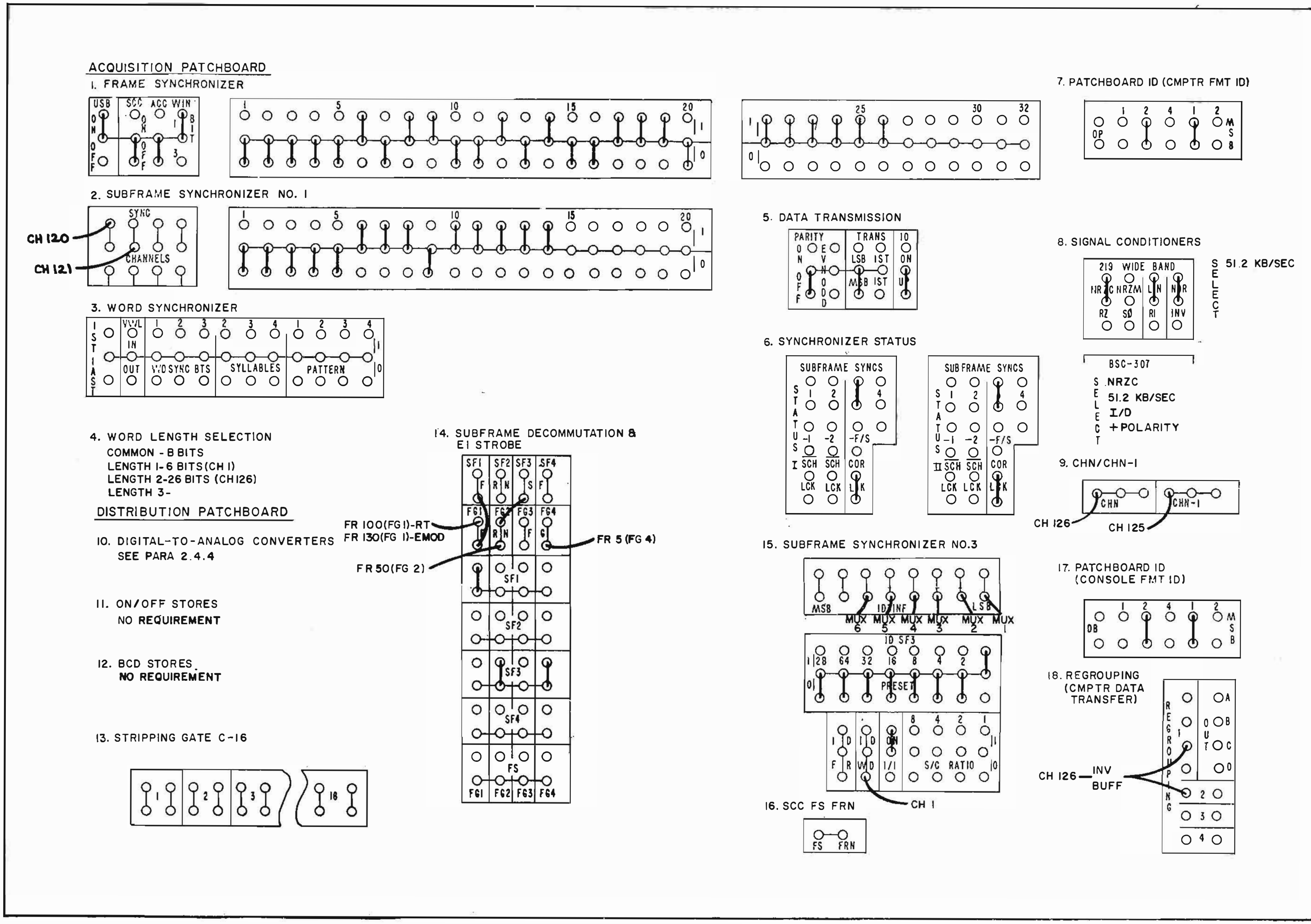


Figure 2-5. MSFTP-1 Patching for LM-HBR

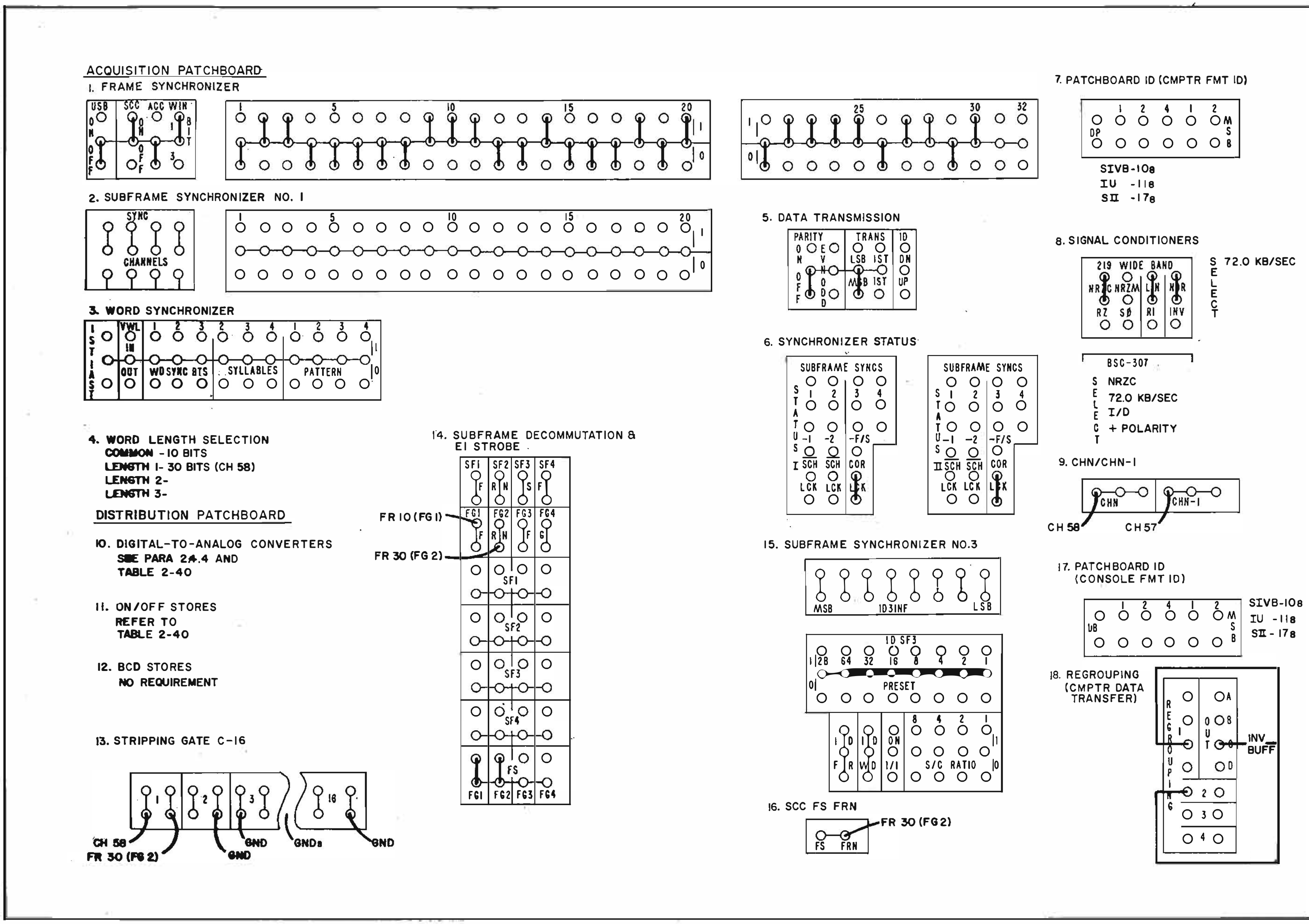


Figure 2-6. MSFTP-1 Patching for S-II, S-IVB, and IU

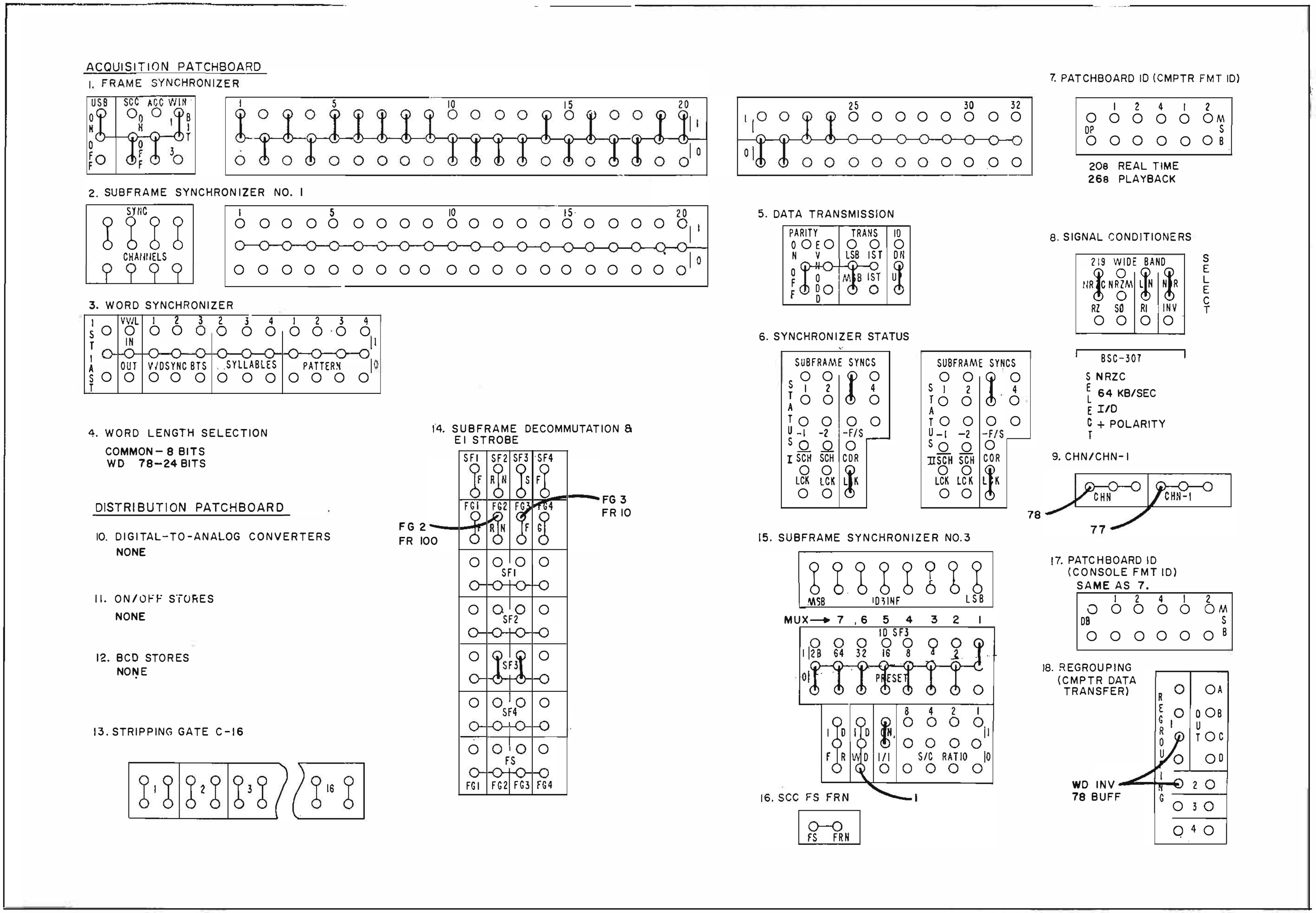


Figure 2-7. MSFTP-1 Patching for SM-6

2.4.7 MSFTP-1 SIMULATOR PATCHING INSTRUCTIONS

2.4.7.1 S-IVB/IU/S-II Program. The following preliminary settings on the PCM signal simulator will be used to check S-IVB/IU/S-II patching:

a. F-Word Length: 30.

b. CABS-Word Length: 10.

c. Frame Length: 58.

d. Subcom Ratio: 30:1.

e. A-Word Location: As required.

f. S-Word Location: As required.

g. A and S Mode: As required.

h. F Complement: Last frame.

i. Parity: Off.

j. Blanking: Out.

k. F Word: 101 101 111 010 100 010 011 100 000 110.

l. A Word: As required.

m. S Word: As required.

n. Bit Rate: 72.0 kb/sec.

o. All other switches will be in the OFF position.

2.4.7.2 CSM HBR Program. Make the following preliminary settings on the PCM signal simulator for checking the patching:

a. F-Word Length: 24.

b. CABS-Word Length: 8.

c. Frame Length: 126.

d. Subcom Ratio: 50:1 or 5:1 (50:1 ratio for checkout of subcom B, ID count of 62 octal; 5:1 ratio for checkout of subcom A, ID count of 5 octal. This requires repatching of the distribution board subframe sync No. 3 FRN from frame 50 to frame 5.)

e. A-Word Location: Word 1, frame 0.

f. S-Word Location: As required.

g. A Mode: ID.

h. F Complement: Off.

i. Parity: Off

j. Blanking: Out.

k. F-Word: 000 001 010 111 100 110 110 111.

l. A-Word: As required.

m. S-Word. As required.

n. Bit Rate: 51.2 kb/sec.

o. ID Preset: 301 octal.

2.4.7.3 CSM LBR Program. Make the following preliminary settings on the PCM simulator for checking the patching:

a. F-Word Length: 26.

b. F-Word: 000 001 010 111 100 110 110 111 11.

c. F Comp: Off.

d. Frame Length: 198.

e. A-Word Length: 6.

f. A-Word Location: Word 1, frame 0.

g. A-Word Mode: Com.

h. A-Word: 000001.

i. Bit Rate: 1.6 kb/sec.

2.4.7.4 LM HBR Program. Make the following preliminary settings on the PCM signal simulator for checking the patching:

a. F-Word Length: 24 bits.

b. CABS-Word Length: 8 bits.

c. Frame Length: 126.

d. Subcom Ratio: 50:1 or 5:1 (50:1 ratio for checkout of subcom B, ID count of 62 octal; 5:1 for checkout of subcom A, ID count of 5 octal. This requires repatching of the distribution board subframe sync No. 3 FRN from frame 50 to frame 5.)

e. A Word Location: Word 1, frame 0.

f. B Word Location: As required.

g. A Mode: ID.

h. F Word: 111 111 011 100 101 001 101 000.

i. F Complement: Off.

j. Parity: Off.

k. Blanking: Out.

l. A Word: As required.

m. S Word: As required.

n. Bit Rate: 51.2 kb/sec.

o. ID Preset: 001 octal.

2.4.7.5 LM LBR Program. Make the following preliminary settings on the PCM simulator for checking the patching:

a. F Word Length: 26 bits.

b. A Word Length: 6 bits.

c. Frame Length: 198.

d. A Word Location: Word 1, frame 0.

e. F Word: 111 111 011 100 101 001 101 000 00.

f. F Complement: Off.

g. A Word: 000001.

h. A Word Mode: COM.

i. Parity: Off.

j. Bit Rate: 1.6 kb/sec.

2.4.8 MSFTP-2 PCM SETUP

2.4.8.1 Wideband Signal Conditioners

	LM/CSM (HBR)	LM/CSM (LBR)	S-IVB/IU/S-II
Bit Rate	51.2 kb/sec	1.6 kb/sec	72.0 kb/sec
Code Type	NRZC	NRZC	NRZC

	SM-6	LM Dumps	
Bit Rate	64 kb/sec	3.2 kb/sec*	25.6 kb/sec 102.4 kb/sec
Code Type	Split Phase	S Ø	

Note

External clock switch out (VAN only).

*Station playback.

2.4.8.2 Narrowband Signal Conditioners. Bit rates and codes are controlled by the program.

2.4.8.3 Decommutator Control

a. FS-III Errors, 1.

b. Sync Allowable Errors

Mode	I		II		III	
			Patt	Err	Patt	Err
Frame	1	2				
	1	0	1	0	2	1
Subframe No. 1	1		1	0	2	1
No. 2	1		1	0	2	1
No. 3	0		1	0	2	0

NOTE

ID pattern errors: 2.

c. DAC Offset. Use DAC offset of None for both calibration and operation of CSM/LM, and SLV formats.

d. COMP DET. Program.

2.4.9 COMPUTER BUFFER PATCHING

The following patches will be made to conform with the RSDP operational programs:

MSFTP-1 Buffer No. 1	MSFTP-1 Buffer No. 2	MSFTP-2 Patch Plug (J2 & J3)	Function
A1 to D1 to G10	K1 to N1	A to EL	Data bit 2^0
A2 to D2 to I10	K2 to N2	B to EK	Data bit 2^1
A3 to D3 to I9	K3 to N3	C to EJ	Data bit 2^2
A4 to D4 to I8	K4 to N4	D to EH	Data bit 2^3
A5 to D5 to I7	K5 to N5	E to EF	Data bit 2^4
A6 to D6 to I3	K6 to N6	F to EE	Data bit 2^5
A7 to D7 to I2	K7 to N7	H to ED	Data bit 2^6
A8 to D8 to I1	K8 to N8	J to EC	Data bit 2^7
A9 to D9	K9 to N9	K to EB	Data bit 2^8
A10 to D10	K10 to N10	L to EA	Data bit 2^9
B1 to E1	L1 to O1	M to DZ	Data bit 2^{10}
B2 to E2	L2 to O2	N to DY	Data bit 2^{11}
B3 to E3	L3 to O3	P to DX	Data bit 2^{12}
B4 to E4	L4 to O4	R to DW	Data bit 2^{13}
B5 to E5	L5 to O5	S to DV	Data bit 2^{14}
B6 to E6	L6 to O6	T to DU	Data bit 2^{15}

MSFTP-1 Buffer No. 1	MSFTP-1 Buffer No. 2	MSFTP-2 Patch Plug (J2 & J3)	Function
B7 to E7	L7 to O7	U to DT	Data bit 2^{16}
B8 to E8	L8 to O8	V to DS	Data bit 2^{17}
B9 to E9	L9 to O9	W to DR	Data bit 2^{18}
B10 to E10	L10 to O10	X to DP	Data bit 2^{19}
C1 to F1	M1 to P1	Y to DN	Data bit 2^{20}
C2 to F2	M2 to P2	Z to DM	Data bit 2^{21}
F3 to H3	P3 to R3	CC to DL	Frame sync correction
F4 to H8	P4 to R8	AX to DK	Tape playback
G1 to F5	Q1 to P5	BZ to DJ	Veh ID 2^0
G2 to F6	Q2 to P6	AK to DH	Veh ID 2^1
G3 to F7	Q3 to P7	AL to DF	Veh ID 2^2
G4 to F8	Q4 to P8	AM to DE	Veh ID 2^3
G5 to F9	Q5 to P9	AN to DD	Veh ID 2^4
H1 to F10	R1 to P10	AV to DC	Abnormal bit
G9 to G7			FGG2
I6 to J6	S6 to T6	CA to CV	Abnormal interrupt (loss of sync)

2.4.10 MSFTP-2 MANUAL SIMULATOR

2.4.10.1 General. The manual simulator may be used to simulate the CSM HBR, LM HBR, CSM LBR, LM LBR, S-IVB, and IU formats.

2.4.10.2 CSM and LM HBR. By patching the program patchboard as shown in figure 2-8 and using the switches on the manual simulator control panel, the following functions can be performed:

a. Simultaneous Calibration of All Data Words Except MAP's. The common syllable is used to perform this function.

b. Simulation of MAP's. Syllable 2 is patched to word 97 for CSM HBR (word 94 for LM HBR) and is, therefore, always available. The MSFTP-2 decom address for words 100 and 97 should be used for words 97 and 94 respectively.

c. Simulation of a Unique Word in Any Location of the Format. The data content of the unique word is controlled by the SYLLABLE 3 switches. The location is controlled by the counter control switches which should be operated as follows:

(1) Word Location. Counters 1 and 2 are used to place syllable 3 in any word location in the format, and are patched as binary counters. Bit 1 of counter 1 is the LSB. Bit 4 of counter 2 is the MSB. To locate syllable 3 to a desired word, the counter 1 and counter 2 switches should be set to one less than the word number. For example, if word 85 is the location desired, counter 1 should be set to 0010 and counter 2 to 1010.

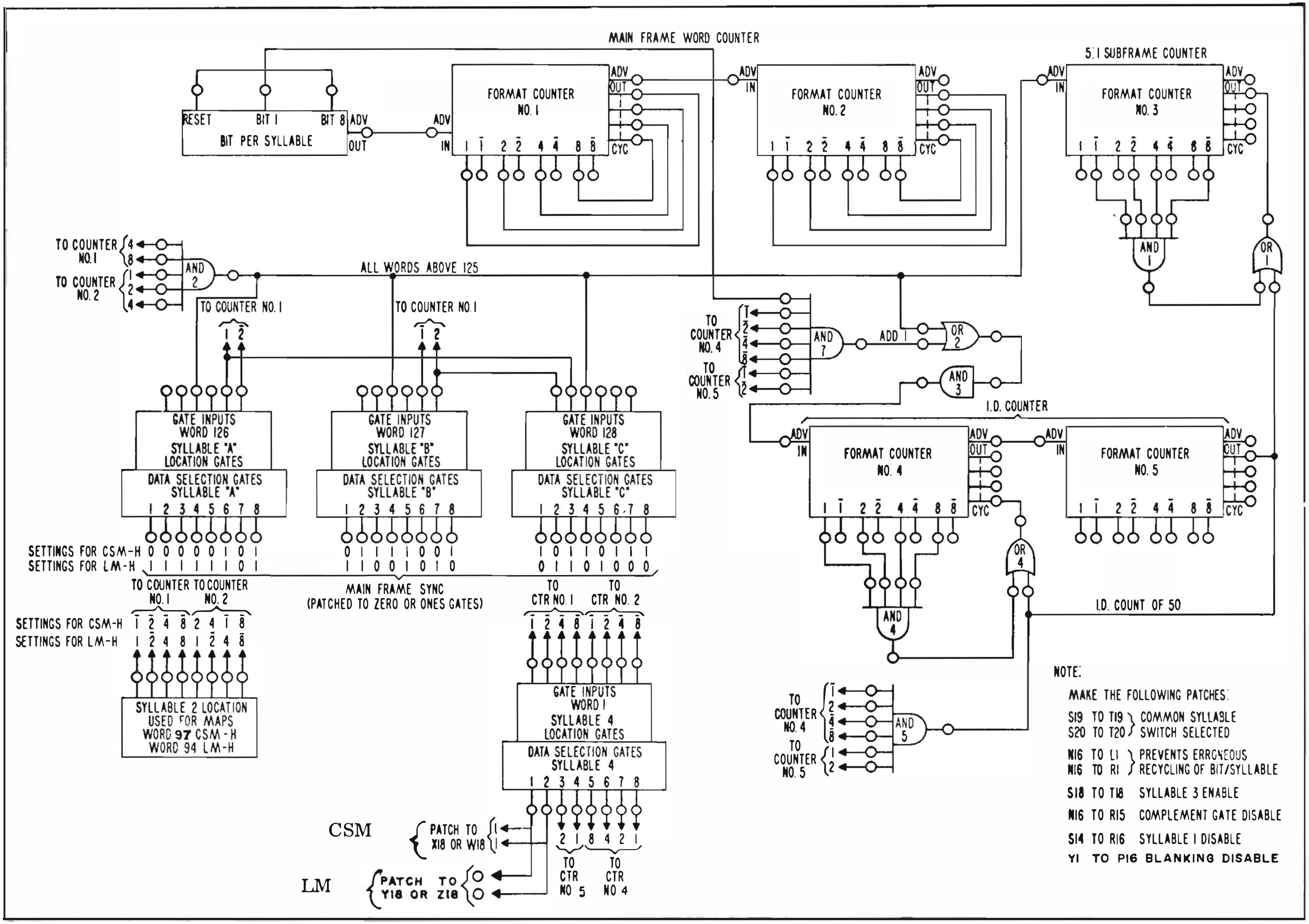


Figure 2-8. Manual Simulator Patching for CSM-H and LM-H

Note

The control switches for counters 1 and 2 should always be set to give a valid word location to syllable 3.

(2) Frame Count. Two subframe ratios are used in the CSM and LM HBR formats. They may be simulated as follows:

(a) 5:1 Subframe. Counter 3 is used for the 5:1 subframe counter. To simulate any word that has a rate of 10 samples-per-second, counter 3 should be set to one less than the frame count. The control switches on counter 3 should be in the OFF position whenever the 5:1 subframe is not being simulated.

(b) 50:1 Subframe. Counters 4 and 5 are used for the 50:1 subframe ID count. Bit 1 of counter 4 is the LSB. Bit 2 of counter 5 is the MSB. To simulate any word that has a rate of 1 sample-per-second, counters 4 and 5 should be set to the frame number. The control switches for these counters should be in the OFF position whenever the 50:1 subframe is not being simulated.

(c) Simulation of CSM Words with Sample Rate Over 50 smp/sec

1. A word with a sample rate of 100 will appear twice in each frame (128 words); the two words will always be 64 words apart. Therefore, to simulate the word, it is only necessary to select the first word and leave off bits 4 and 8 of counter 2. This will cause the word to appear in the selected location but be repeated 64 words later.

For Example: CG2117 is a 100-smp/sec parameter and is listed as word 14 in the alpha list. In order to properly simulate this parameter, it must be placed in word 14 and word 78. Subtract 3 from word 14 to convert to MSFTP-1 location and subtract 1 for the simulator. The counters would, therefore, be set as follows: Counter 1 - 0101, counter 2 - 00XX (X is off).

2. If a parameter has a sample rate of 200, the word appears four times each frame and will always be 32 words apart. To simulate, select the first word (as listed in the alpha list) and turn off all bits above bit 1 of counter 2.)

2.4.10.3 CSM and LM LBR. By patching the program patchboard as shown in figure 2-9 and using the switches on the manual simulator control panel, the following functions can be performed:

a. Simultaneous Calibration of All Data Except MAP's. The common syllable is used to perform this function.

b. Simulation of CSM LBR MAP's. Syllable 1 is patched to words 11, 31, 51, 71, 91, 111, 131, 151, 171, and 191 and is, therefore, always available. The MSFTP-2 address for words 14, 34, 54, 74, 94, 114, 134, 154, 174, and 194 should be used.

Note

Syllable 1 is disabled for LM LBR.

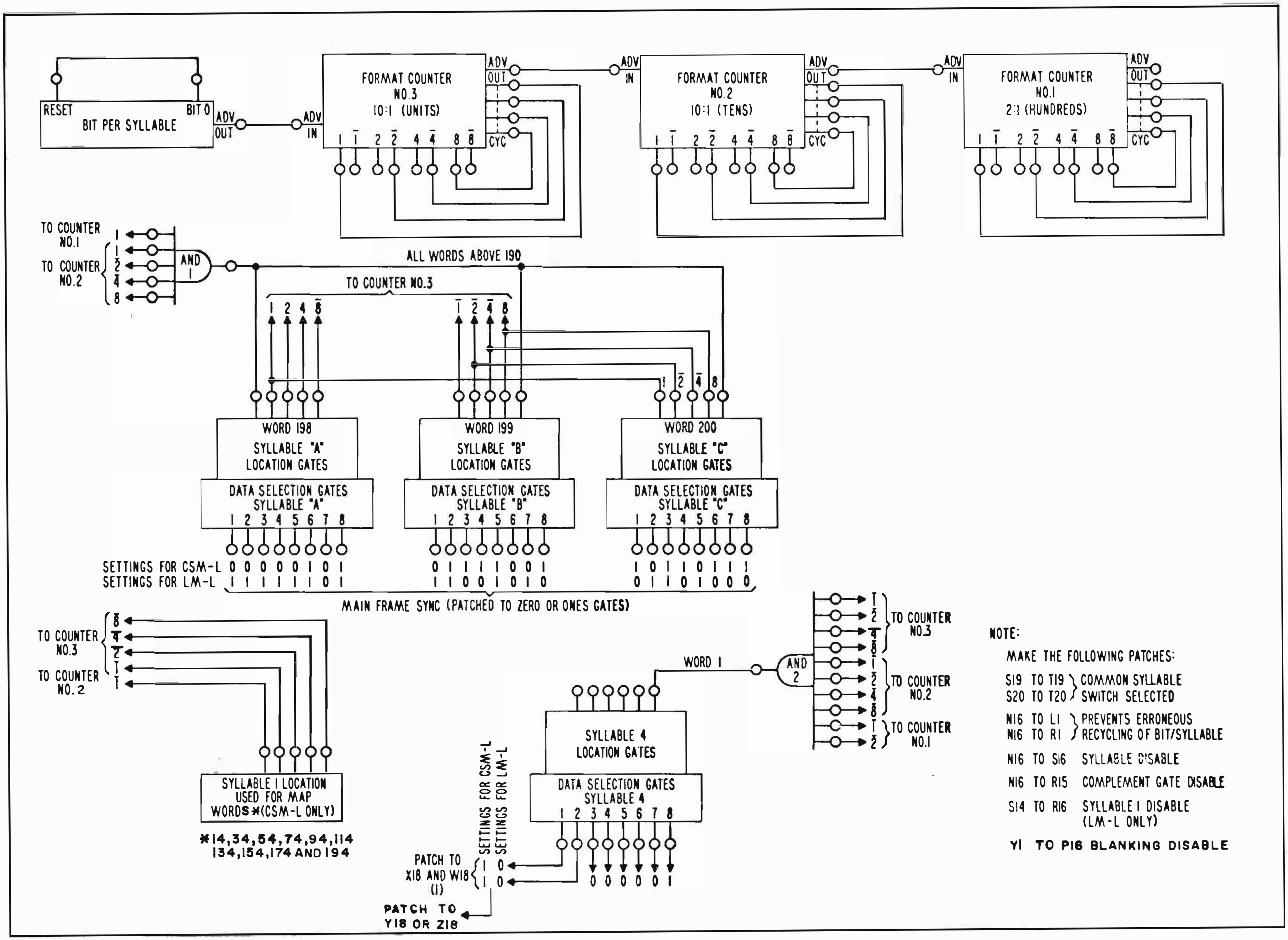


Figure 2-9. Manual Simulator Patching for CSM-L and LM-L

c. Simulation of a Unique Word in Any Location of the Format. The data content of the unique word is controlled by the SYLLABLE 3 switches. The location is controlled by the counter control switches which are operated for word location as follows:

(1) Format counters 1, 2, and 3 are used as the word counters and are patched as binary decimal counters. Counter 1 represents hundreds; counter 2, tens and counter 3, units.

(2) To place syllable 3 in a given word location, counters 1, 2, and 3 should be set to one less than the desired location. For example, if word 135 is the location desired, counter 1 should be set to 0001 (binary 1), counter 2 to 0011 (binary 3), and counter 3 to 0100 (binary 4).

Note

The SYLLABLE 3 control switches should always be in a position that gives a valid location to the syllable.

2.4.10.4 S-II, S-IVB, and IU. By patching the program patchboard as shown in figure 2-10 and using the switches on the manual simulator control panel, the following functions can be performed:

a. Simultaneous Calibration of All Data Words in the Format Except Word 29. The common syllable is used to perform this function.

b. Simulation of AVP's and CRP's. Syllable 1 is patched to word 29 and is, therefore, always available for use in simulating AVP's and CRP's.

c. Simulation of a Unique Word in Any Location of the Format. The data content of the unique word is controlled by the SYLLABLE 3 switches. The location is controlled by the counter control switches which should be operated as follows:

(1) Word Location. Counters 1 and 2 are used to place syllable 3 in any word location in the format. The counters are patched as binary decimal counters with counter 1 representing tens, counter 2 representing units, and 3 set to one less than the desired location. For example, if word 26 is the desired location, counter 1 should be set to 0010 (binary 2), and counter 2 should be set to 0101 (binary 5).

Note

The control switches should always be in a position that gives syllable 3 a valid location.

(2) Frame Count. Three subframe ratios are used in the S-IVB/IU program. They may be simulated as follows:

(a) 30:1 Subframe

1. Counters 4 and 5 are used for the 30:1 subframe and are patched as binary decimal counters. Counter 4 represents tens; counter 5, units.

2. To simulate a frame number, the control switches of counters 4 and 5 should be set to one less than the desired frame count. For example, if frame 18 is desired, counter 4 should be set to 0001 and counter 5 to 0111.

3. The counter-4 control switches should be in the OFF position whenever the 30:1 subframe is not being simulated.

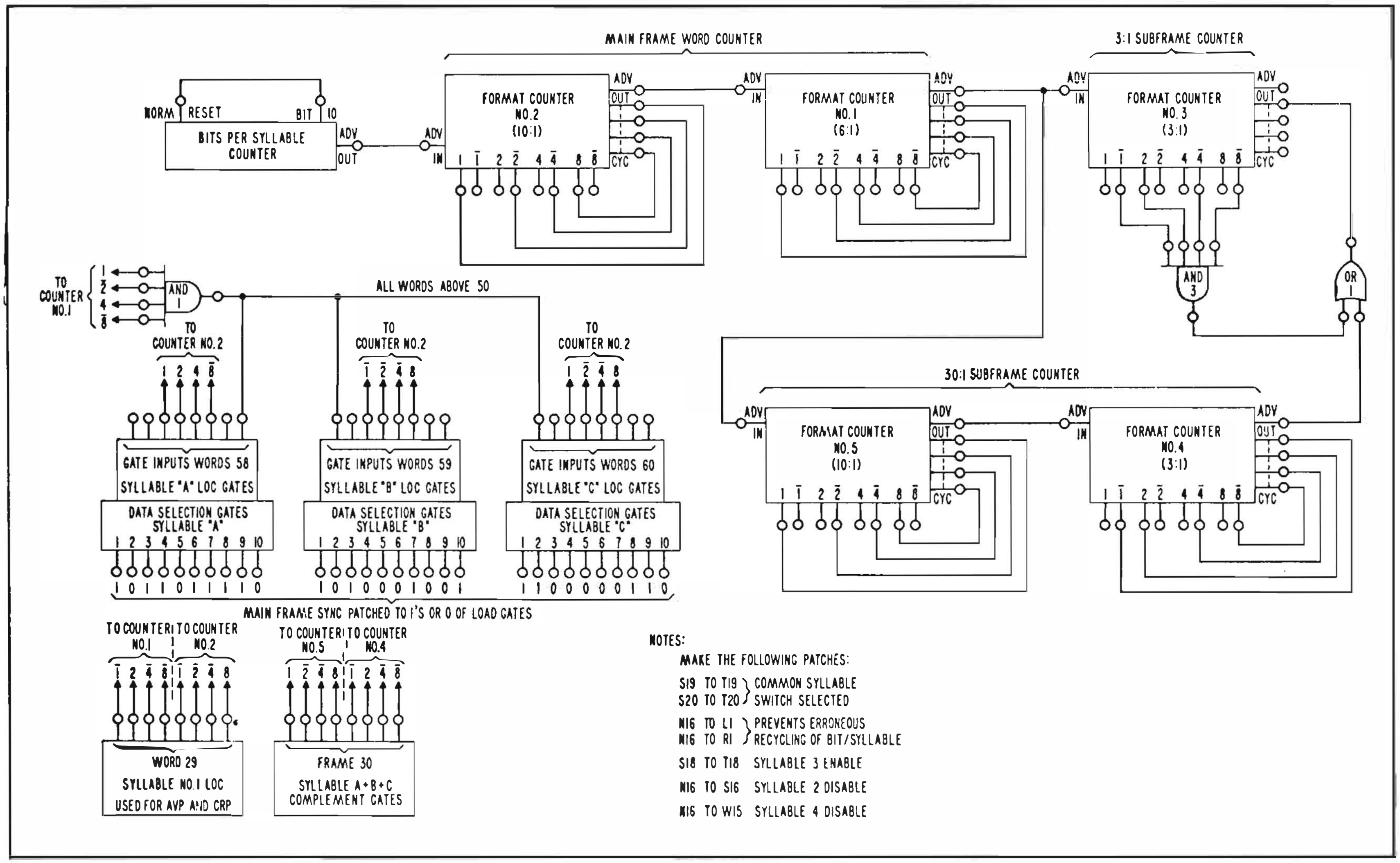


Figure 2-10. Manual Simulator Patching for S-II, IU, and S-IVB

(b) 10:1 Subframe. Counter 5 is used as the 10:1 subframe counter. To simulate a frame count, the control switches should be set to one less than the desired frame number. The counter-4 control switches should be in the OFF position whenever the 10:1 or 30:1 subframes are not being simulated.

(c) 3:1 Subframe. Counter 3 is used as the 3:1 subframe counter. To simulate a frame count, the control switches should be set to one less than the desired frame number. The counter-3 control switches should be in the OFF position whenever the 3:1 subframe is not being simulated.

2.4.11 PAM PROCESSING REQUIREMENTS AND INSTRUCTIONS

2.4.11.1 PAM Data Description

a. PAM data is downlinked on the 2282.5-MHz and 2265.5-MHz USB links from EVC No. 1 and No. 2. The data from EVC No. 1 is contained on IRIG 12. The data from EVC No. 2 is contained on IRIG 11.

b. To obtain the PAM data, set up two discriminators (IRIG 11 and IRIG 12). See para 2.6.1.5 for the USB signal outputs.

c. PAM data is 30 segments per frame downlinked at 1-1/2 frames per second. The data is RZ. Refer to the alphanumeric listing for specific PAM contents.

2.4.11.2 Discriminator Setup Instructions for PAM. The following instructions should be used to set up the discriminators for PAM:

a. 110-Hz output filters will be used.

b. DELAY/AMPLITUDE switch: DELAY

c. IRIG 11 discriminator for EVC No. 2 data (will feed DDF-13 No. 2).

d. IRIG 12 discriminator for EVC No. 1 data (will feed DDF-13 No. 1).

e. Deviation ± 7-1/2 percent.

2.4.12 DDF 13 OPERATING INSTRUCTIONS

2.4.12.1 When not required to process live data, the DDF-13 normally will be kept locked up on the SS-13 simulator. When DDF-13 is not required to process data into the computer, the PAM operator will set the Data Transfer switch to the OFF position.

2.4.12.2 The following DDF-13 test points should be monitored with the multitrace oscilloscope during real-time support:

a. Sample delay window.

b. Amplitude input.

Scope synchronization is taken from sync jack. This does not preclude the PAM tech monitoring other points he feels will aid in observing data quality and integrity.

2.4.13 PASS SUMMARY REPORT

Pass Summary Reports (PASSUM's) will be submitted after each scheduled activity. Detailed procedures are contained in sections 11 and 16 of this NOSP.

2.4.14 DECOMMUTATION SYSTEMS PREPASS CHECKLISTS

2.4.14.1 MSFTP-1

a. System Function Panel. Patch in accordance with figures 2-2 through 2-7.

b. Signal Conditioners

(1) Narrowband Signal Conditioner and Bit Synchronizer (Model 307)

Unit/Function	Indication/Setting
(a) Bit rate and multiplier	As required
(b) Bandwidth	3%
(c) Detector	I/D
(d) Fine frequency	0
(e) Code	PROGRAM
(f) DC restoration	IN
(g) Polarity	+
(h) Mode	SET-UP

(2) Wideband Signal Conditioner

Unit/Function	Indication/Setting
(a) ON/OFF switch	ON
(b) Format input NRZC, NRZM, RZ and split-phase pushbutton switches	NRZ/SØ as required
(c) Multiplier switch indicates selection of bit rate range	As required
(d) BIT RATE switch, a rotary switch which permits selection of bit rate	As required
(e) Loop width switch S3	WIDE-LOOP
(f) Input attenuation switch S1	1:1 position
(g) FILTER-LINEAR or/RESET switches DS7 and DSS indicate which filter is in use	PROGRAM
(h) OUT OF SYNC lamp	lit

c. Station Input Panel 3A12

Unit/Function	Indication/Setting
(1) Station input signal switch S2	NARROW/WIDE
(2) Format select switch should indicate the proper format for the mission in progress:	
(a) PCM No. 1	FORMAT
(b) PCM No. 2	FORMAT
(c) PCM No. 3	FORMAT
(d) PCM No. 4	FORMAT
(3) Computer buffer INHIBIT switch No. 1	OFF
(4) Computer buffer INHIBIT switch No. 2	OFF
(5) Computer buffer No. 1 playback switch	OFF
(6) Computer buffer No. 2 playback switch	OFF

d. Synchronizers

Frame	S-II/S-IVB/IU	CSM/LM
Search	1	1
Check errors/patterns	0/1	0/1
Lock errors/patterns	0/1	1/1
Subframe		
Search		1
Check errors/patterns		0/1
Lock errors/patterns		1/1

2.4.14.2 MSFTP-2

a. Narrowband Signal Conditioner (BSC-20-210)

Unit/Function	Indication/Setting
(1) Input voltage P-P switch	1-15
(2) VCO control adjusted	0
(3) LOOP BW switch	MED
(4) MODE SELECT switch	PROGRAM

Unit/Function	Indication/Setting
(5) BIT-RATE SELECTOR switch	Programmed
(6) DETECTOR switch	I/D
(7) CODE TYPE switch	Programmed
(8) DC restoration switch	IN for normal and playback use

b. Wideband Signal Conditioner (BSC-20-211)

Unit/Function	Indication/Setting
(1) Input voltage P-P switch	1-15
(2) VCO control adjusted	0
(3) LOOP BW switch	MED
(4) MODE SELECT switch	LOCAL
(5) MULTIPLIER and BITS PER SEC switches	As required
(6) DETECTOR switch	I/D
(7) CODE TYPE switch	NRZ/SØ as required
(8) DC restoration switch	IN for normal and recorder playback use

c. PCM Decommutator Control Panel

(1) System Function Section

Unit/Function	Indication/Setting
(a) MAN SIM/SP SIM/WIDE/NAR switch	WIDE or NAR
(b) OPERATE/LOAD/TEST switch	OPERATE
(c) LOCAL/REMOTE switch	Station option
(d) FORMAT SELECT switch	As required
(e) Computer buffer INHIBIT switches	OFF
(f) RELAY INHIBIT switch	OFF
(g) FS III ERRORS switch	1
(h) Computer priority No. 1 (tape playback)	OFF
(i) Computer priority No. 2 (tape playback)	OFF

(2) Synchronization Section

Unit/Function	Indication/Setting						
(a) Synchronization BITS and PATTERNS switches	Mode	I		II		III	
		1	2	Patt	Err	Patt	Err
	Frame	1	0	1	0	2	1
	Subframe No. 1	1		1	0	2	1
	No. 2	1		1	0	2	1
	No. 3	0		1	0	2	0

Note

ID pattern errors: 2

Unit/Function	Indication/Setting
(b) COMP DET switch	PROGRAM

d. D/A Control Panel

Unit/Function	Indication/Setting
(1) D/A 1-24, 25-48, 49-72 switches	DATA
(2) NORMAL/INVERTED selection switches	NORMAL
(3) OFFSET select switch	NONE

e. Program Entry

Unit/Function	Indication/Setting
CMPTR/TAPE-5/TAPE-8 switch	TAPE-8

2.4.14.3 SS-13 Simulator and DDF-13 Program Instructions

a. The following instructions should be used for the SS-13 simulator and the DDF-13 program:

(1) SS-13 Simulator

Unit/Function	Indication/Setting
(a) Rate	45 p/sec
(b) MF Length	30
(c) SF Length	999
(d) SF Location	999
(e) Mode	PAM/RZ +
(f) Duty Cycle	50%

(g) Sync Formats

1. MF Sync — IRIG 2
2. SF Sync — OFF

(h) Channel Assignments

1. Zero Ref Ch — 001
2. F. S. Ref Ch — 002
3. Special Data Var Ch — Variable
4. Group — $\frac{20}{1}$ $\frac{40}{2}$ $\frac{50}{3}$ $\frac{60}{4}$ $\frac{80}{5}$ $\frac{20}{6}$ $\frac{40}{7}$ $\frac{50}{8}$ $\frac{60}{9}$ $\frac{80}{10}$
5. Missing Channel — OFF

(2) DDF-13

(a) Mode — PAM/RZ

(b) Channel Rate — 45 p/sec

(c) Sync Formats

1. PCM Frame Sync Code — NA
2. MF Sync — IRIG 2
3. SF Sync — OFF

(d) Main Frame Format

1. S/L — 0
2. Last Pulse-1 — 29
3. Last Pulse — 30
4. Zero Ref Ch — 1
5. F.S. Ref Ch — 2

(e) Subframe Format

1. S/L — 0
2. Last Pulse — 999
3. MF Location — 999

Note

1.60 = 0000000110 = 0 percent reference.
10.0 = 1111111001 = 100 percent reference.
(This is to prevent the computer from seeing the LSB Toggle.)

b. The following DDF-13 front panel switch settings are not contained in the program instructions:

(1) MODE switch: PAM (+).

(2) DATA INPUT: As required to receive IRIG 11 or 12.

(3) CHANNEL RATE: 45 p/sec.

(4) L. E. SENS: 3.

(5) BANDWIDTH: 5.

(6) SAMPLE DELAY: 1.

(7) DISPLAY SELECT: Zero reference.

(8) METER SELECT: Level

(9) GAIN: 0.

(10) LEVEL: 0.

(11) GAIN and LEVEL SERVOS: Activated after obtaining lock on source data.

c. On the Krohn-Hite Mode 3200R-2 Filter, set the LOW PASS/HIGH PASS switch to LOW PASS, and set the cutoff frequency to 360 Hz.

Note

Switch settings for paragraphs 2.4.14.3 are nominal settings for normal signal conditions. If required, these settings may be altered to achieve a stable lock condition. Advise TIC of any switch setting changes.

2.4.15 CONTINGENCY FM REMOTING

Note

Contingency FM/FM biomed remoting may be required for an indefinite period at any time during the mission, especially during or directly after an EVA. If this requirement occurs, TIC will instruct the station to output one of the EKG parameters CJ0060, CJ0061, CJ0062, or GT 9999 on the IRIG 6 on a specified V/D line. No attempt will be made to calibrate IRIG 6. IRIG 7 will be calibrated on TIC's cue, and after the calibrations are complete, TIC will request the station to output the selected biomed parameter on IRIG 7 and delete output from IRIG 6. If equipment conflicts occur, biomed remoting will take precedence over engineering contingency FM/FM remoting data requirements.

2.4.15.1 General. MCC may request FM remoting of certain PCM parameters via voice/data lines for evaluation. This request may be for remoting in real time (during a pass) or postpass playback either alone or in conjunction with the special telemetry codes in para 2.4.2.

2.4.15.2 Premission Setup. To provide minimum real-time configuration changes the following equipment will be set up and maintained throughout the mission:

a. The spare or lowest priority decom (S-IVB) will be used to remote the data. DAC's 11-17 will be patched on the mission DSDU board (A2) to open TLM function patch panel tielines.

b. DAC's 11-17 will be patched to a spare IRIG mixer on VCO's 1-7 respectively. DAC-18 will be used in the event of a DAC failure.

2.4.15.3 Data Identification. TIC/NST TM will provide the station with:

a. Vehicle and data source.

b. Decom addresses and associated DAC's.

c. For CSM HBR and LBR CTE seconds and minutes are program assigned to DAC No. 11 and No. 12 in address 4252 and 4253 for HBR, address 7365 and 7366 for LBR. These parameters will normally be remoted. In the event an alternate parameter is required to be remoted on these DAC's, the DAC assignments in address 4252/4253 or 7365/7366 must be cleared.

d. The rev number and CTE/MET time if the data is to be taken from a prerecorded tape, and the bit rate if it is to be played back at an accelerated speed.

e. The V/D net to be used for remoting.

f. Special telemetry procedures code, if applicable.

g. The biomed parameters to be remoted.

2.4.15.4 Remoting Checkout (Prime Method)

a. The station will manually program the proper DAC outputs on the Spare/S-IVB decom (computer transfer inhibited). The applicable mixer output will be routed through the Sonex discriminators and input to the MK-200 pen recorders.

b. The manual simulator will be input to the decom and the common syllable stepped 0-25-50-75-100 percent and verified on the recorder.

c. The mixer output level to the wireroom will be verified with the wire tech.

d. Upon completion, either the tape or real-time data required will be patched to the decom and the OPSR notified of station readiness.

e. On cue from TIC/NST TLM the station will output calibration points from the manual simulator of 50, 0, 25, 50, 75, and 100 percent of all parameters simultaneously. At the 0 percent value, DAC's 11 through 17 will be consecutively inverted and restored to normal prior to proceeding with the step calibrations.

Note

To provide parameter ID when using MSFTP-1 decoms, DAC's 11 through 17 outputs are to be consecutively disconnected from the VCO inputs at the 100 percent value and restored to normal prior to proceeding with the step calibrations. MSFTP-1 decom is to be used only in the event that a MSFTP-2 cannot be made available.

f. On cue from TIC the station will input and remote the stored program simulator containing the appropriate mission program.

2.4.15.5 Remoting Checkout (Secondary Method)

a. Same as para 2.4.15.4a.

b. Assure proper DAC CAL, DAC to VCO interface, and VCO calibration.

c. Same as para 2.4.15.4c.

d. Same as para 2.4.15.4d.

e. On cue from TIC/NST TLM the station will provide 0 to 100 percent calibrations using the DAC calibrator. With the DAC's at the 0-percent value, each DAC will be consecutively inverted and restored to normal. Five point cals will be provided using the VCO/MIXER calibrator.

f. Same as para 2.4.15.4f.

2.5 DEMODULATION EQUIPMENT

2.5.1 BIOMED REMOTING

2.5.1.1 General. All stations will configure to remote biomed data. Biomed data received at the station as a portion of the PCM (CSM) data will be transferred to the computer via the associated PCM decom. Biomed data received at the station via FM IRIG channels (LM/LCRU EVCS) will be discriminated and input to the AMQ as described in paragraph 2.5.3. The EVCS biomed will be downlinked via the LM and/or LCRU depending on mission phase. The subcarrier assignments will be the same regardless of the downlink being used (table 2-10).

Table 2-10. Biomed Subcarrier Assignments

IRIG Channel	Meas. No.	Assignment	Downlink
9	GT8224	EVCS No. 2 EKG	LM/LCRU
10	GT8124	EVCS No. 1 EKG	LM/LCRU
13	GT9999	LM EKG.	LM

2.5.1.2 Biomed Monitoring. If available, a Brush recorder may be interfaced to the PCM decoms to monitor the CSM downlink biomed data. Table 2-11 gives the biomed DAC assignments. A second Brush recorder may be used in the RF TLM area, to monitor LM/EVCS biomed, if available. The recorder may be interfaced to the biomed DAC discriminator outputs. Refer to table 2-11 for biomed measurement assignments.

2.5.1.3 Interface Testing

a. All stations will be tested according to the appropriate H-count.

b. CADFISS TLM will be the test conductor.

c. When the transmitting configuration includes an LM or EVA parameter, use track 11 of the biomed plus-time tape, containing the period of IRIG VCO 9, 10, and 13, as the LM/EVA data source with the tape cued to T+4 minutes.

d. The following subformats will be used :

Mission Phase	Subformat Code
(1) TLC:	
(a) LM not active	456
(b) LM checkout	416
(2) LO:	
(a) LM activation	410
(b) EVA 1, 2, and 3	423
(3) TEC to splash	456

2.5.2 SM-6

The PSK demods will be used to detect the downlink data. The data is downlinked as shown in table 2-1.

2.5.3 AMQ PROCESSING REQUIREMENTS AND INSTRUCTIONS

2.5.3.1 General

a. MIL and BDA will discriminate 5 S-II FM parameters and input them to the AMQ as shown in table 2-12.

b. GDS, HSK, and MAD will route CSM and LM/IU and LCRU receiver AGC's to the AMQ as shown in table 2-12.

c. All stations will discriminate the biomed IRIG subcarriers from the LM and LCRU and input them to the AMQ as shown in table 2-12.

d. All stations will discriminate IRIG channel 13 from the LCRU and input it to the AMQ. The LCRU telemetry consists of two measurements which are time-shared

Table 2-11. Measurement Number Assignments

Position	Type Meas	Vehicle	A-G Link	Meas No.	MSFTP-2 DAC	MSFTP-1 DAC	MSFTP-2 Decom Add	MSFTP-1 Decom Add
LH couch	EKG	CSM	PCM	CJ0060J	07	07	5250	4,36,68,100
CNTR couch	EKG	CSM	PCM	CJ0061J	05	05	5246	2,34,66,98
RH couch	EKG	CSM	PCM	CJ0062J	06	06	5247	3,35,67,99
LH couch	RESP	CSM	PCM	CJ0200R	02	02	4210	61
CNTR couch	RESP	CSM	PCM	CJ0201R	03	03	4212	90
RH couch	RESP	CSM	PCM	CJ0202R	04	04	4213	91
LM	EKG	LM	FM/FM/FM or PM	GT9999				
EVC (No. 1)	EKG	LM/ LCRU	FM/FM/FM or PM	GT8124				
EVC (No. 2)	EKG	LM/ LCRU	FM/FM/FM or PM	GT8224				

Table 2-12. AMQ Parameter Assignments

AMQ Channel	Meas. No.	Downlink/IRIG	Meas. Name
0	NA	NA	Ground/Input
1, 5, 9, 13, 17, 21, 25, 29 33, 37, 41, 45, 49, 53, 57, 61, 69, 73, 77	GT8224	2282.5/2265.5/9	EVC No. 2 EKG
2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78	GT8124	2282.5/2265.5/ 10	EVC No. 1 EKG
3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43, 47, 51, 55, 59, 63, 67, 71, 75, 79	GT9999	2282.5/13	LM EKG
4	D13-201	BF2-12	E1 thrust CH press
8	D13-202	BF2-09	E2 thrust CH press
12	D13-203	BF2-11	E3 thrust CH press
16	D13-204	BF1-05	E4 thrust CH press
20	D13-205	BF1-06	E5 thrust CH press
24	AGC volt	NA	USB rec AGC
28	AGC volt	NA	USB rec AGC
32	RT8000	2265.5/13	LCRU TLM

on a 14.5 kHz FM subcarrier: RT8000-LCRU radiator temperature and LCRU subsystem voltage. The data cycle is 30 seconds with LCRU radiator temperatures on for 10 seconds and LCRU subsystem voltage on for 20 seconds. There is no synchronization code available to split the measurements; therefore, the TLM tech must time each data cycle to determine the proper parameter value. The output of LCRU IRIG channel 13 will be displayed on a stripchart recorder for parameter readout purposes during all times the LCRU is active.

2.5.3.2 S-II, LM and LCRU Parameter Assignments

a. The parameters will be routed through the appropriate standard IRIG discriminator to the AMQ channels. Use standard output filters on the S-II discriminators. For biomed, 35 Hz output filters will be used. The DELAY/AMPLITUDE switch will be in the DELAY position.

b. Refer to table 2-12 for channel assignments.

c. The Vidar calibrator will be used to calibrate the discriminator AMQ setup. The lower band-edge output of the calibrator will result in an AMQ output of 001_8 The upper band-edge output of the calibrator will result in a 376_8 output. Care must be exercised at upper bands so that the AMQ output is adjusted at the point where the transition to 376_8 takes place.

d. Two banks of discriminators containing IRIG's 9, 10, 11, and 12, will be set up. One set will be patched to the LM and one patched to the LCRU USB output. One set will be used for monitoring and the other for data processing (outputs patched to AMQ and DDF-13). Two discriminators will be set to IRIG channel 13. One will be patched to the LM and the other patched to the LCRU USB outputs. These will be permanently patched to the AMQ channels 3 and 32 respectively. The input to the data processing discriminators will be patched to the LM or LCRU as directed by TIC. The input to the monitoring set will be patched to the opposite downlink, to check signal quality (using a scope) prior to patching in the data discriminators. IRIG channel 13 will be monitored on a stripchart recorder.

2.5.3.3 USB AGC Calibration Procedures for the AMQ (GDS, HSK, MAD)

a. The USB receiver AGC that is remoted to MCC via the AMQ will require calibration at least once in a 24-hour period. The details of calibration will be handled by the USB personnel. The AMQ operator will be required to stand by the AMQ and give octal readouts of the calibrator points during calibration periods.

b. AMQ channels (numbers 24 and 28) will be used for remoting the ground station AGC. Prior to running calibrations with USB, use an external precision voltage source to ensure that zero VDC equals 000 octal on the AMQ Output Display, and plus ten VDC equals 377 octal (+0 counts -2 counts).

c. Sonex S45 discriminator channels 5 and 7 will be used to process the wing station receiver AGC. The deviation switch will be set to minus to provide zero VDC at UBE and plus ten VDC at LBE. The Vidar calibrator will be used to initially set up each discriminator.

d. In order to provide a more closely aligned AGC reading between the prime and wing station receivers, the following calibration procedures will be used (refer to section 4 for USB preliminary setup):

(1) Patch the wing receiver designated as CSM through the appropriate discriminator to AMQ channel 24. Have the USB tech adjust the input to the receiver being calibrated to -160 dBm and call out the receiver AGC voltage obtained at this point.

(2) Adjust the applicable discriminator output to obtain the same output voltage called out in step (1) and note the octal reading on the AMQ output display.

(3) Repeat the procedure of steps (1) and (2) with the receiver adjusted to -70 dBm.

(4) Proceed with the receiver calibrations in accordance with the USB requirements.

(5) Place the receiver designated for LM/IU/LCRU on the second discriminator and input to AMQ channel 28. Repeat steps (1) through (4).

(6) Perform steps (1) through (5) with the prime station by inputting the receiver AGC voltage directly to the AMQ input. The USB receiver calibration end limits of -70 and -160 dBm should produce the same relative AMQ output display as observed in steps (2) and (5).

2.5.3.4 Selection of Receiver to be Input to the AMQ

a. During mission support periods the TIC will inform the stations of AGC remoting requirements in accordance with the following combinations:

Remoting Comb.	AMQ 24	Channel 28
1	CSM	LM
2	LCRU	LM
3	CSM	LCRU

Example: "(Sta) , TIC, Request you remote AGC combination 1 at this time (or commencing at ______GET) ".

b. If the station is two-way on the vehicles with system 3 uplinking to the LM and system 2 uplinking to the CSM, the applicable system 2 receiver would be input to AMQ channel 24, and system 3 receiver input to AMQ channel 28.

c. If the station is three-way on either vehicle or both vehicles, the receiver AGC selected for remoting will be from the receiver that is supplying Doppler data to the tracking data processor for the respective vehicle.

2.5.4 DEMODULATION EQUIPMENT PREPASS CHECKLIST

2.5.4.1 Discriminators

a. Sonex S-45. The station readiness test and all prepass calibrations must have been completed.

Unit/Function	Indication/Setting
(1) Power switch (power supply)	ON
(2) Deviation +/-	+
(3) CA/CD	CA
(4) Meter range	As required

b. EMR-210

Unit/Function	Indication/Setting
(1) Power switch	ON
(2) Channel selector	See para 2.5.3.2d
(3) DELAY/AMPLITUDE	DELAY
(4) Output filter	See para 2.4.11.2, 2.5.3.2a
(5) Deviation bandwidth	±7 1/2

c. EMR-229 and 4140

Unit/Function	Indication/Setting
(1) Power switch	ON
(2) Subcarrier channel	See para 2.5.3.3b
(3) DELAY/AMPLITUDE	DELAY
(4) LOCAL/REMOTE	LOCAL (4140 only)

2.5.4.2 Multiplexers

a. EMR-4900

Unit/Function	Indication/Setting
(1) Power switch	ON
(2) Input selector 1-18 and 19-36	NORM
(3) VCO mixer configuration	See table 2-13 through 2-31
(4) All unused VCO's	OFF

b. FMT-500

Unit/Function	Indication/Setting
(1) Power switch	ON
(2) VCO mixer configuration	See tables 2-13 through 2-31
(3) Simulate switch	OFF
(4) Input 1-18 and 19-36	NORM

c. DIC-1/1G

Unit/Function	Indication/Setting
(1) Power switch	ON
(2) Meter, function, and range	As required
(3) Output level (1, 2, and 33)	As required
(4) Operate/calibration switch	OPERATE
(5) VCO mixer configuration	See table 2-20

d. Model 101 AMQ

Unit/Function	Indication/Setting
(1) TEST/OPERATE	OPERATE

Unit/Function	Indication/Setting
(2) LOCAL/REMOTE	LOCAL
(3) SEQ/ADD	SEQ
(4) SYNC/ASYNC	SYNC
(5) Recycle channel	79
(6) Sample rate	
(a) Digi switches	8.0
(b) Multiplier	100
(7) A/D decom data	Variable
(8) Decom address	Variable
(9) Channel address	NA
(10) Advance encode	NA
(11) Data overflow	Extinguished

2.5.4.3 PSK Demods

a. SM-6 Real-time 768 kHz

Unit/Function	Indication/Setting
(1) Loop BW	1
(2) Tracking	10 percent
(3) Subcarrier	7.6800×10^5
(4) BW	1.5×10^5

b. SM-6 Dump 576 kHz

Unit/Function	Indication/Setting
(1) Loop BW	1
(2) Tracking	10 percent
(3) Subcarrier	5.7600×10^5
(4) BW	1.5×10^5

2.6 RECORDERS

2.6.1 GENERAL

The recorder track assignments for required data are contained in tables 2-14 through 2-32.

2.6.1.1 Extraneous Data. All stations may, at their discretion, record extraneous data on open tracks. Tape labels will be annotated to show the type of data recorded and that the data was recorded at station option. Should a requirement for the open track occur, it will have precedence over the station's optional recorded data.

2.6.1.2 Track Failure. If an individual track required for recording becomes inoperative, the recorder tech will immediately patch the data line to an open track or an assigned track not actively recording. Note the GET of switching and notifying NST TLM. This tape, and any subsequent recordings made prior to clearing the fault, will be clearly annotated to show the true data/track content.

2.6.1.3 Cycle Lock/Speed Lock. Cycle lock will be recorded on all M-22 recorders. The output of the M-22 record amplifier may be patched to the FR-1900A recorder if desired.

2.6.1.4 Data Modem Recording. Stations will record the output of the Recorder Interface Adapter installed by EI 4796.

2.6.1.5 Recorded Data Description. Refer to tables 4-4 through 4-7 for descriptions of telemetry data links recorded on magnetic tape tracks.

2.6.1.6 Three-recorder Sequence of Operation

a. Recorder Initiation

(1) At H-2 minutes, start recorders No. 1 and 2.

(2) At H+30 minutes, start recorder No. 3 and stop recorder No. 1.

(3) At H+58 minutes, start recorder No. 1 and stop recorder No. 2 at end-of-reel for a tape change and cleaning.

(4) At H+88 minutes, start recorder No. 2 and stop recorder No. 3.

Note

H-times are provided as a nominal guide only.

b. Recording During Lunar Orbit. During period of lunar occultation prior to LCRU activation, the operating recorders will both be stopped at LOS+2 minutes of the CSM and LM, and started at the earliest expected AOS-2 minutes. The stagger recording sequence will be followed for all phases after TLI.

c. Recorder Failure. If a three-recorder sequence incurs a recorder failure or is called up for playback support during an active support period, the station will operate the remaining two recorders in series.

2.6.1.7 Series Operation. When operating the recorders in series, ensure a one-minute overlap between tapes, alternately running the two recorders. The series recorder tapes will remain on site until duplicate tapes can be made.

2.6.2 85-FOOT STATIONS

2.6.2.1 General. The 85-foot stations will record during all periods of acquisition. Three wideband recorders will be patched redundantly and will become group A recorders. An additional group of two wideband recorders will be patched redundantly and will become the group B recorders. The group A and B designation will be used for track assignment purposes. For real-time recording, group A will be used and operated as described in paragraph 2.6.1.6 at 30 in./sec. Group B will be used for dump recording. Stations will configure one additional recorder as shown in the ALSEP/P&FS NOSP when scheduled to support dual Apollo/ALSEP/P&FS. The configuration of unassigned recorders will be at station option.

2.6.2.2 Recording Identification. Group A tapes will be annotated series 1 and series 2 (see figure 2-11). Group B tapes will be recorded in parallel. One recorded redundant tape will be annotated suffix A and the other suffix B.

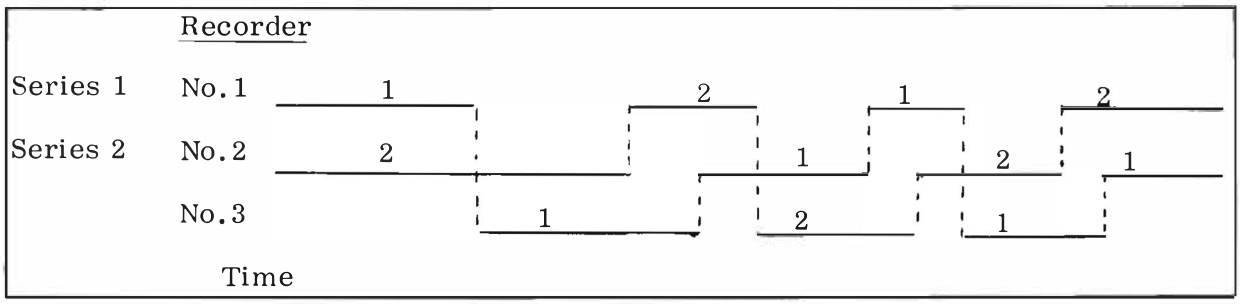


Figure 2-11. Recording Sequence

2.6.2.3 Tape Recorder Track Assignments. The record switching matrices will be pre-programmed with 5 formats, three formats for group A recorders and two formats for group B recorders. The formats to be used during the mission are as follows:

Mission Phase	Format RT		Format DP
Launch to S-IVB/IU battery depletion	A1	and	B1
S-IVB/IU TLM battery depletion to LM impact	A2	and	B1
LM impact to splash	A3	and	B1

Note

B2 format will be patched in accordance with the ALSEP/P&FS NOSP. B recorders will be used for playback purposes.

2.6.2.4 Matrix Switching. When using the matrices in the pre-programmed modes, do not make manual switch changes. Switch to the manual mode to make manual switch changes. Stations may program additional formats at their discretion as long as the recording tracks assigned are not altered.

2.6.3 30-FOOT STATIONS

2.6.3.1 General. Thirty-foot stations will configure recorders as shown in tables 2-14 through 2-33. Stations will configure an additional recorder as shown in the ALSEP/P&FS NOSP whenever scheduled to support dual Apollo/ALSEP/P&FS. The configuration for unassigned recorders is at station option.

2.6.3.2 Liftoff to S-IVB/IU TLM Battery Depletion. Recorders will be configured as shown in tables 2-14 through 2-33.

2.6.3.3 After S-IVB/IU TLM Battery Depletion. After S-IVB/IU TLM battery depletion, all stations will provide two complete sets of MSC data.

a. 30-foot Stations with Four Wideband Recorders. Three MCC recorders will be set up as shown in tables 2-14 through 2-31. The three recorders for Apollo support will operate in accordance with para 2.6.1.6.

b. 30-foot Stations with Five Wideband Recorders. Three recorders will be set up as shown in tables 2-14 through 2-30. The remaining recorders will be operated for dump playback and/or as spare recorders. The three recorders for MCC support will be operated in accordance with para 2.6.1.6.

2.6.3.4 Recorder Operation. Recorders will be operated during all periods of acquisition prior to TLI +3 hours. After TLI +3 hours, 30-foot stations will record only under the following conditions:

a. When scheduled to go two-way on any link.

b. During DSE dumps scheduled by SCM.

c. When scheduled by SCM as a backup to a two-way station.

d. On request from TIC.

e. When supporting S-IVB/IU TLM (record on the Network magnetic tapes until S-IVB/IU TLM battery depletion).

f. During scheduled VLBI support periods.

2.6.3.5 Recording Speeds

a. The three-recorder sequence will be operated at 30 in./sec. except for dump recording.

b. Prior to the three-recorder sequence of operation at 30-foot stations, the MCC recorders will be operated at 30 in./sec except for dumps which will be operated as described in para 2.6.4.3. The MSFC recorders will be operated at 30 in./sec. However, during the launch phase, MIL,BDA, and VAN will operate MSFC recorders at 60 in./sec.

c. Designated recorders for ALSEP/P&FS will be operated in accordance with the ALSEP/P&FS NOSP.

2.6.4 DUMP RECORDING

2.6.4.1 Typical Preparations for Dump Recording. After the FM transmitter has been turned on and the FM signal strength has been confirmed as sufficient for good quality dump data, the TIC will inform the station OPSR that they will start in 30 seconds. The dump may be in two transmissions (LM, and SIM and CSM) with approximately 5 minutes between segments for rewinding the tape aboard the CSM. Tapes used for dump recording can contain more than one dump. The dump tapes should be clearly annotated and include the word "dump" and the dump number assigned by the TIC.

Note

1. Tape speed changes will be clearly annotated on the label as to start and stop times of each speed.

2. The dump recorder speed will be changed only once per tape.

2.6.4.2 Dump Recording at 85-foot Stations. Upon notification of an impending dump, the recorder tech will start both recorders when the TIC announces: "30 seconds to dump modulation." The two group B receivers will be used for dump recording. Dumps will be recorded at the following speeds:

a. 30 in./sec for 1:1 dumps (mode 1, 11 or 13).

b. 120 in./sec for 32:1 dumps (mode 2,3,14 or 15).

c. 120 in./sec for 8:1 dumps (mode 10).

The two group B dump recorders will be operated in parallel for all dumps. If a dump recorder incurs a failure, the station will make duplicate tapes of the dump during the post-support period.

2.6.4.3 Dump Recording at 30-foot Stations

a. General. Dumps will be recorded at 30 in./sec for 1:1 dumps (mode 1,11, and 13), 120 in./sec for 32:1 dumps (modes 2,3,14, and 15), or 120 in./sec for 8:1 dumps (mode 10). After changing to the three-recorder sequence of operation, the three-recorder sequence will be maintained while recording dump data ,and the recording speeds will be changed to 120 in./sec, if required.

b. Dump Recording at 120 in./sec (Three-recorder Sequence). Upon notification of an impending dump, the recorder tech will start the standby recorder at 120 in./sec when TIC announces: "30 seconds to dump modulation." At the same time, the operating recorder with the greatest amount of tape remaining will be changed to 120 in./sec. After the dump recorder has reached operating speed, the tape on the remaining real-time recorder will be run off. This recorder will be configured to continue recording dump or real-time data as required.

c. Dump Recording at 120 in./sec (Two-recorder Sequence). The previous procedure also applies to two recorders operating in series. The standby recorder will be started at 120 in./sec, and the tape on the operating recorder will be run off and reloaded to continue recording the dump if required after the standby recorder is at operating speed.

2.6.5 TIME CODE TRANSLATOR AND DATA PLAYBACK

2.6.5.1 The output of the active wideband magnetic tape recorder track containing the time mixer will be patched to an IRIG discriminator, defined in the receiver configuration tables 2-13 through 2-30. The output of the discriminator will be patched to the Datatron time code translator input. The output of the discriminator will be set to 3 Vpp. When MCC requests data playback, the appropriate wideband recorder must be patched to the discriminator. The 36-bit BCD recorded DIR may be patched directly into the time code translator without using this procedure.

2.6.5.2 During passes, the front panel indicator on the translator should be checked to ensure that it is updated every second and that the time indicated is the actual GMT (minus record/reproduce time). Before the translator output will appear in the 4.8 kb/sec output data, the following conditions must be satisfied:

a. A playback format (FMT) must be selected on the computer (100, 200, 300, or 800 series FMT).

b. The playback bit must be set.

c. The CSM, LM, IU, or S-IVB decom must be in lock.

2.6.6 COMMUNICATIONS RECORDERS

2.6.6.1 Recorder Assignments. Voice communications will be recorded on the following recorders:

a. FR-1100/GS-80: ACN, BDA, CYI, CRO, GDS, GWM, HAW, HSK, MAD, MIL, and TEX.

b. AMP-300: VAN.

2.6.6.2 Recorder Track Assignments and Speeds. Communications recorder track assignments are contained in tables 2-32 and 2-33. Recording speed for the FR-1100/GS-80 and AMP-300 is 1 7/8 in./sec.

2.6.7 ANNOTATIONS AND CALIBRATIONS

2.6.7.1 Nonrecording of Required Data. When required data is not being recorded on its assigned track due to on-station failure, voice annotation will be made and the reason will be given.

2.6.7.2 Prepass and Postpass Calibrations. All prepass and postpass calibrations will be made at 15 in./sec and annotated.

2.6.8 ADDITIONAL INSTRUCTIONS FOR RECORDING VHF LINKS

VHF receiver signal strength will be recorded on magnetic tape as indicated in tables 2-14 through 2-31.

2.6.9 MIXER CONFIGURATION

The configuration for the USB mixer is found in section 4 of this NOSP.

2.6.10 RECORDER CAPABILITIES

Video recorder capabilities and characteristics are listed in STDN No. 502.2.

2.6.11 RECORDER PREPASS CHECKLISTS

2.6.11.1 M-22 Recorders

Note

At the completion of this checklist, all controls should remain at the positions listed herein.

a. Power Controls and Indicators

Unit/Function	Indication/Setting
(1) TRANSPORT POWER/OFF	TRANSPORT POWER
(2) DATA LOCATOR	OFF
(3) SEARCH	OFF
(4) CYCLE LOCK	OFF
(5) SPEED selection switch	Refer to para 2.6.1.6, 2.6.2.1, 2.6.4.3

b. Transport Control Settings

Unit/Function	Indication/Setting
(1) Mount and thread clean new tape.	
(2) MODE control select switch	STOP/STANDBY

Note

Set the recorder to RUN and RECORD modes when required.

c. Electronics

Unit/Function	Indication/Setting
(1) REC/BIAS/REP bias level	0 dB

(2) REC/BIAS/REP amplifier module	REC

(3) Check cycle lock

(4) Match source impedance, never set lower than source impedance.

2.6.11.2 VR-3600

Unit/Function	Indication/Setting
a. MODE select switch	STOP

b. Mount and thread clean new tape.

Note

Activate the recorder to the RUN and RECORD modes when required.

c. BIAS ON/OFF	ON
d. SIG/BIAS monitor meter switch	SIG

e. Match source impedance; never set lower than source impedance.

2.6.11.3 FR-1900A

Unit/Function	Indication/Setting
a. Sync	TAC
b. TRANSPORT MODE	STOP
c. TAPE SPEED	See para 2.6.2.1, 2.6.2.4, 2.6.3.5, 2.6.3.6

2.6.11.4 FR-1100

Unit/Function	Indication/Setting
a. SPEED selector switch	1 7/8 in./sec

b. Mount and thread clean new tape.

Note

Activate the recorder to the DRIVE and RECORD modes when required.

c. Monitor signal presence on timing and annotation tracks.

2.6.11.5 Brush Mk-200

a. Control Panel Switch Settings

Unit/Function	Indication/Setting
(1) Control selector	LOCAL
(2) Chart speed	STOP

Note

Chart speed selection should be changed from STOP to a "mm/sec" position when required.

b. Preamplifier Control

Unit/Function	Indication/Setting
(1) SENSITIVITY per chart line switch	To provide full scale deflection
(2) Verify that the event marker pen is activated by the timing signal.	

2.6.11.6 Brush Event Recorders

Unit/Function	Indication/Setting
a. Chart speed	10 mm/sec
b. REMOTE/LOCAL selector	LOCAL
c. Paper supply	Quantity sufficient for pass

Table 2-13. Recorder Matrix Setup for GDS, HSK, and MAD

TRK	Launch to S-IVB/IU TLM Battery Depletion, Format A1, DSS No. 630	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer prime and cycle lock	Dir
4	2282.5 IU TLM video DP-1B (alt)	FM
5	2287.5 CSM PCM (prime)	FM
6	768 PSK demod out (prime) SM-6	FM
7	2287.5 CSM PCM (alt)	FM
8	2282.5 IU TLM video (prime)	FM
9	768 PSK demod (alt) (SM-6)	FM
10	Blank	FM
11	LM EVCS (alt)	Dir
12	LM EVCS (prime)	Dir
13	36-bit BCD/1 kHz	Dir
14	USB TDP data modem	Dir

TRK	S-IVB/IU TLM Battery Depletion to LM Impact, Format A2, DSS No. 631	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer prime and cycle lock	Dir
4	Blank	FM
5	2287.5 CSM PCM (prime)	FM
6	768 PSK demod out SM-6 (prime)	FM
7	2287.5 MHz CSM PCM (alt)	FM
8	2282.5 LM PCM (prime)	FM
9	768 PSK demod (alt) (SM-6)	FM
10	Blank	FM
11	2265.5/1.25 demod out (LCRU)	Dir
12	LM EVCS (prime)	Dir
13	36-bit BCD/1 kHz	Dir
14	2265.5 baseband (LCRU)	Dir

TRK	LM Impact to Splash, Format A3, DSS No. 632	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer prime and cycle lock	Dir
4	2282.5 P&FS (alt)	FM
5	2287.5 CSM PCM (prime)	FM
6	768 PSK demod out SM-6 (prime)	FM
7	2287.5 MHz PCM (alt)	FM
8	2282.5 P&FS (prime)	FM
9	768 PSK demod (alt) SM-6	FM
10	Blank	FM
11	2265.5/1.25 demod out (LCRU)	Dir
12	Blank	Dir
13	36-bit BCD/1 kHz	Dir
14	Blank	Dir

TRK	Dump, Format B1, DSS No. 637	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer prime and cycle lock	Dir
4	2272.5 LM SØ (prime)	FM
5	2272.5 CSM PCM (prime)	FM
6	576 PSK demod out SM-6 (prime)	FM
7	2272.5 CSM PCM (alt)	FM
8	Blank	FM
9	576 PSK demod out SM-6 (alt)	FM
10	Blank	FM
11	2272.5 voice dump (prime)	Dir
12	Blank	Dir
13	36-bit BCD/1 kHz	Dir
14	2272.5 voice dump (alt)	Dir

Note

Prime/alt refers to USB matrix output lines.

Table 2-13. Recorder Matrix Setup for GDS, HSK, and MAD (cont)

TLM Mixer No. 1	
IRIG	Assignment
15	Voice anno. prime
16	Voice anno. wing
17	CSM CMD ver
G	DTU (HS biomed) out
3, 4, 5 6, 7, 8	USB wing mix 1
	100 kHz ref

TLM Mixer No. 2	
IRIG	Assignment
15	SDT/1 kHz
16	36-bit BCD/1 kHz
17	LM/IU CMD ver
G	DTU (HS TLM) out
3, 4, 5 6, 7, 8	USB wing mix 2

Table 2-14. Telemetry Receiver Configuration for ACN

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config LHC / RHC	Linear 0° / 90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Ships Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
										1	2			
VHF	CSM	A-G			296.8/ 259.7					15				
VHF	CSM	A-G			296.8/ 259.7					16				

Legend

1. Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17, 100-kHz reference.
2. 36-Bit BCD/1 kHz on IRIG 18 USB CMD Ver Rcvr No. 2 on IRIG 17, and SDT/1 kHz on IRIG 16

Table 2-15. Telemetry Recorder Setup for ACN

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	245.3 MHz combined video DP-1	FM
5	2287.5 MHz CSM PCM	FM	5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM	6	258.5 MHz combined video CP-1	FM
7	2272.5 MHz CSM PCM	FM	7	2272.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM	8	2282.5 MHz IU TLM video DP-1B	FM
9	DTU (HS biomed) out/USB TDP data modem	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	2265.5 LCRU baseband	Dir	11	2272.5 MHz dump voice	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir	12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir	14	USB TDP data modem	Dir

TRK	Recorder No. 3 DSS No. 630	Mode	TRK		Mode
1	Patch redundant to and operate		1		
2	simultaneously with recorder No.		2		
3	1 until TLI. After TLI, run		3		
4	serially until OPN authorization		4		
5	for three-recorder sequence		5		
6	operation.		6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

DSS No. 631. After S-IVB/IU TLM battery depletion, change the format to DSS No. 630.

Table 2-16. Telemetry Receiver Configuration for BDA

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config LHC/RHC	Linear 0°/90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Ships Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B		3 / 4	
DP-1	IU	2074	X / X		245.3	300	100			13A	13B		5 / 6	
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B		7 / 8	
(Note 1) BP-1	S-II	2074	X / X		248.6	300	100			8A	8B			1 / 2
(Note 1) BF-1	S-II	2074	X / X		241.5	500	300			10A	10B			3 / 4
(Note 1) BF-2	S-II	2074	X / X		234.0	500	300			9A	9B			5 / 6
										△1	△2			
VHF	CSM	A-G			296.8/ 259.7					15				
VHF	CSM	A-G			296.8/ 259.7					16				

Legend

△1 Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17, 100-kHz reference

△2 36-bit BCD/1 kHz on IRIG 18, USB CMD Ver Rcvr No. 2 on IRIG 17, and SDT/1 kHz on IRIG 16

Note

1. Use A/A 3 to track the S-II to splashdown
2. S-II link required for launch only.
3. AGC S/S recorders will be used during launch phase only.

Table 2-17. Telemetry Recorder Setup for BDA

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	245.3 MHz combined video DP-1	FM
5	2287.5 MHz CSM PCM	FM	5	Blank	FM
6	2272.5 MHz LM SØ dump	FM	6	258.5 MHz combined video CP-1	FM
7	2272.5 CSM PCM	FM	7	Blank	FM
8	2282.5 LM PCM	FM	8	2282.5 MHz IU TLM video DP-1B	FM
9	DTU (HS biomed) out/USB TDP data modem	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	2265.5 LCRU baseband	Dir	11	Blank	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir	12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir	14	USB TDP data modem	Dir

TRK	Recorder No. 3 MSFC DSS No. 632	Mode	TRK	Recorder No. 4 DSS No. 630	Mode
1	TLM mixer No. 1	Dir	1	Patch redundant to recorder	
2	TLM mixer No. 2	Dir	2	No. 1 and run simultaneously.	
3	USB mixer and cycle lock	Dir	3		
4	Blank	FM	4		
5	2287.5 MHz CSM PM	FM	5		
6	Blank	FM	6		
7	2272.5 CSM PCM	FM	7		
8	Blank	FM	8		
9	Blank	FM	9		
10	UHF CMD ver rcvr	FM	10		
11	241.5 MHz pre-D comb. BF-1	Dir	11		
12	248.6 MHz pre-D comb. BP-1	Dir	12		
13	36-bit BCD on 1 kHz	Dir	13		
14	234.0 MHz pre-D BF-2	Dir	14		

Note

DSS No. 631 and 632. After S-IVB/IU TLM battery depletion, change format to DSS No. 630.

Table 2-18. Telemetry Receiver Configuration for CRO

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config LHC / RHC	Linear 0° / 90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
										1	2			
VHF	CSM	A-G			296.8/ 259.7					15				
VHF	CSM	A-G			296.8/ 259.7					16				

Legend

1 Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17, 100-kHz reference.

2 36-Bit BCD/1 kHz on IRIG 18 USB CMD Ver Rcvr No. 2 on IRIG 17, and SDT/1 kHz on IRIG 16

Table 2-19. Telemetry Recorder Setup for CRO

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	245.3 MHz combined video DP-1	FM
5	2287.5 MHz CSM PCM	FM	5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM	6	258.5 MHz combined video CP-1	FM
7	2272.5 MHz CSM PCM	FM	7	2272.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM	8	2282.5 MHz IU TLM video DP-1B	FM
9	DTU (HS biomed) out/USB TDP data modem	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	2265.5 MHz LCRU baseband	Dir	11	2272.5 MHz dump voice	Dir
12	2265.5 MHz LCRU comp(1.25 MHz)	Dir	12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir	14	USB TDP data modem	Dir

TRK	Recorder No. 3 DSS No. 630	Mode	TRK		Mode
1	Patch redundant to and run		1		
2	simultaneously with recorder		2		
3	No. 1 until TLI. After TLI, run		3		
4	serially until OPN authorization		4		
5	for three-recorder sequence		5		
6	operation.		6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

DSS No. 631. After S-IVB/IU TLM battery depletion, change the format to DSS No. 630.

Table 2-20. Telemetry Receiver Configuration for CYI

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config LHC / RHC	Linear 0° / 90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Ships Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
										△1	△2			
VHF	CSM	A-G			296.8/ 259.7					15				
VHF	CSM	A-G			296.8/ 259.7					16				

Legend

△1 Voice annotation on IRIG18, USB CMD ver rcvr No. 1 on IRIG 17, 100-kHz reference.

△2 36-bit BCD/1 kHz on IRIG18, and SDT/1 kHz on IRIG16. USB CMD ver rcvr No. 2 on IRIG 17.

Table 2-21. Telemetry Recorder Setup for CYI

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir
5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM
7	2272.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM
9	DTU (HS biomed) out/USB TDP data modem	FM
10	Blank	FM
11	2265.5 MHz LCRU baseband	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir
13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir

TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	245.3 combined video DP-1	FM
5	2287.5 MHz CSM PCM	FM
6	258.5 MHz combined video CP-1	FM
7	2272.5 MHz CSM PCM	FM
8	2282.5 IU TLM video DP-1B	FM
9	USB CMD ver rcvr No. 2	FM
10	USB CMD ver rcvr No. 1	FM
11	2272.5 MHz dump voice	Dir
12	250.7 combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir
14	USB TDP data modem	Dir

TRK	Recorder No. 3 (WB) MCC DSS No. 630	Mode
1	Patch redundant to and operate	
2	simultaneously with recorder	
3	No. 1 until TLI. After TLI, run	
4	serially until OPN authorization	
5	for three-recorder sequence	
6	operation.	
7		
8		
9		
10		
11		
12		
13		
14		

TRK		Mode
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Note

DSS No. 631. After S-IVB/IU TLM battery depletion, change the format to DSS No. 630.

Table 2-22. Telemetry Receiver Configuration for GWM

Link	Vehicle	Rcvr Type	Ant/Rcvr Config: LHC / RHC	No. Linear: 0° / 90°	Rcvr Front Panel Setting: Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships: AGC	Ships: Demod Type	AGC S/S Mixers: Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr: Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
	ARIA	**2074**	X /		**249.5**	**300**	**100**							
	ARIA	**2074**	/ X		**249.5**	100	**100**						2 / 1	
										△1	△2			
VHF	CSM	**A-G**			296.8/ 259.7					15				
VHF	CSM	**A-G**			296.8/ 259.7					16				

Legend

△1 Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17, 100-kHz reference.

△2 36-Bit BCD/1 kHz on IRIG 18, USB CMD Ver Rcvr No. 2 on IRIG 17, and SDT/1 kHz on IRIG 16

Table 2-23. Telemetry Recorder Setup for GWM

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir
5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM
7	2272.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM
9	DTU (HS biomed) out/USB TDP data modem	FM
10	Blank	FM
11	2265.5 MHz LCRU baseband	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir
13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir

TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	245.3 MHz combined video DP-1	FM
5	2287.5 CSM PCM	FM
6	258.5 MHz combined video CP-1	FM
7	Blank	FM
8	2282.5 MHz IU TLM video DP-1B	FM
9	USB CMD ver rcvr No. 2	FM
10	USB CMD ver rcvr No. 1	FM
11	Blank	Dir
12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir
14	USB TDP data modem	Dir

TRK	Recorder No. 3 (WB) MCC DSS No. 630	Mode
1	Patch redundant to and operate	
2	simultaneously with recorder	
3	No. 1 until TLI. After TLI, run	
4	serially until OPN authorization	
5	for three-recorder	
6	sequence operation.	
7		
8		
9		
10		
11		
12		
13		
14		

TRK		Mode
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Note

1. DSS No. 630, Track 2. When supporting ARIA, track 2 will be 249.5 ARIA pre-D, direct.
2. DSS No. 631. After S-IVB/IU battery depletion, change format to DSS No. 630.

Table 2-24, Telemetry Receiver Configuration for HAW

Link	Vehicle	Rcvr Type	Ant/Rcvr Config LHC	Ant/Rcvr Config RHC	No. Linear 0°	No. Linear 90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Ships Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X	X			250.7	500	300			12A	12B			
DP-1	IU	2074	X	X			245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X	X			258.5	300	100			14A	14B			
DE-1	IU	1071		X			250.7	500	300							
DP-1	IU	1071		X			245.3	300	100							
CP-1	S-IVB	1071		X			258.5	300	100							
	ARIA	2074	X	X			249.5	100	100						2 / 1	
	ARIA	2074	X	X			249.5	300	100							
												△1	△2			
VHF	CSM	A-G					296.8/ 259.7					15				
VHF	CSM	A-G					296.8/ 259.7					16				

Legend

△1 Voice annotation on IRIG 18 USB CMD Ver Rcvr on IRIG 17, 100-kHz reference.

△2 36-bit BCD/1 kHz on IRIG 18. USB CMD Ver Rcvr No. 2 on IRIG 17 and SDT/ 1 kHz on IRIG 16.

Table 2-25. Telemetry Recorder Setup for HAW

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	245.3 MHz combined video DP-1	FM
5	2287.5 MHz CSM PCM	FM	5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM	6	258.5 MHz combined video CP-1	FM
7	2272.5 MHz CSM PCM	FM	7	Blank	FM
8	2282.5 MHz LM PCM	FM	8	2282.5 MHz IU TLM Video DP-1B	FM
9	DTU (HSbiomed) out/USB TDP data modem	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	2265.5 MHz LCRU baseband	Dir	11	Blank	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir	12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir	14	USB TDP data modem	Dir

TRK	Recorder No. 3 (WB) MCC DSS No. 630	Mode	TRK		Mode
1	Patch redundant to and run		1		
2	simultaneously with recorder		2		
3	No. 1 until TLI. After TLI,		3		
4	run serially until OPN authori-		4		
5	zation for three-recorder		5		
6	sequence operation.		6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

1. DSS No. 630. When supporting ARIA, Track 2 will be 249.5 ARIA Pre-D direct.

2. DSS No. 631. After S-IVB/IU TLM battery depletion, change the format to DSS No. 630.

Table 2-26. Telemetry Receiver Configuration for MIL

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config: LHC / RHC	Linear: 0° / 90°	Rcvr Front Panel Setting: Freq (MHz)	Rcvr Front Panel Setting: IF/Comb BW (kHz)	Rcvr Front Panel Setting: Video Fil BW (kHz)	Ships: AGC	Ships: Demod Type	AGC S/S Mixers: Mix 1 IRIG	AGC S/S Mixers: Mix 2 IRIG	AGC S/S Mixers: Mix 3 IRIG	AGC S/S Strip Chart Rcdr: Rcdr 1 Pen No.	AGC S/S Strip Chart Rcdr: Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300				12(2)			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
BF-1(1)	S-II	2074	X / X		241.5	500	300				10(2)			
BF-2(1)	S-II	2074	X / X		234.0	500	300				9(2)			
BP-1(1)	S-II	2074	X / X		248.6	300	100			11A	11B			
AF-1(1)	S-IC	2074	X / X		256.2	500	300				7(2)			
AP-1(1)	S-IC	2074	X / X		244.3	300	100			8A	8B			
VHF (1)	CSM	A-G			259.7					10				
										$\triangle$1	$\triangle$2			
VHF	CSM	A-G			296.8/ 259.7					15				
VHF	CSM	A-G			296.8/ 259.7					16				

Legend

$\triangle$1 Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17 100 kHz reference.

$\triangle$2 36-Bit BCD/1 kHz on IRIG 18, USB CMD Ver Rcvr No. 2 on IRIG 17, and SDT/1 kHz on IRIG 16

Note

(1) Required for launch only.

(2) Combined AGC.

Table 2-27. Telemetry Recorder Setup for MIL

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	249.1 pre-D	Dir
5	2287.5 MHz CSM PCM	FM	5	245.3 MHz combined video DP-1	FM
6	2272.5 MHz LM SØ dump/2287.5 MHz CSM PCM (SDDS FM output)	FM	6	258.5 MHz combined video CP-1	FM
7	2272.5 MHz CSM PCM	FM	7	Blank	FM
8	2282.5 MHz LM PCM	FM	8	2282.5 MHz IU TLM video DP-1B	FM
9	DTU (HS biomed) out/USB TDP data modem	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	2265.5 MHz LCRU baseband	Dir	11	249.1 pre-D	Dir
12	2265.5 MHz LCRU composite (1.25 MHz)	Dir	12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir	14	USB TDP data modem	Dir

TRK	Recorder No. 3 (WB) MSFC DSS No. 632	Mode	TRK	Recorder No. 4 (WB) MCC DSS No. 630	Mode
1	TLM mixer No. 1	Dir	1	Patch redundant to and operate	
2	TLM mixer No. 2	Dir	2	simultaneously with recorder	
3	USB mixer and cycle lock	Dir	3	No. 1 through TLI. After TLI,	
4	256.2 MHz pre-D comb. AF-1	Dir	4	run serially until OPN authori-	
5	244.3 MHz pre-D comb. AP-1	Dir	5	zation for three-recorder	
6	Blank	FM	6	sequence operation.	
7	2287.5 MHz CSM TLM video	FM	7		
8	Blank	FM	8		
9	Blank	FM	9		
10	Blank	FM	10		
11	241.5 MHz pre-D comb. BF-1	Dir	11		
12	234.0 MHz pre-D comb. BF-2	Dir	12		
13	36-bit BCD on 1 kHz	Dir	13		
14	248.6 MHz pre-D comb. BP-1	Dir	14		

Note

1. DSS No. 630, Track 11. 2287.5 CSM PCM (SDDS FM output) is required for launch through insertion phase only.

2. DSS No. 631. After S-IVB/IU TLM battery depletion, change DSS No. to 630.

3. DSS No. 632. After launch, patch recorder No. 3 redundant to and run in series with recorder No. 2 from TLI until S-IVB/IU TLM battery depletion, and change DSS No. to 631. After S-IVB/ IU TLM battery depletion, change format to DSS No. 630.

Table 2-28. Telemetry Receiver Configuration for TEX

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config LHC/RHC	Linear 0°/90°	Rcvr Front Panel Setting Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships AGC	Ships Demod Type	AGC S/S Mixers Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	2074	X / X		250.7	500	300			12A	12B			
DP-1	IU	2074	X / X		245.3	300	100			13A	13B			
CP-1	S-IVB	2074	X / X		258.5	300	100			14A	14B			
										1	2			
VHF	CSM	A-G			296.8/259.7								A1	
VHF	CSM	A-G			296.8/259.7								A2	

Legend

1. Voice annotation on IRIG 18, USB CMD Ver Rcvr No. 1 on IRIG 17, 100-kHz reference.
2. 36-Bit BCD/1 kHz on IRIG 18, and SDT/1 kHz on IRIG 16, USB CMD ver rcvr No. 2 on IRIG 17.

Note

VHF A/G SS will be recorded on strip-chart recorder in Acq Aid Building.

Table 2-29. Telemetry Recorder Setup for TEX

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir
5	2287.5 MHz CSM PCM	FM
6	2272.5 MHz LM SØ dump	FM
7	2272.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM
9	DTU (HS biomed) out/USB TDP data modem	FM
10	Blank	FM
11	2265.5 MHz LCRU baseband	Dir
12	2265.5 MHz LCRU comp (1.25 MHz)	Dir
13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz dump voice	Dir

TRK	Recorder No. 2 (WB) MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir
4	245.3 MHz combined video DP-1	FM
5	Blank	FM
6	258.5 MHz combined video CP-1	FM
7	Blank	FM
8	2282.5 MHz IU TLM video DP-1B	FM
9	USB CMD ver rcvr No. 2	FM
10	USB CMD ver rcvr No. 1	FM
11	Blank	Dir
12	250.7 MHz combined video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir
14	USB TDP data modem	Dir

TRK	Recorder No. 3 (WB) MCC DSS No. 630	Mode
1	Patch redundant to and operate	
2	simultaneously with recorder	
3	No. 1 through TLI. After TLI,	
4	run serially until OPN authori-	
5	zation for three-recorder se-	
6	quence operation.	
7		
8		
9		
10		
11		
12		
13		
14		

TRK		Mode
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Note

DSS No. 631. After S-IVB/IU TLM battery depletion, change the format to DSS No. 630.

Table 2-30. Telemetry Receiver Configuration for VAN

Link	Vehicle	Rcvr Type	Ant/Rcvr No. Config: LHC / RHC	Linear: 0° / 90°	Rcvr Front Panel Setting: Freq (MHz)	IF/Comb BW (kHz)	Video Fil BW (kHz)	Ships: AGC	Ships: Demod Type	AGC S/S Mixers: Mix 1 IRIG	Mix 2 IRIG	Mix 3 IRIG	AGC S/S Strip Chart Rcdr: Rcdr 1 Pen No.	Rcdr 2 Pen No.
DF-1	IU	TR-102	X / X		250.7	500	250	100	C	12A	12B			
DP-1	IU	TR-102	X / X		245.3	300	100	100	B	13A	13B			
CP-1	S-IVB	TR-102	X / X		258.5	300	100	100	B	14A	14B			
(Note 1) EM	CSM	TR-102	X / X		243.0	10	6.25	1	A					
2) CS-1														
VHF	CSM	A/G (XCVR #1)			296.8/ 259.7					15				
VHF	CSM	A/G (XCVR #2)			296.8/ 259.7					16				
VHF	CSM	A/G (XCVR #3)			296.8/ 259.7					9				
VHF	CSM	A/G (XCVR #4)			296.8/ 259.7					10				
										△1	△2			

Legend

△1 Voice annotation on IRIG 18, 100-kHz ref; USB CMD ver rcvr No. 1 on IRIG 17.

△2 36-bit BCD/1kHz on IRIG 18, and SDT/1kHz on IRIG 16; USB CMD ver rcvr No. 2 on IRIG 17.

Note

1. EM-emergency hand held transmitter.

Table 2-31. Telemetry Recorder Setup for VAN

TRK	Recorder No. 1 (WB) MCC DSS No. 630	Mode	TRK	Recorder No. 2 MSFC DSS No. 631	Mode
1	TLM mixer No. 1	Dir	1	TLM mixer No. 1	Dir
2	TLM mixer No. 2	Dir	2	TLM mixer No. 2	Dir
3	USB mixer and cycle lock	Dir	3	USB mixer and cycle lock	Dir
4	LM EKG/EVCS composite	Dir	4	245.3 MHz comb. video DP-1	FM
5	2287.5 MHz CSM PCM	FM	5	Blank	FM
6	2272.5 MHz LM SØ dump	FM	6	258.5-MHz comb. video CP-1	FM
7	2272.5 MHz CSM PCM	FM	7	2287.5 MHz CSM PCM	FM
8	2282.5 MHz LM PCM	FM	8	2282.5 IU TLM video DP-1B	FM
9	DTU (HS biomed) out	FM	9	USB CMD ver rcvr No. 2	FM
10	Blank	FM	10	USB CMD ver rcvr No. 1	FM
11	Blank	Dir	11	243.0 MHz CSM voice	Dir
12	Blank	Dir	12	250.7 MHz ccmb. video DF-1	Dir
13	36-bit BCD on 1 kHz	Dir	13	36-bit BCD on 1 kHz	Dir
14	2272.5 MHz voice dump	Dir	14	CDP data modem	Dir

TRK	Recorder No. 3 MCC DSS No. 630	Mode	TRK		Mode
1	Patch redundant to recorder		1		
2	No. 1 and run simultaneously.		2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

DSS No. 631. After S-IVB/IU TLM battery depletion, change format to DSS No. 630.

Table 2-32. Station Spacecraft Communications Recorder Setup for Launch, Earth Orbit to VHF Termination and Transearth Coast to Splashdown

TRK	GDS HSK MAD DSS No. 330 FR 1100/GS-80	Mode	TRK	30-Foot USB Stations (Land & Ship) FR 1100/GS-80 & Amp-300 DSS No. 330	Mode
1	Voice annotation/sta conf loop		1	Voice annotation/sta conf loop	
2	Net 1		2	Net 1	
3	Net 2		3	Net 2	
4	Net 3		4	Net 3	
5	VHF A-G loop (GDS only) LM AM key		5	VHF A-G loop	
6	USB CSM A-G loop		6	USB CSM A-G loop	
7	VHF A-G rcvr No. 1 output (GDS)/ USB LM A-G loop.		7	VHF A-G rcvr No. 1 output	
8	USB CSM voice ver rcvr		8	USB voice ver rcvr No. 1	
9	36-bit BCD on 1 kHz		9	36-bit BCD on 1 kHz	
10	USB LM voice ver rcvr		10	USB voice ver rcvr No. 2	
11	USB CSM backup voice		11	USB CSM backup voice	
12	VHF A-G rcvr No. 2 output (GDS)/ USB LM backup voice		12	Radar coordination	
13	OPSR loop		13	OPSR loop	
14	VHF A/G 2 loop		14	VHF A-G rcvr No. 2 output	
TRK	Recorder No. 3	Mode	TRK	Recorder No. 4	Mode
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

1. If a contingency occurs, BDA will record LM backup voice on track 1.

2. Voice annotation will be made when the ComTech announces he has switched to the 210-ft station.

Table 2-33. Station Spacecraft Communications Recorder Setup for VHF Termination to LM Impact

TRK	GDS HSK MAD DSS No. 330 FR 1100/GF-80	Mode	TRK	30-foot USB Stations (Land & Ship) FR 1100/GS-80 & AMP-300 DSS No. 330	Mode
1	Voice annotation/sta conf loop		1	Voice annotation	
2	Net 1		2	Net 1	
3	Net 2		3	Net 2	
4	Net 3		4	Net 3	
5	LM AM key		5	Radar coordination	
6	USB CSM A-G loop		6	USB CSM A-G loop	
7	USB LM A-G loop		7	USB LM A-G loop	
8	USB CSM voice ver rcvr		8	USB voice ver rcvr No. 1	
9	36-bit BCD on 1 kHz		9	36-bit BCD on 1 kHz	
10	USB LM voice ver rcvr		10	USB voice ver rcvr No. 2	
11	USB CSM backup voice		11	USB CSM backup voice	
12	USB LM backup voice		12	USB LM backup voice	
13	OPSR loop		13	OPSR loop	
14	CSM AM key		14	Station conference loop	
TRK	Recorder No. 3	Mode	TRK	Recorder No. 4	Mode
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		

Note

1. If a contingency occurs, BDA will record LM backup voice on track 1.

2. Voice annotation will be made when the ComTech announces he has switched to the 210-ft station.

Table 2-34. Tape Track Assignments

TRK	AS-512 Apollo Confidence Tape	Mode
1	36-bit BCD/1 kHz	Dir
2	LM (HBR) HSR 51.2 kb/sec	FM
3	CSM LBR (1.6 kb/sec)	FM
4	SM-6/EMOD/CSM LM/HLBR MLBR	FM
5	CSM HBR (51.2 kb/sec)	FM
6	CSM/LM FMT 30 discrete	FM
7	S-IVB	FM
8	LM HBR	FM
9	IU	FM
10	LMLBR (1.6 kb/sec)	FM
11	S-II (72.0 kb/sec)	FM
12	CSM (HBR) HSR 51.2 kb/sec	FM
13	SM-6	FM
14	Blank	Dir

TRK	AS-512 Val Tape	Mode
1	Blank	Dir
2	SM-6	FM
3	SIC	FM
4	CSM LBR	FM
5	CSM HLBR	FM
6	CSM HBR 51.2 kb/sec/biomed	FM
7	S-IVB	FM
8	IU	FM
9	LM HBR	FM
10	LM HLBR	FM
11	LB LBR	FM
12	LM MLBR	FM
13	S-II	FM
14	Blank	Dir

TRK	AS-512 Biomed/Plus-time Tape	Mode
1	Blank	Dir
2	NASA 36-bit BCD/1 khz	Dir
3	LM FM composite	Dir
4	Blank	Dir
5	SM-6	FM
6	CSM HBR 51.2 kb/sec PCM/biomed	FM
7	LM HBR	FM
8	Simulator seq 56	FM
9	CSM 51.2 kb/sec contingency biomed data	FM
10	Blank	FM
11	FM biomed composite CADFISS	Dir
12	17-kHz cycle lock	Dir
13	LCRU FM composite	Dir
14	Blank	Dir

TRK		Mode
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

2.7 DISPLAYS

2.7.1 GENERAL

The following paragraphs contain the information necessary for configuring the MIL abort interface console recorder, MK200 recorder, station operator consoles, and the BDA range safety console.

Note

> To assist in filling out mission logs, all stations may, at their option, record decom sync status on available recorders.

2.7.2 MIL STATION CONFIGURATION

Table 2-35 contains MK 200 setup and table 2-36 contains information for configuring the abort interface console.

2.7.3 BDA RANGE SAFETY SUPPORT

The S-II, S-IVB, and IU data as given in table 2-37 will be displayed on event lights, pen recorders, and display meters at the range safety officer's console. DAC and stores listed in table 2-37 are in the MSFTP-2 decom programs.

2.7.4 STATION OPERATIONS CONTROLLER CONSOLE CONFIGURATION

2.7.4.1 The SOCC will have the following display labels:

PCM-1 SOLID	PCM-2 SOLID	PCM-3 SOLID	PCM-4 SOLID
CSM-HBR	CSM-HBR	CSM-HBR	CSM-HBR
CSM-LBR	CSM-LBR	CSM-LBR	CSM-LBR
S-IVB	S-IVB	S-IVB	S-IVB
IU	IU	IU	IU
LM-HBR	LM-HBR	LM-HBR	LM-HBR
LM-LBR	LM-LBR	LM-LBR	LM-LBR
S-II	S-II	S-II	S-II
CSM-HLBRD	CSM-HLBRD	CSM-HLBRD	CSM-HLBRD
LM-MLBRD	LM-MLBRD	LM-MLBRD	LM-MLBRD
LM-HLBRD	LM-HLBRD	LM-HLBRD	LM-HLBRD

Table 2-35. MIL Analog Recorder (MK 200) DSS No. 558

Pen (Analog)*	Measurement No.
1	Decom No. 1 sync
2	Decom No. 2 sync
3	Decom No. 3 sync
4	Decom No. 4 sync
5	Spare
6	Spare
7	Spare
8	Spare
*Recorder speed will be set to 2 mm/sec.	

Table 2-36. MIL Abort Interface Unit (AIU) Recorder (MK 200) DSS No. 256

Analog Pen No.	Measurement	
1	B-3	2 out of 3 logic for abort B command
2	B-2	
3	B-1	
4	A-1	2 out of 3 logic for abort A command
5	A-2	
6	A-3	
7	B verified	
8	A verified	
Event Pen No.	**Measurement**	
1	SDT/slow code	
2	CSM/SM sep A (CD0023X)	
3	CSM/SM sep B (CD0024X)	
4	Abort A	
5	Abort B	
6	Interrupt status	
7	Test/operate	
8	Spare	
9	SDT/slow code	
Note DSS No. 256 recorder speed will be 2 mm/sec.		

Table 2-37. BDA Range Safety Requirements

Freq (MHz)	Link	Meas. No.	IRIG	DAC	Store	Display Requirement MK 200 8 Ch	RSO Mtr	RSO Evt	ESE Mtr	ESE Evt	MK 200 8 Ch	MK 200 Evt	Display Label
245.3	DP-1	R4-602		56		2	8		12				S-IVB PITCH
245.3	DP-1	R5-602		57		1	7		11				S-IVB YAW
245.3	DP-1	R6-602		58		3	9		13				S-IVB ROLL
234.0	BF-2	D13-201	12				1		3		4		E1 THRUST CHAMBER PRESSURE
234.0	BF-2	D13-202	9				2		4		5		E2 THRUST CHAMBER PRESSURE
234.0	BF-2	D13-203	11						5		6		E3 THRUST CHAMBER PRESSURE
241.5	BF-1	D13-204	5						6		7		E4 THRUST CHAMBER PRESSURE
241.5	BF-1	D13-205	6						7		8		E5 THRUST CHAMBER PRESSURE
248.6	BP-1	M55-221		53			3		8				RCVR 1 SIG STR LO
248.6	BP-1	M56-221		52			4		9				RCVR 2 SIG STR LO
248.6	BP-1	K231-203			114			9					E3 MAINSTAGE OK PRESS A
248.6	BP-1	K285-203			115			10					E3 MAINSTAGE OK DEPRESS A
258.5	CP-1	D1-401		59		4	10		16				PRESS - THRUST CHAMB
258.5	CP-1	K14-401			41			16		5			MAINSTAGE OK PRESS SW1
258.5	CP-1	K157-401			117			20		6			MAINSTAGE OK PRESS SW2
258.5	CP-1	K158-401			118			17		11			MAINSTAGE OK PRESS SW1 DEPRESS
258.5	CP-1	K159-401			119			21		12			MAINSTAGE OK PRESS SW2 DEPRESS
258.5	CP-1	N57-411		55		5	11		17				R/S RCVR 1 SIG STR
258.5	CP-1	N62-411		54		6	12		18				R/S RCVR 2 SIG STR
245.3	DP-1	K75-602			112			11		2		4	EDS OR MANUAL CUTOFF
248.6	BP-1	K421-207			113			12		3		5	EDS ALL ENGS CUTOFF
2287.5	CSM	CD-0023X			23			24		7			CM-SM SEP RELAY CLOSE A
2287.5	CSM	CD-0024X			24			25		8			CM-SM SEP RELAY CLOSE B
245.3	DP-1	K84-602			110			7		1		3	EDS EXCESSIVE PITCH OR YAW RATE
245.3	DP-1	M30-411		50		7	5		14				VOLT RNG SFTY 1
245.3	DP-1	M31-411		51		8	6		15				VOLT RNG SFTY 2

Note

Any changes to meters and event displays on this table may be coordinated between the BDA OPSR and the RSO after the RSO arrives at BDA.

2.7.4.2 Station operators console patching instructions follow:

Format	Assignment TB 1, 2, 3, & 4		Console Light No.	Bit Configuration of Format ID (octal)
CSM-HBR	3B	to	1	00110 (06)
CSM-LBR	1C	to	2	00111 (07)
S-IVB	2C**	to	3	01000 (10)
IU	3C**	to	4	01001 (11)
LM-HBR	1D	to	5	01010 (12)
CSM-HBRD	1I or 1J*			11001 (31)
LM-LBR	2D	to	6	01011 (13)
CSM-LBRD	1E			01101 (15)
S-II**	3E**	to	7	01111 (17)
CSM-HLBRD	3I or 3J*	to	8	11011 (33)
LM-MLBRD	3A	to	9	00011 (03)
LM-HLBRD	2B	to	10	00101 (05)

*Patch to J only if TB-1 is not designated with the letter I.

**After S-IVB/IU LOS repatch lights 3, 4, and 7 as required to display ALSEP, SM-6, and P&FS.

Format	Assignment	Bit Configuration of Format ID (octal)
PSE	1H	10110 (26)
ASE	2H	10111 (27)
SM-6 RT	1F	10000 (20)
SM-6 DUMP	1H	10110 (26)
P&FS	3H	11000 (30)
LSP	1I or 1J*	11001 (31)

*Patch to J only if TB-1 is not designated with the letter I.

2.7.4.3 IOCC Patching

a. General. This section details mandatory (MSC station status words) and station-required patching for the Integrated Operations Control Console (IOCC). Figures 2-12 and 2-13 are logic figures which provide the composite bits for each word. Caution must be exercised as there is a difference between 30-foot and 85-foot station patching. Where noted, console event location is at the discretion of the station. Refer to decoder output patching where indicated.

b. 18J1 Patching

J1 Pin	Signal	Patch From	Patch To*	Location	IOCC Events *	Mandatory Patching	
						30-ft	85-ft
A	USB Audio Exciter 1	C9I			X		
B	Rtn	C10J					
C	UHF Audio System 1	C11J			X		
D	Rtn	C11J					
E	USB Audio Exciter 2	C12I			X		
F	Rtn	C13J					
G	UHF Audio System 2	C14J			X		
H	Rtn	C14I					
J	LM Voice Verify	C15J			X		
K	Rtn	C16J					
L	CSM Voice Verify	C17I			X		
M	Rtn	C17J					
N		C18I					
P		C19I					
R		C19J					
S		C20J					

*Console event location is at station discretion.

c. 18J3 Patching (refer to decoder output patching)

J3 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching 30-ft	Mandatory Patching 85-ft
A	PCM TLM Lock 1	C9E	*		X		
B	Rtn	C28E	Gray	Common			
C	Decoder 1 Bit 1	C9G	C26H	P1-B			
D	Decoder 1 Bit 2	C11G	C27H	-C			
E	Decoder 1 Bit 4	C10E	C27G	-D			
F	Decoder 1 Bit 8	C11H	C28G	-E			
G	Decoder 1 Bit 16	C12F	C29H	-F			
H	Rtn Decoder	C17H	C29G	-G			
J		C14H					
K		C15H					
L		C16G					
M		C17G					
N		C18H					
P	PCM TLM Lock 2	C13H	*		X		
R	Rtn	C29F	Gray	Common			
S	Decoder 2 Bit 1	C13E	C22J	P2-B			
T	Decoder 2 Bit 2	C15G	C22I	-C			
U	Decoder 2 Bit 4	C15E	C23I	-D			
V	Decoder 2 Bit 8	C16H	C24J	-E			
W	Decoder 2 Bit 16	C16F	C24I	-F			
X	Rtn Decoder	C30H	C25I	-G			
Y		C18G					
Z		C19G					
a		C19H					
b		C20G					
c		C21G					
d	PCM TLM Lock 3	C18H	*				
e	Rtn	C31E	Gray	Common			
f	Decoder 3 Bit 1	C18F	C27I	P3-B			
g	Decoder 3 Bit 2	C20H	C27J	-C			
h	Decoder 3 Bit 4	C20F	C28J	-D			
i	Decoder 3 Bit 8	C21F	C29I	-E			
j	Decoder 3 Bit 16	C21H	C30I	-F			
k	Rtn Decoder	C30G	C30J	-G			
m		C22H					
n		C22G					
p		C23G					
d		C24H					
r		C24G					
s	PCM TLM Lock 4	C23F	*		X		
t	Rtn	C32G	Gray	Common			
u	Decoder 4 Bit 1	C23H	C22L	P4-B			
v	Decoder 4 Bit 2	C25F	C22K	-C			
w	Decoder 4 Bit 4	C25H	C23K	-D			
x	Decoder 4 Bit 8	C26E	C24L	-E			
y	Decoder 4 Bit 16	C26G	C24K	-F			
z	Rtn Decoder	C32F	C25K	-G			

*Console event location is at station discretion.

J3 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
AA		C10G					
BB	PAM 1 Lock	C9H	*		X		
CC	Rtn	C10H					
DD	PAM 2 Lock	C12G	*		X		
EE	Rtn	C12H					
FF	PAM 3 Lock	C13G	*		X		
GG	Rtn	C14G					
HH							

*Console event location is at station discretion.

d. IOCC Decoder Output and Power Patching

(1) Output Patching

Taper Pin	Signal	Patch From	Patch To*	IOCC* Event	Indicator
B3	Decoder 1	C21Y		X	CM HI
C1	Decoder 1	C22Z		X	CM LO
C2	Decoder 1	C22Y		X	ALS/SM-D
C3	Decoder 1	C23Y		X	SM-RT
D1	Decoder 1	C24Z		X	LM HI
D2	Decoder 1	C24Y		X	LM LO
E3	Decoder 1	C25Y		X	P&FS
J3	Decoder 1	C26Z		X	CM 1.6 @ 51.2
A3	Decoder 1	C27Z		X	LM 1.6 @ 12.8
B2	Decoder 1	C27Y		X	LM 1.6 @ 51.2
J1	Decoder 1	C28Y		X	CSM-HBRD
E1	Decoder 1	C29Z		X	CSM-LBRD
B3	Decoder 2	C10CC		X	CM HI
C1	Decoder 2	C9DD		X	CM LO
C2	Decoder 2	C10DD		X	ALS/SM-D
C3	Decoder 2	C12CC		X	SM-RT
D1	Decoder 2	C12DD		X	LM HI
D2	Decoder 2	C13CC		X	LM LO
E3	Decoder 2	C14CC		X	P&FS
J3	Decoder 2	C14DD		X	CM 1.6 @ 51.2
A3	Decoder 2	C15DD		X	LM 1.6 @ 12.8
B3	Decoder 2	C16CC		X	LM 1.6 @ 51.2
J1	Decoder 2	C29Y		X	CSM-HBRD
E1	Decoder 2	C31Z		X	CSM-LBRD
B3	Decoder 3	C17CC		X	CM HI
C1	Decoder 3	C17DD		X	CM LO
C2	Decoder 3	C30CC		X	ALS/SM-D
C3	Decoder 3	C18CC		X	SM-RT
D1	Decoder 3	C19CC		X	LM HI
D2	Decoder 3	C19DD		X	LM LO
E3	Decoder 3	C20CC		X	P&FS
J3	Decoder 3	C21CC		X	CM 1.6 @ 51.2
A3	Decoder 3	C22DD		X	LM 1.6 @ 12.8
B2	Decoder 3	C22CC		X	LM 1.6 @ 51.2
J1	Decoder 3	C32Z		X	CSM-HBRD
E1	Decoder 3	C31Y		X	CSM-LBRD
B3	Decoder 4	C23CC		X	CM HI
C1	Decoder 4	C24DD		X	CM LO
C2	Decoder 4	C24CC		X	ALS/SM-D
C3	Decoder 4	C25CC		X	SM RT
D1	Decoder 4	C26DD		X	LM HI
D2	Decoder 4	C27DD		X	LM LO
E3	Decoder 4	C27CC		X	P&FS
J3	Decoder 4	C28CC		X	CM 1.6 @ 51.2
A3	Decoder 4	C29DD		X	LM 1.6 @ 12.8
B3	Decoder 4	C29CC		X	LM 1.6 @ 51.2
J1	Decoder 4	C32CC		X	CSM-HBRD
E1	Decoder 4	C32BB		X	CSM-LBRD

*Console event location is at station discretion.

(2) Power Patching

Signal	Patch From	Patch To	IOCC Event	Indicator
Decoder 1	C25G	Red	P1-A	Power 28V
Decoder 2	C21I	Red	P2-A	Power 28V
Decoder 3	C26J	Red	P3-A	Power 28V
Decoder 4	C21K	Red	P4-A	Power 28V

e. 18J5 Patching

J5 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching 30-ft	Mandatory Patching 85-ft
A	Rcvr 1 PM Lock	C9A	C2LL	K300-13		X	X
B	Rtn	C10B	Gray	Common		X	X
C	Normal Mod No. 1	C11B	C3S	K278-13		X	X
D	Rcvr 2 PM Lock	C11A	C4DD	K301-13		X	X
E	Rtn	C12A	Gray	Common		X	X
F	Rtn (C, J, M, PP)	C13B	Gray	Common		X	X
G	Rcvr 3 PM Lock	C14B	C4Z	K302-13		X	X
H	Rtn	C14A	Gray	Common		X	X
J	Norm Mod No. 2	C15B	C1E	K285-13		X	X
K	Rcvr 4 PM Lock	C16A	C1AA	K303-13		X	X
L	Rtn	C17A	Gray	Common		X	X
M	Range Mod No. 2	C17B			X		
N	MK1 ON/OFF 1	C18A	C4H	K283-13		X	X
P	MK1 ON/OFF 2	C19A	C7B	K290-13		X	X
R	Rtn	C19B	Gray	Common		X	X
S	Sys 1 XTAL 1/3	C20A	A4K	K3-13		X	X
T	Sys 2 XTAL 2/4	C21A	A3N	K4-13		X	X
U	Rtn	C22B	Gray	Common		X	X
V	Rcvr 1 XTAL 1/4	C22A	C7Y	K304-13		X	X
W	Rcvr 2 XTAL 1/4	C23A	C6Z	K305-13		X	X
X	Rcvr 3 XTAL 1/4	C24B	C5FF	K306-13		X	X
Y	Rcvr 4 XTAL 1/4	C24A	C6JJ	K307-13		X	X
Z	Rtn	C25A	Gray	Common		X	X
a	LCRU Sys 1	C26B	B17D	K141-13		X	X
b	LCRU Sys 2	C27A	B25D	K159-13		X	X
c	Rtn	C27B	Gray	Common		X	X
d		C28B					
e		C29A					
f	Acq Ant Trk	C30A			X		
g	Rtn	C30B			X		
h	Auto Trk	C31B			X		
i	Rtn	C32A			X		
j	Prog Trk	C9B			X		
k	Rtn	C9C			X		
n	Rtn	C10A	Gray	Common		X	X
q	Rtn	C12B	Gray	Common		X	X
r	Range Ex 1	C13D	C2U	K281-13		X	X
s	Rtn	C13A	Gray	Common		X	X
t	Voice Ex 1	C15C	B18E	K140-13		X	X
			B17C	K141-12		X	X
u	Rtn	C15A	Gray	Common		X	X
v	CMD Ex 1	C16D	C4K	K279-13		X	X
w	Rtn	C16B	Gray	Common		X	X
x	Emer Voice Ex 1	C18D	B10T	K115-13		X	X
y	Rtn	C18B	Gray	Common		X	X
z	Radiating Ex 1	C20D	C2T	K277-13		X	X
AA	Rtn	C20B	Gray	Common		X	X
BB	Range Ex 2	C21B	C5J	K288-13		X	X

J5 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
CC	Rtn	C21D	Gray	Common		X	X
DD	Voice Ex 2	C23B	B26E	K158-13		X	X
			B25C	K159-12		X	X
EE	Rtn	C23D	Gray	Common		X	X
FF	CMD Ex 2	C25B	C7C	K286-13		X	X
GG	Rtn	C25D	Gray	Common		X	X
HH	Emer Voice Ex 2	C26A	B10H	K117-13		X	X
JJ	Rtn	C26C	Gray	Common		X	X
KK	Radiating Ex 2	C28A	C4D	K284-13		X	X
LL	Rtn	C28D	Gray	Common		X	X
MM	Slave Trk	C29B			X		
NN	Rtn	C30D					
PP	Range Mod 1	C31A			X		

f. 18J7 Patching (85-ft Station - GDS)

J7 Pin	Signal	Patch From	Patch To *	Location*	IOCC Events
A	PM-TM (SDDS-5)	C9J			X
B	Rtn	C9K			
C	FM-TM (SDDS-5)	C11K			X
D	Rtn	C10I			
E	PM Voice (SDDS-5)	C11L			X
F	Rtn	C12J			
G	FM Voice (SDDS-5)	C13L			X
H	Rtn	C13I			
J					
K					
L					
M					
N					
P					
R					
S					
T					
U					
V					
W					
X					
Y					
Z					
a					
b					
c					
d					
e					
f					
g					
h					
j					

*Console event location is at station discretion.

g. 18J7 Patching (30-foot Stations)

J7 Pin	Signal	Patch From	Patch To *	IOCC Event*
A	Acq Aid 1 EL Auto	C9J		
B	Rtn	C9K		
C	Acq Aid 1 AZ Auto	C11K		
D	Rtn	C10I		
E	Acq Aid 1 Slaved	C11I		
F	Rtn	C12J		
G	1 TLM Link 1	C13L		
H	Rtn	C13I		
J	1 TLM Link 2	C15K		
K	Rtn	C15I		
L	Acq Aid 2 EL Auto	C16L		
M	Rtn	C16J		
N	Acq Aid 2 AZ Auto	C18L		
P	Rtn	C18J		
R	Acq Aid 2 Slaved	C20L		
S	Rtn	C20J		
T	2 TLM Link 1	C21J		
U	Rtn	C21L		
V	2 TLM Link 2	C23J		
W	Rtn	C23L		
X	UHF Carrier On	C25J		
Y	Rtn	C25L		
Z				
a				
b				
c				
d				
e				
f				
g				
h				
j				

*Console event location is at station discretion.

h. 18J8 Patching

J8 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
A	Rcvr 5 PM Lock	C10C	D7E	K255-13			X
B	Rtn	C9D	Gray	Common			X
C	Normal Mod 3	C10D	D3S	K242-13			X
D	Rcvr 6 PM Lock	C12C	D5M	K256-13			X
E	Rtn	C12D	Gray	Common			X
F	Rtn (C, J, M, k)	C13C	Gray	Common			X
G	Rcvr 7 PM Lock	C14C	D5S	K257-13			X
H	Rtn	C14D	Gray	Common			X
J	Normal Mod 4	C15D	D1E	K249-13			X
K	Rcvr 8 PM Lock	C16C	D8R	K258-13			X
L	Rtn	C17C	Gray	Common			X
M	Range Mod 4	C17D			X		
N	Range Ex 3	C18C	D2U	K245-13			X
P	Rtn	C19C	Gray	Common			X
R	Voice Ex 3	C19D	B18AA	K212-13			X
			B17Y	K213-12			X
S	LCRU Sys 3	C20C	B17Z	K213-13			X
T	CMD Ex 3	C21C	D4K	K243-13			X
U	Rtn	C22D	Gray	Common			X
V	Emer Voice 3	C22C	B9I	K118-13			X
W	Rtn (R,S,V)	C23C	Gray	Common			X
X	Radiating Ex 3	C24D	D2T	K241-13			X
Y	Rtn	C24C	Gray	Common			X
Z	Range Ex 4	C25C	D5J	K252-13			X
a	Rtn	C26D	Gray	Common			X
b	Voice Ex 4	C27D	B26AA	K230-13			X
			B25Y	K231-12			X
c	LCRU Sys 4	C27C	B25Z	K231-13			X
d	CMD Ex 4	C28C	D7C	K250-13			X
e	Rtn	C29D	Gray	Common			X
f	Emer Voice 4	C29C	B10U	K 119-3			X
g	Rtn (b, c, f)	C31D	Gray	Common			X
h	Radiating Ex 4	C32D	D4D	K248-13			X
i	Rtn	C31C	Gray	Common			X
j		C9E					
k	Range Mod 3	C10F			X		
m	MK 1 ON/OFF 3	C11F	D4H	K247-13			X
n	MK 1 ON/OFF 4	C11E	D7B	K254-13			X
p	Rtn	C12E	Gray	Common			X
q	Sys 3 XTAL 1/3	C13F	A7C	K7-13			X
r	Sys 4 XTAL 2/4	C14F	A7B	K8-13			X
s	Rtn	C14E	Gray	Common			X
t	Rcvr 5 XTAL 1/4	C15F	D2NN	K259-13			X
u	Rcvr 6 XTAL 1/4	C16E	D3MM	K260-13			X
v	Rcvr 7 XTAL 1/4	C17E	D4GG	K261-13			X
w	Rcvr 8 XTAL 1/4	C17F	D3CC	K262-13			X
x	Rtn	C18E	Gray	Common			X
y	Acq Ant Trk	C19E			X		

J8 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
z	Rtn	C19F					
AA	Auto Trk	C20E			X		
BB	Rtn	C21E					
CC	Prog Trk	C22F			X		
DD	Rtn	C22E					
EE	Valid Range 3	C23E			X		
FF	Rtn	C24F	Gray	Common			X
GG	Valid Range 4	C24E			X		
HH	Rtn	C25E	Gray	Common			X

i. 18J9 Patching

J9 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
A	UHF Sys 1 Radiate	C10K			X		
B	Rtn	C9L					
C	UHF Sys 2 Radiate	C10L			X		
D	Rtn	C12K					
E	USB Select	C12L			X		
F	Rtn	C13K					
G	UHF Select	C14K			X		
H	Safe S4-1C	C14L					
J		C15L					
K	Safe S4-2C	C16K					
L	Safe Rtn S4-1NC	C17K					
M		C17L	Red	28 Vdc		X	X
N	Safe Light S4-G	C18K	B24S	K150-13		X	X
P	Oper Rtn S4-H	C19K					
R		C19L					
S		C20K					

j. 18J15 Patching

J15 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patch	
						30 ft	85 ft
A	PM TM 1	C9S			X		
B	Rtn	C10T					
C	FM TM 1	C11T			X		
D	Rtn	C11S					
E	PM V 1	C12S			X		
F	Rtn	C13T					
G	PM TM 3	C14T			X		
H	Rtn	C14S					
J	FM TM 3	C15T			X		
K	Rtn	C16S					
L	PM V 3	C17S			X		
M	Rtn	C17T					
N	FM V 3	C18S			X		
P	Rtn	C19S					
R	PM TM 4	C19T			X		
S	Rtn	C20S					
T	PM V 2	C21S			X		
U	Rtn	C22T					
V	FM V 2	C22S			X		
W	Rtn	C23S					
X	PM TM 2	C24T			X		
Y	Rtn	C24S					
Z	FM TM 2	C25S			X		
a	Rtn	C26T					
b	FM TM 4	C27S			X		
c	Rtn	C27T					
d	PM V 4	C28T			X		
e	Rtn	C29S					
f	FM V4	C30S			X		
g	Rtn	C30T					
h	CSM/LM Rtn	C31T	Gray	Common		X	X
i	FM V1	C9T			X		
j	Rtn	C9U					
k	CSM PM V	C11U	C3MM	K296-13		X	X
m	CSM PM TM	C10S	C4GG	K297-13		X	X
n	CSM FM V	C11V			X		
p	CSM FM TM	C12T	C2PP	K299-13		X	X
q	LM PM V	C13V	C5M	K292-13		X	X
r	LM PM TM	C13S	C5S	K293-13		X	X
s	LM FM V	C15U	C8R	K294-13		X	X
t	LM FM TM	C15S	C2NN	K295-13		X	X

k. 18J16 Patching

(1) Normal Patching

J16 Pin	Signal	Patch From	Patch To*	Location	IOCC Events	Mandatory Patch 30-ft	Mandatory Patch 85-ft
1	Mode II F/C	C16V			X		
2	Mode I F/C	C16T			X		
3	Mode I M&O	C18V			X		
4	MAP O'ride on	C18T			X		
5	MAP O'ride off	C20V			X		
6	LD Enable	C20T			X		
7	LD Disable	C21T			X		
8	UHF Good	C21V			X		
9	UHF Bad	C23T			X		
10	CSM Sys TSTD	C23V			X		
11	Rtn (J16-1)	C25T					
12	Rtn (J16-2)	C25V					
13	Rtn (J16-3)	C26S					
14	Rtn (J16-4)	C26U					
15	Rtn (J16-5)	C28S					
16	Rtn (J16-6)	C28V					
17	Rtn (J16-7)	C29T					
18	Rtn (J16-8)	C30V					
19	Rtn (J16-9)	C31S					
20	Rtn (J16-10)	C30U					
21		C32U					
22	L/S TSTD	C10U			X		
23	CSM Good	C9V			X		
24	CSM Bad	C10V			X		
25	L/S Good	C12U			X		
26	L/S Bad	C12V			X		
27	CSM FM TM Lock	C13U	C1PP	K299-5 (2-0)		X	X
28	CSM PM TM Lock	C14U	C1FF	K297-5 (2-1)		X	X
29	LCRU 124 kHz Lock	C14V	B27B	K159-5 (2-2)		X	**
			B19B	K141-5 (2-2)		X	
30	LM PRN	C15V	A4J	K3-7 (2-13)		X	**
			A3H	K4-3 (2-13)		X	
31	LM 30 kHz (Voice)	C16U	A3L	K3-6 (2-14)		X	**
			A1H	K4-2 (2-14)		X	
32	LM 70 kHz (SUBC)	C17U	A2I	K3-5 (2-15)		X	**
			A2G	K4-1 (2-15)		X	
33	Rtn (J16-22)	C17V					
34	Rtn (J16-23)	C18U					
35	Rtn (J16-24)	C19U					
36	Rtn (J16-25)	C19V					
37	Rtn (J16-26)	C20U					

*Console event location (Pins 1-26) is at station discretion.
**Requires special patching; refer to tables 2-38 through 2-41.

J16 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patch 30-ft	Mandatory Patch 85-ft
38	Rtn (J16-27)	C21U	C1NN	K299-9		X	X
39	Rtn (J16-28)	C22V	C1GG	K297-9		X	X
40	Rtn (J16-29)	C22U	B27D	K157-9		X	X
			B19D	K139-9		X	X
			B19Z	K211-9			X
			B27Z	K229-9			X
41	Rtn (J16-30)	C23U	A3S	K1-12		X	X
			A4D	K5-12			X
42	Rtn (J16-31)	C24V	A1P	K1-11		X	X
			A1E	K5-11			X
43	Rtn (J16-32)	C24U	A4T	K1-10		X	X
			A3C	K5-10			X
49	P&FS 32.768 kHz	C29V	B22S	K148-9(2-18)		X	X
			B22MM	K220-9(2-18)			X
53	786 kHz (SIM)	C9W	B23L	K147-9(2-22)		X	X
			B23HH	K219-9(2-22)			X
54	576 kHz (SIM)	C10X	B21H	K143-9(2-23)		X	X
			B21DD	K215-9(2-23)			X
55	UDB Status	C11X	B22V	K150-9		X	X
56	CSM PM Voice	C11W	C3JJ	K296-5(2-3)		X	X
57	CSM PM Carrier Lock	C12W	C6Y	K304-5(2-4)		X	X
			C6CC	K305-5(2-4)		X	**
			C8GG	K306-5(2-4)		X	
			C8JJ	K307-5(2-4)		X	
60	Rtn (J16-49)	C14W	B21S	K148-5		X	**
64	Rtn (J16-53)	C17X	B21L	K147-5		X	**
65	Rtn (J16-54)	C18W	B21I	K143-5		X	**
66	Rtn (J16-55)	C19W	B24R	K150-1		X	X
67	Rtn (J16-56)	C19X	C3KK	K296-9		X	X
68	Rtn (J16-57)	C20W	C2AA	K302-9		X	X
			C3X	K303-9		X	X
			D7R	K257-9			X
			D6U	K258-9			X
			D24B	Multiple to D24A (see J16-87)		X	X
70	CSM PRN	C22X	A3I	K3-3 (2-5)		X	**
			A1L	K4-7 (2-5)		X	
71	CSM 30 kHz	C22W	A1I	K3-2 (2-6)		X	**
			A3P	K4-6 (2-6)		X	
72	CSM 70 kHz	C23W	A4I	K3-1 (2-7)		X	**
			A4E	K4-5 (2-7)		X	
73	LM FM TM Lock	C24X	C3NN	K295-5 (2-8)		X	X
74	LM PM TM Lock	C24W	C7T	K293-5 (2-9)		X	X
75	LM FM Voice Lock	C25W	C8V	K294-5 (2-10)		X	X
76	LM PM Voice Lock	C26X	C7P	K292-5 (2-11)		X	X
77	LM PM Carrier Lock	C27W	C8AA	K304-1 (2-12)		X	**
			C8DD	K305-1 (2-12)		X	
			C6HH	K306-1 (2-12)		X	
			C6LL	K307-1 (2-12)		X	

**Requires Special Patching; refer to tables 2-38 through 2-41.

J16 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patch	
						30-ft	85-ft
80	Rtn (J16-70)	C29W	A4N	K2-12		X	X
			A7J	K9-12			X
81	Rtn (J16-71)	C30W	A3V	K2-11		X	X
			A8K	K9-11			X
82	Rtn (J16-72)	C30X	A1T	K2-10		X	X
			A8J	K9-10			X
83	Rtn (J16-73)	C9X	C4NN	K295-9		X	X
84	Rtn (J16-74)	C9Y	C7R	K293-9		X	X
85	Rtn (J16-75)	C11Y	C6U	K294-9		X	X
86	Rtn (J16-76)	C10W	C5N	K292-9		X	X
87	Rtn (J16-77)	C11Z	C4CC	K301-9		X	X
			C1JJ	K300-9			X
			D8G	K255-9			X
			D5N	K256-9			X
			D24A	Multiple to D24B		X	
				(see J16-68)			X

(2) Special Patching. Special 18-J16 patching is required at 85-foot stations only. Refer to tables 2-38 through 2-41 for special patching instructions. The two types of diode patch cords used to make the mandatory patches are as follows:

(a) PN 166910. **A three-legged diode patch cord. The cathode of two diodes are tied together in one common plug and the anode of each diode goes to one plug.**

(b) PN 166909. **A five-legged diode patch cord. The cathode of two diodes are tied together in one common plug and the anode of each diode goes to two plugs.**

Table 2-38. **Special Patching Using Patch Cords PN 166909**

J16 Pin	Signal	Cathode Plug Patch to	Diode	Anode Plug Patch to	Location
30	LM PRN (2-13)	C15V	CR1-1	A4J	K3-7
			CR1-2	A3H	K4-3
			CR2-1	A6E	K7-7
			CR2-2	A6B	K8-3
31	LM 30 kHz (Voice) (2-14)	C16U	CR1-1	A3L	K3-6
			CR1-2	A1H	K4-2
			CR2-1	A6C	K7-6
			CR2-2	A8A	K8-2
32	LM 70 kHz (Subc) (2-15)	C17U	CR1-1	A2I	K3-5
			CR1-2	A2G	K4-1
			CR2-1	A7G	K7-5
			CR2-2	A7I	K8-1
70	CSM PRN (2-5)	C22X	CR1-1	A3I	K3-3
			CR1-2	A1L	K4-7
			CR2-1	A8G	K7-3
			CR2-2	A8D	K8-7
71	CSM 30 kHz (Voice) (2-6)	C22W	CR1-1	A1I	K3-2
			CR1-2	A3P	K4-6
			CR2-1	A8E	K7-2
			CR2-2	A8B	K8-6
72	CSM 70 kHz (Subc) (2-7)	C23W	CR1-1	A4I	K3-1
			CR1-2	A4E	K4-5
			CR2-1	A5E	K7-1
			CR2-2	A5I	K8-5

Table 2-39. **Special Patching Using Patch Cords PN 166910**

J16 Pin	Signal	Cathode Plug Patch To	Diode	Anode Plug Patch To	Location
60	Return (J16-49)	C14W	CR1	B21S	K148-5
			CR2	B21MM	K220-5
64	Return (J16-53)	C17X	CR1	B21L	K147-5
			CR2	B21HH	K219-5
65	Return (J16-54)	C18W	CR1	B21I	K143-5
			CR2	B21EE	K215-5
57	CSM PM CARRIER LK	C12W	CR1	D28B	D28B already common to D29A
			CR2	D30A	D30A already common to D30B
77	LM PM CARRIER LK	C27W	CR1	D25A	D25A already common to D26B
			CR2	D27A	D27A already common to D27B

Table 2-40. **Special Patching Using a Common Squid Patch Cord**

Signal	Patch from	Patch to	Location
Multiple	D29A	C6Y	K304-5
		C6CC	K305-5
		C8GG	K306-5
		C8JJ	K307-5
Multiple	D30B	D3NN	K259-5
		D3JJ	K260-5
		D1FF	K261-5
		D1CC	K262-5
Multiple	D26B	C8AA	K304-1
		C8DD	K305-1
		C6HH	K306-1
		C6LL	K307-1
Multiple	D27B	D1LL	K259-1
		D1II	K260-1
		D3EE	K261-1
		D3AA	K262-1

Table 2-41. **J16 Patch Connections (85-foot)**

Cathode Plug Patch From	Diode	Anode Plug Patch To	Location
B26JJ	CR1	B19B	K141-5
	CR2	B27B	K159-5
B28JJ	CR1	B19X	K213-5
	CR2	B27X	K231-5

Note

Patch C14V to B26II with a normal patch cord. Put a dummy plug in B28KK. C14V is 18J16 pin 29 (LCRU 124 kHz lock) bit 2-2. B26II is tied internally to B26JJ, B28JJ, and B28KK.

l. 18J22 Patching

J22 Pin	Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
						30-ft	85-ft
A	SCI Data 576 kHz	C9AA	B21E	K143-13		X	X
C		C11BB	B23I	K143-12		X	X
D		C11AA	B22J	K143-8		X	X
E	SCI Data 768 kHz	C12AA	B23F	K147-13		X	X
G		C14BB	B22F	K147-12		X	X
H		C14AA	B22G	K147-8		X	X
J	P&FS 32.768 kHz	C15BB	B21M	K148-13		X	X
L		C17AA	B22H	K148-12		X	X
M		C17BB	B21P	K148-8		X	X
N	SCI Data 576 kHz	C18AA	B21AA	K215-13			X
R		C19BB	B23EE	K215-12			X
S		C20AA	B22FF	K215-8			X
U	SCI Data 768 kHz	C22BB	B23BB	K219-13			X
W		C23AA	B22BB	K219-12			X
X		C24BB	B22CC	K219-8			X
Y	P&FS 32.768 kHz	C24AA	B21II	K220-13			X
a		C26BB	B22DD	K220-12			X
b		C27AA	B21KK	K220-8			X

m. Interrelay Patching

Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
					30-ft	85-ft
K1-6	A3T	C1K	K279-9		X	X
		B12S	K115-9		X	X
K1-7	A3R	C3F	K280-9		X	X
K1-8	A4S	C1T	K281-9		X	X
K1-13	A2T	C3N	K278-5		X	X
		B20H	K139-13		X	X
K2-6	A1U	C5C	K286-9		X	X
		B9L	K117-9		X	X
K2-7	A1S	C6F	K287-9		X	X
K2-8	A2M	C8J	K288-9		X	X
K2-13	A2U	C1A	K285-5		X	X
		B28H	K157-13		X	X
K3-9	A4H	C1J	K279-5		X	X
		B11S	K115-5		X	X
K3-10	A1K	C1G	K280-5		X	X
K3-11	A1J	C2F	K283-5		X	X
K4-9	A2F	C6C	K286-5		X	X
		B12J	K117-5		X	X
K4-10	A1M	C6G	K287-5		X	X
K4-11	A3M	C8B	K290-5		X	X
K139-5	B20D	B19A	K141-9		X	X
K141-4	B17A	C3G	K280-13		X	X
K157-5	B28D	B27A	K159-9		X	X
K159-4	B25A	C6D	K287-13		X	X
K277-5	C3T	C3P	K278-9		X	X
K277-9	C4T	Gray	Common		X	X
K281-5	C1U	C4G	K283-9		X	X
K284-5	C2C	C3B	K285-9		X	X
K284-9	C2E	Gray	Common		X	X
K288-5	C8K	C8C	K290-9		X	X
K300-5	C3LL	C5Y	K304-9		X	X
K301-5	C2BB	C6BB	K305-9		X	X
K302-5	C2Y	C8FF	K306-9		X	X
K303-5	C1W	C6KK	K307-9		X	X
K5-6	A1F	D1K	K243-9			X
		B12B	K118-9			X
K5-7	A3B	D3F	K244-9			X
K5-8	A3D	D1T	K245-9			X
K5-13	A4C	D3N	K242-5			X
		B20DD	K211-13			X
K7-9	A5F	D1J	K243-5			X
		B12A	K118-5			X
K7-10	A5C	D1G	K244-5			X
K7-11	A8F	D2F	K247-5			X
K8-9	A6J	D6C	K250-5			X
		B9T	K119-5			X
K8-10	A8C	D6G	K251-5			X

Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
					30-ft	85-ft
K8-11	A6A	D8B	K254-5			X
K9-6	A6I	D5C	K250-9			X
		B9S	K119-9			X
K9-7	A5K	D6F	K251-9			X
K9-8	A7K	D8J	K252-9			X
K9-13	A5J	D1A	K249-5			X
		B28DD	K229-13			X
K211-5	B20Z	B19W	K213-9			X
K213-4	B17W	D3G	K244-13			X
K229-5	B28Z	B27W	K231-9			X
K231-4	B25W	D6D	K251-13			X
K241-5	D3T	D3P	K242-9			X
K241-9	D4T	Gray	Common			X
K245-5	D1U	D4G	K242-9			X
K248-5	D2C	D3B	K249-9			X
K248-9	D2E	Gray	Common			X
K252-5	D8K					X
K255-5	D6E	D4NN	K259-9			X
K256-5	D7P	D3KK	K260-9			X
K257-5	D7T	D1GG	K261-9			X
K258-5	D8V	D3BB	K262-9			X

n. Other Required IOCC Patching

Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
					30-ft	85-ft
Common	Gray	D26EE	18J14-7		X	X
		D25HH	18J14-8		X	X
		D25FF	18J14-10		X	X
		D23HH	18J14-11		X	X
		D23FF	18J14-12		X	X
28 Volts	Red	D30HH	18J14-1		X	X
		D29FF	18J14-2		X	X
		D28HH	18J14-3		X	X
		D28EE	18J14-4		X	X
		D26GG	18J14-5		X	X

Signal	Patch From	Patch To	Location	IOCC Events	Mandatory Patching	
					30-ft	85-ft
Common	Gray	D13F	18A5 DS1	X		
		D20E	18A5 DS11	X		
		D27F	18A5 DS21	X		
		D10E	18A5 DS31	X		
		D18F	18A5 DS41	X		
Common	Gray	D13G	18A6 DS1	X		
		D20G	18A6 DS11	X		
		D27G	18A6 DS21	X		
		D11I	18A6 DS31	X		
		D19I	18A6 DS41	X		
Common	Gray	D13N	18A8 DS1	X		
		D20M	18A8 DS11	X		
		D27N	18A8 DS21	X		
		D10M	18A8 DS31	X		
		D18N	18A8 DS41	X		
Common	Gray	D10P	18A9 DS1	X		
		D19R	18A9 DS11	X		
		D29P	19A9 DS21	X		
		D17S	18A9 DS31	X		
Common	Gray	D12P	19A4 DS1	X		
		D20T	19A4 DS11	X		
		D28V	19A4 DS21	X		
		D12U	19A4 DS31	X		
		D19U	19A4 DS41	X		
28 Volts	Red	D26G	18A5 DS1-DS10	X		
		D28E	18A5 DS11-DS20	X		
		D28H	18A5 DS21-DS30	X		
		D29F	18A5 DS31-DS40	X		
		D30H	18A5 DS41-DS50	X		
28 Volts	Red	D26J	18A6 DS1-DS10	X		
		D27I	18A6 DS11-DS20	X		
		D27J	18A6 DS21-DS30	X		
		D28I	18A6 DS31-DS40	X		
		D29I	18A6 DS41-DS50	X		
28 Volts	Red	D26P	18A8 DS1-DS10	X		
		D28M	18A8 DS11-DS20	X		
		D28R	18A8 DS21-DS30	X		
		D29N	18A8 DS31-DS40	X		
		D30R	18A8 DS41-DS50	X		
28 Volts	Red	D27S	18A9	X		
		D27T	18A9	X		
		D28T	18A9	X		
		D29S	18A9	X		

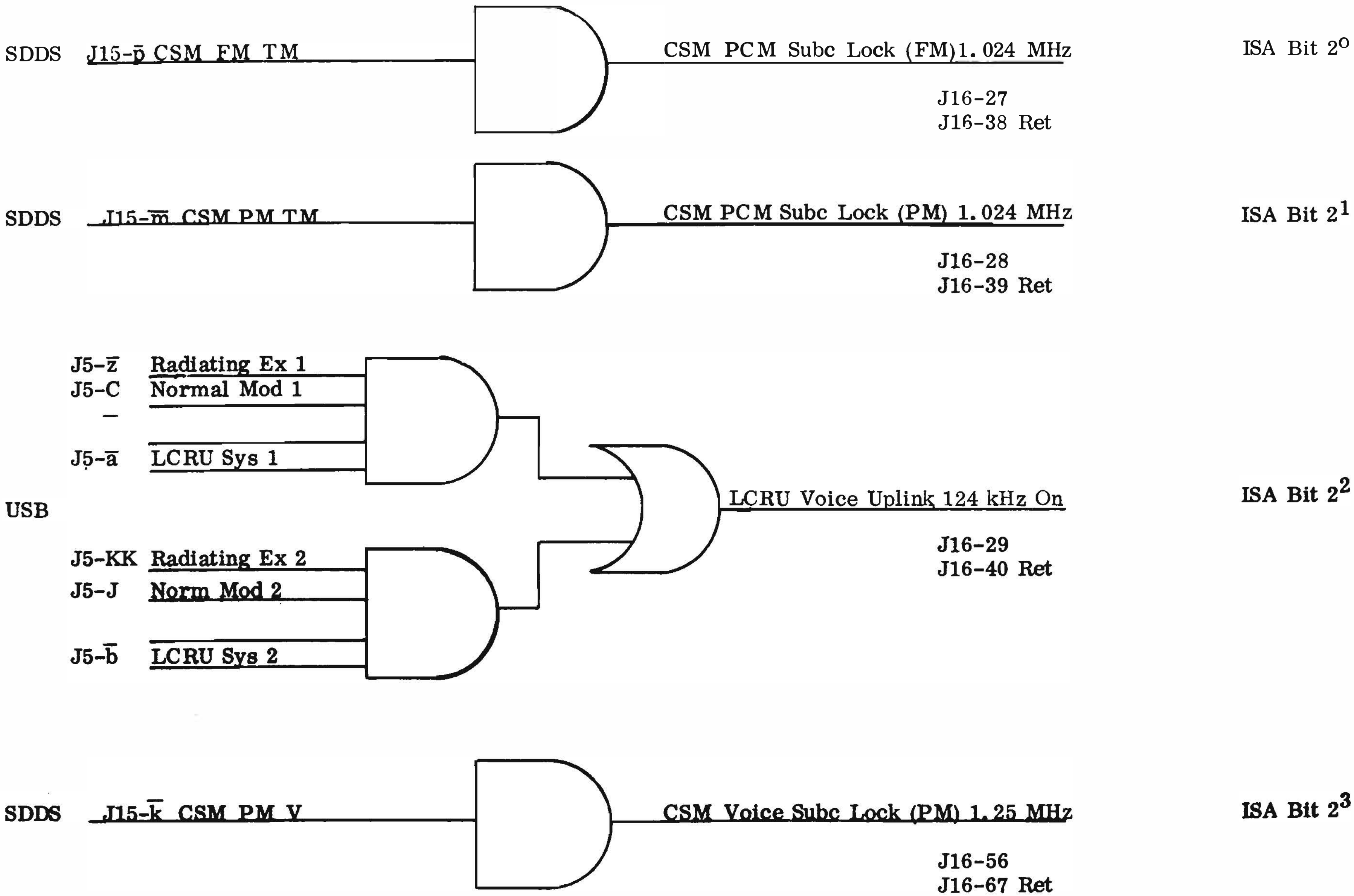


Figure 2-12. **Station Status Word**

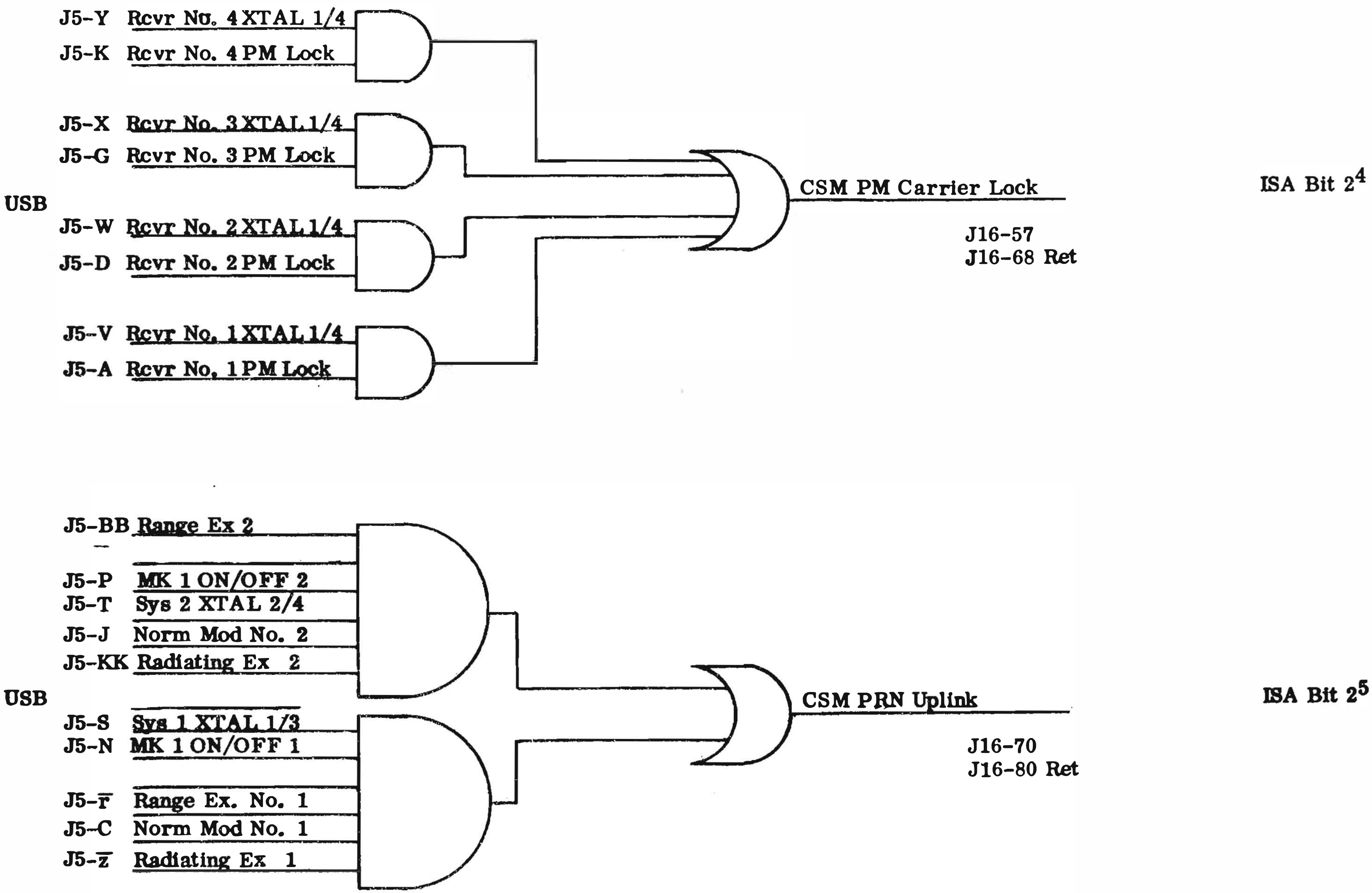


Figure 2-12. **Station Status Word (cont)**

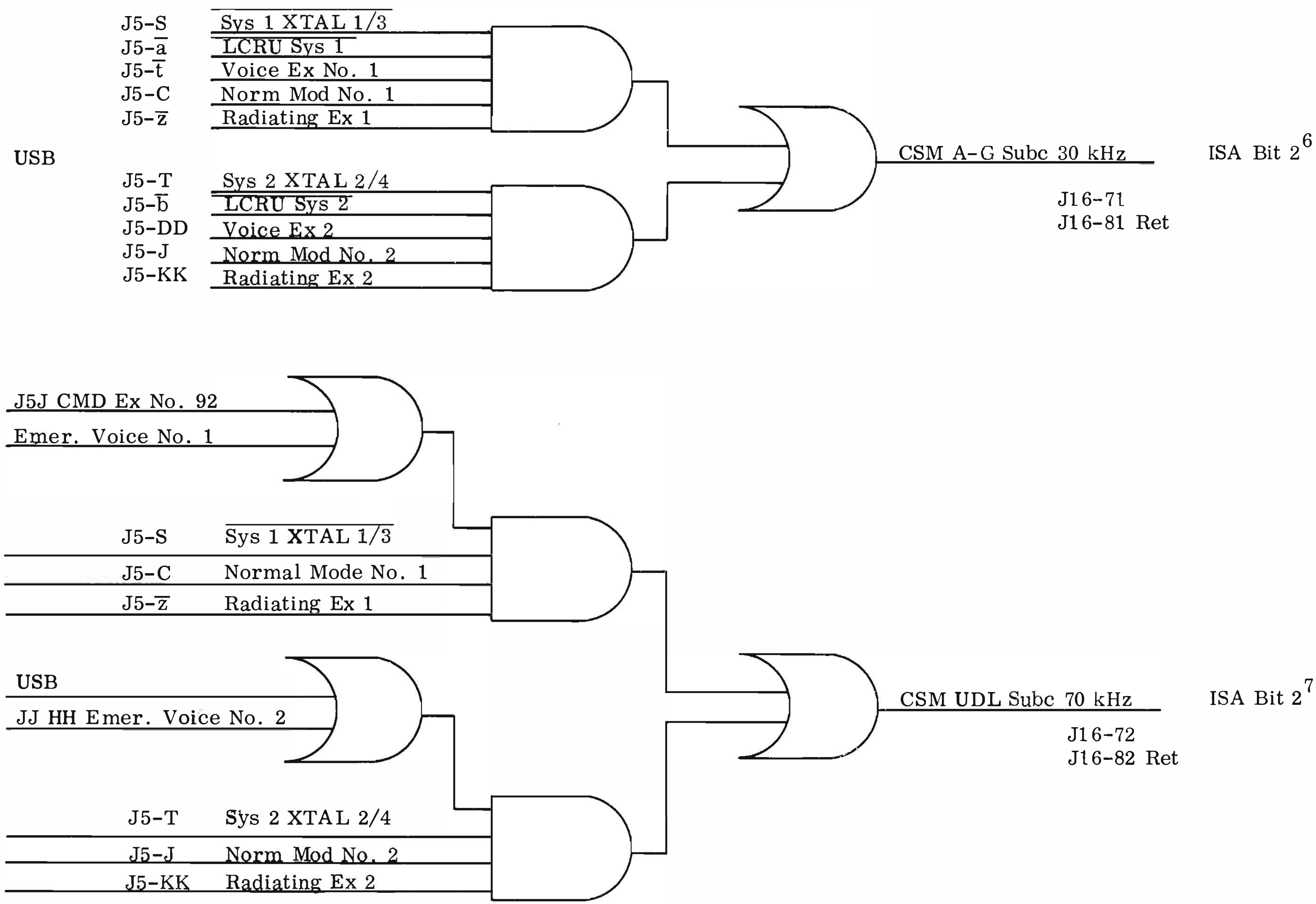


Figure 2-12. Station Status Word (cont)

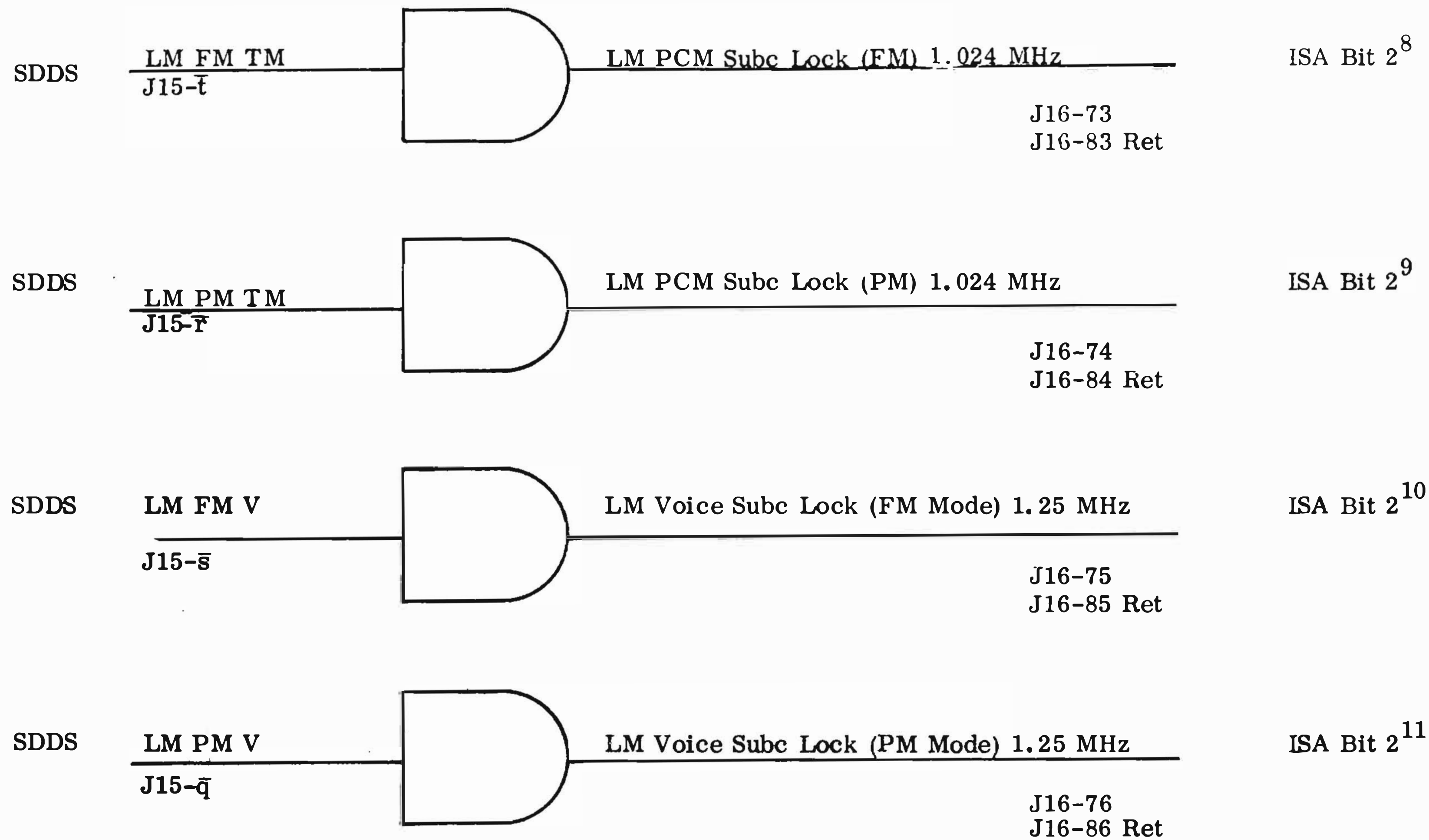


Figure 2-12. Station Status Word (cont)

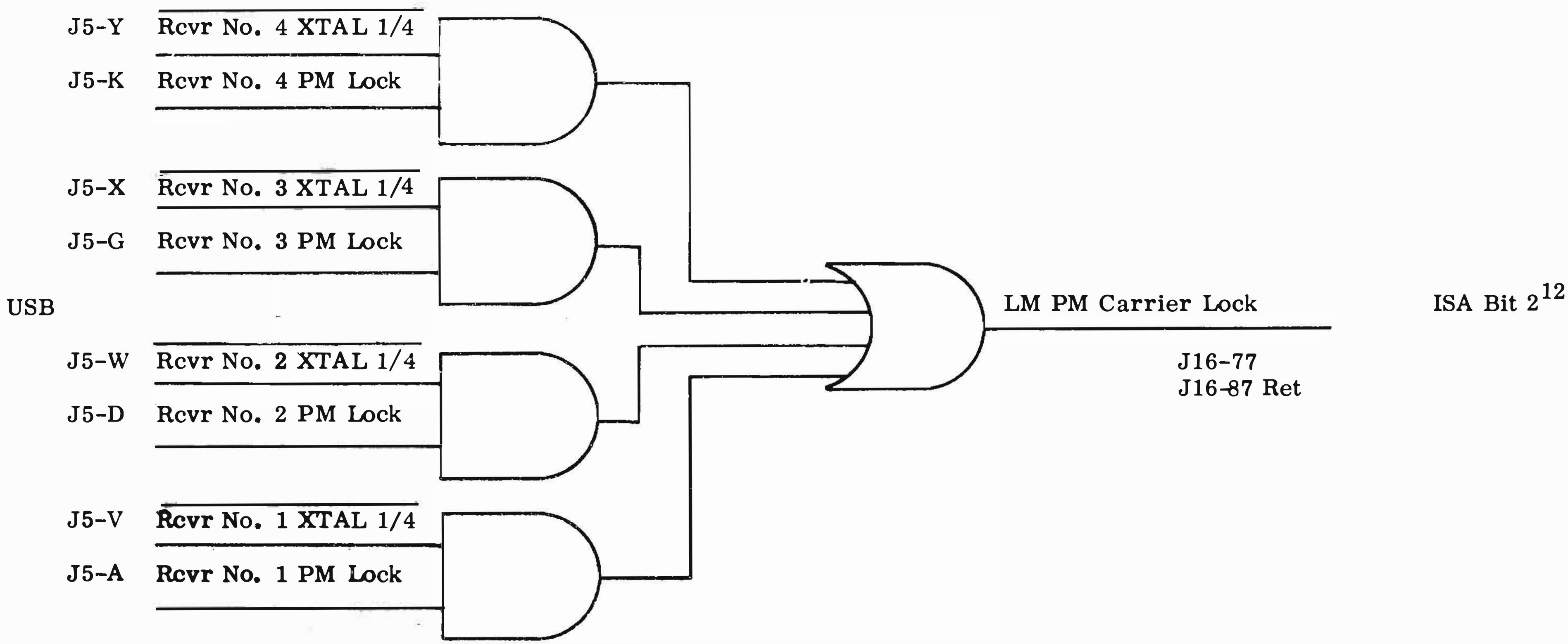


Figure 2-12. **Station Status Word (cont)**

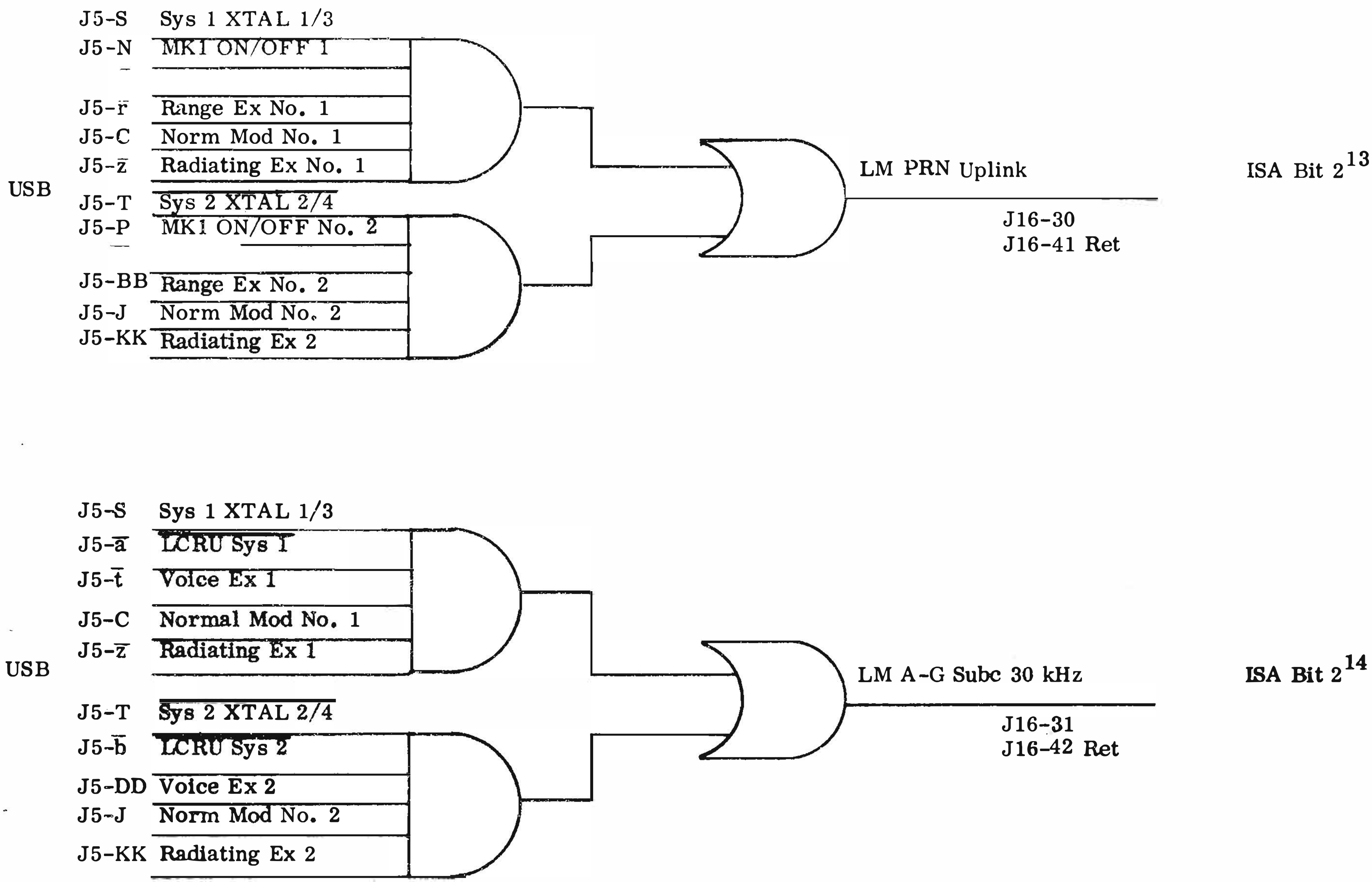


Figure 2-12. **Station Status Word (cont)**

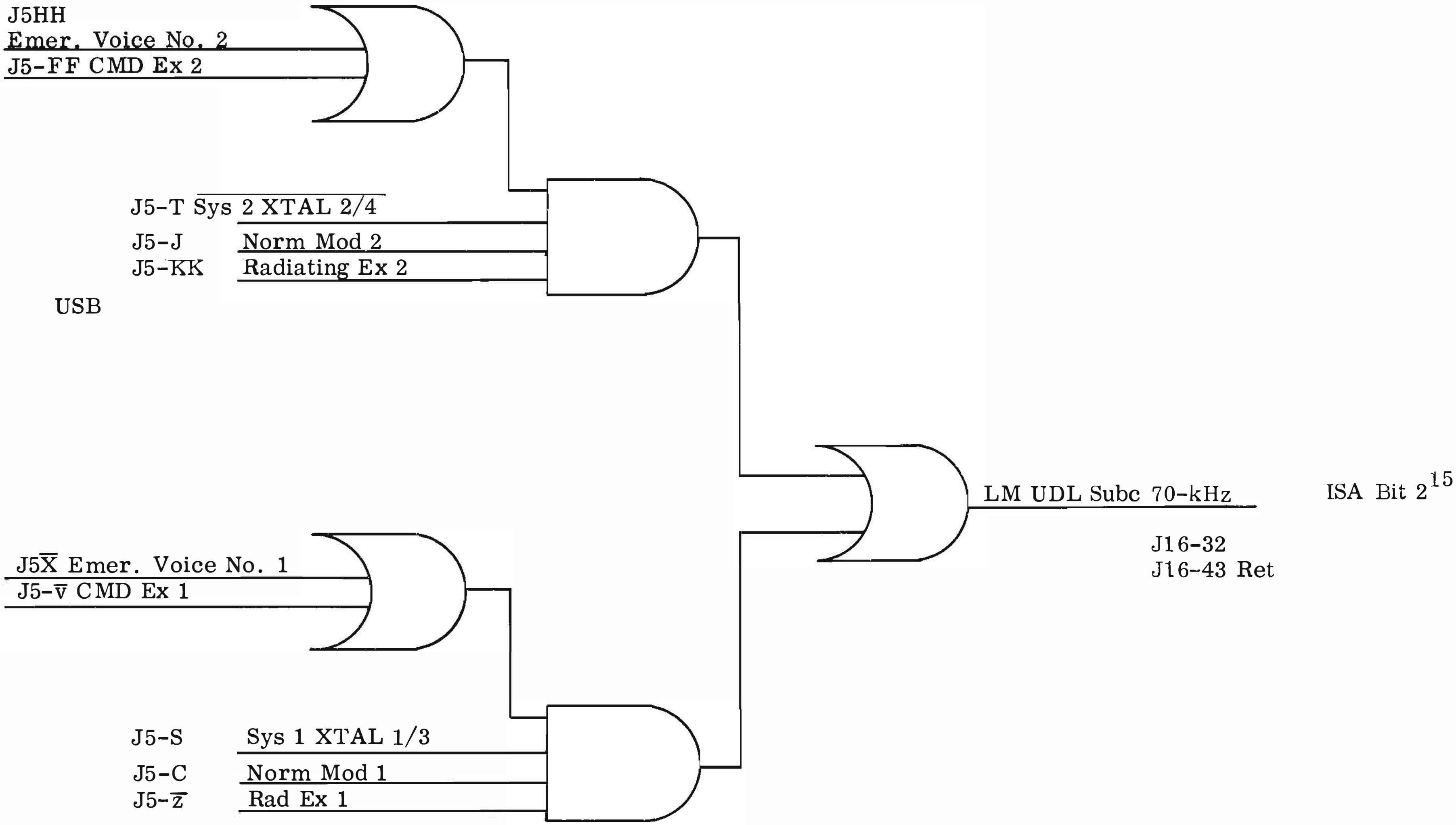


Figure 2-12. Station Status Word (cont)

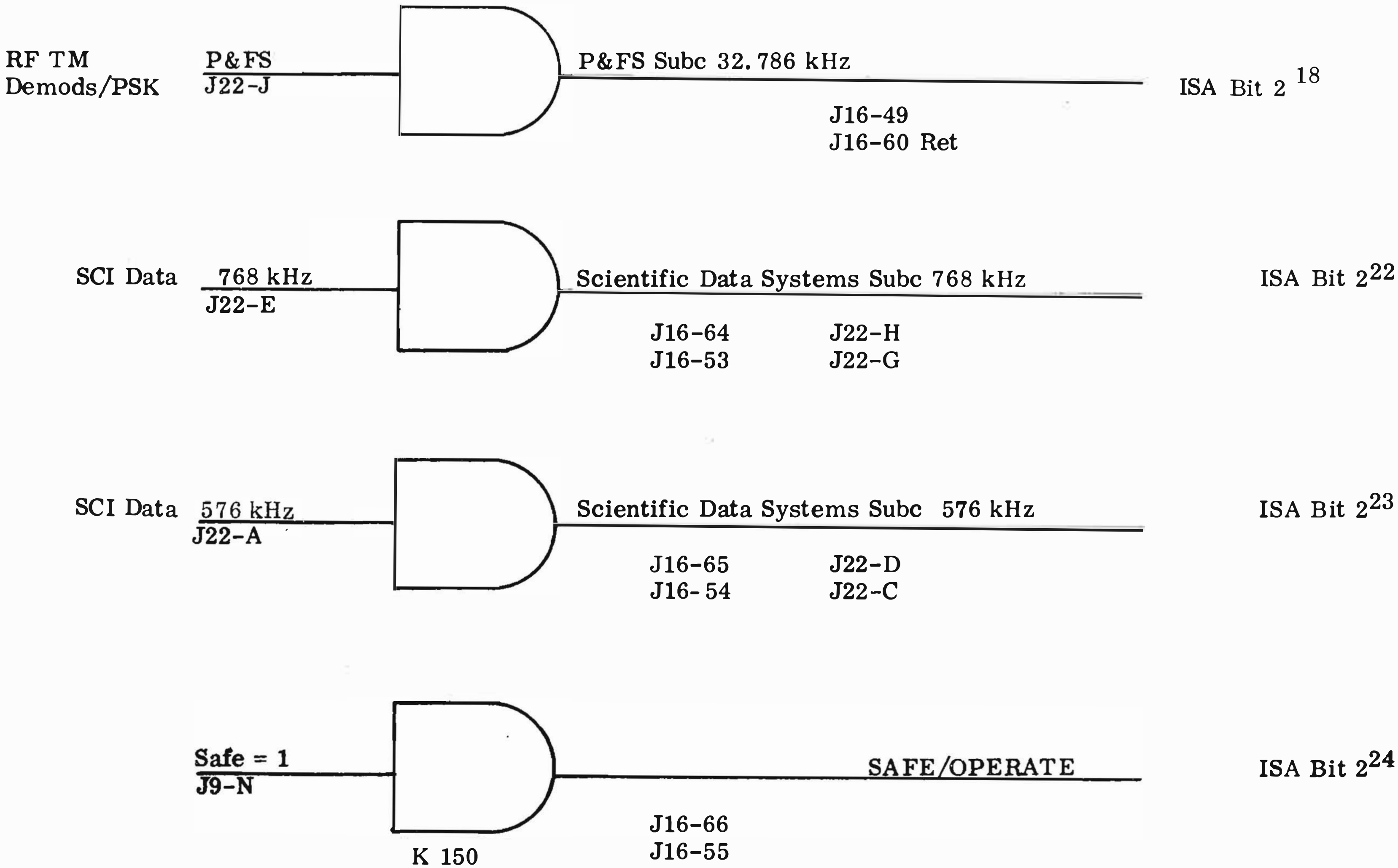


Figure 2-12. Station Status Word (cont)

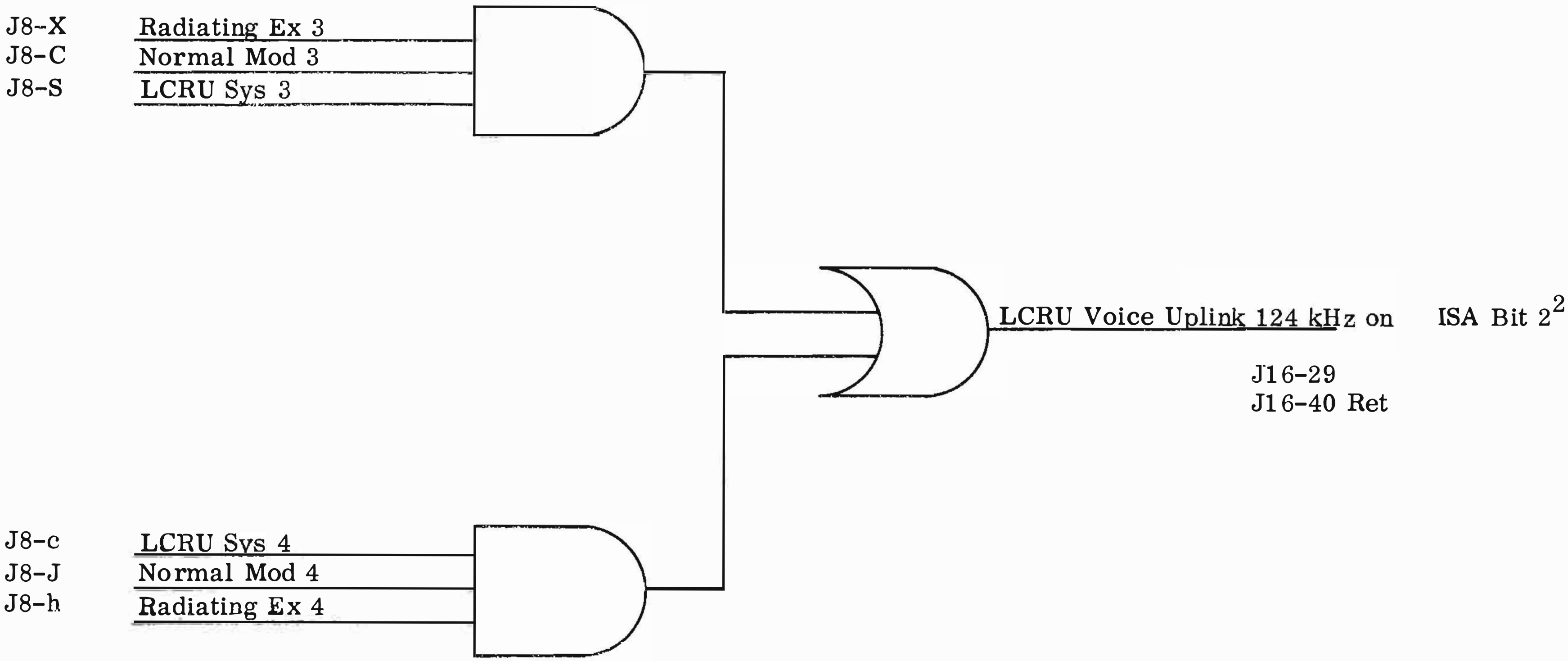


Figure 2-13. Station Status Word (Wing Stations Only)

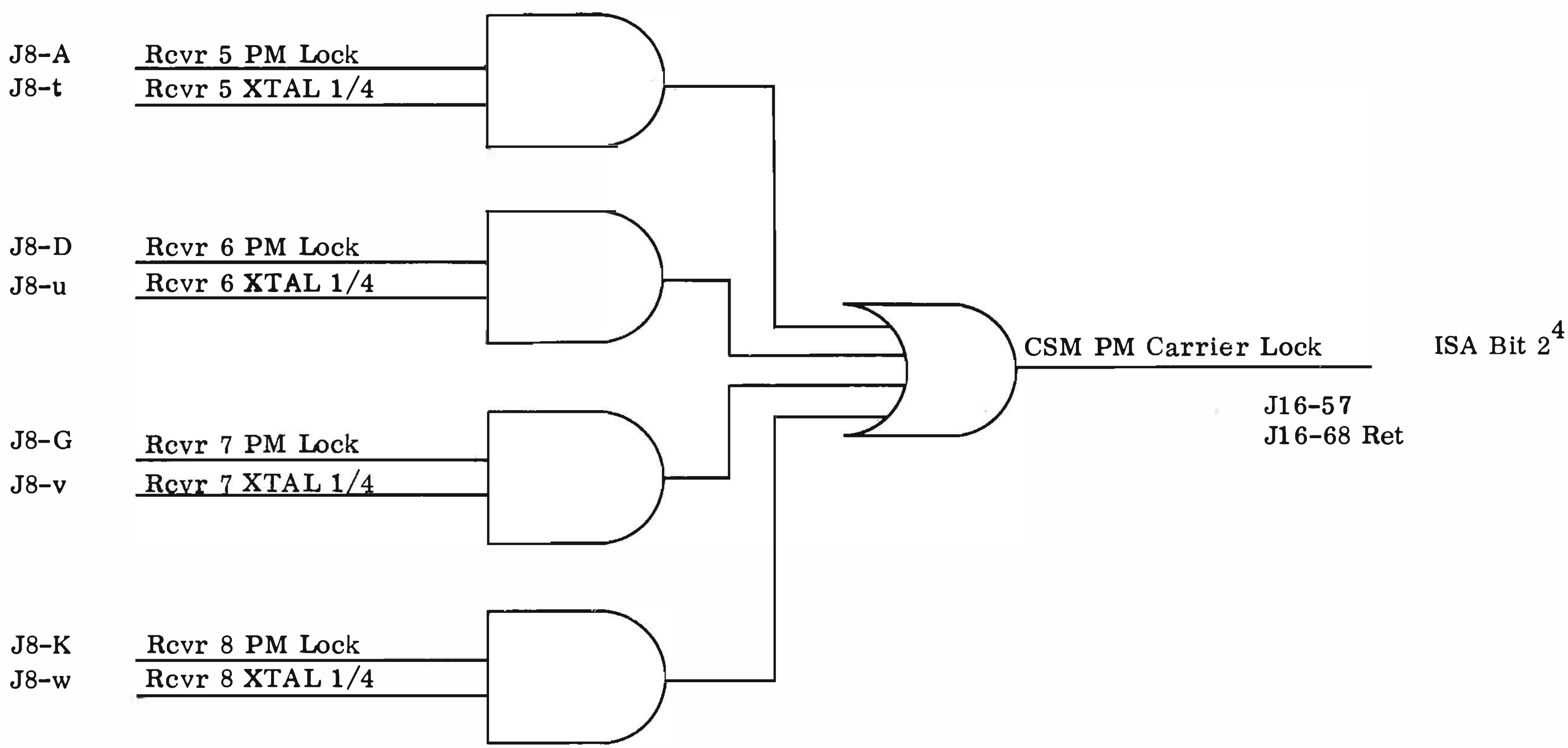


Figure 2-13. Station Status Word (Wing Station Only) (cont)

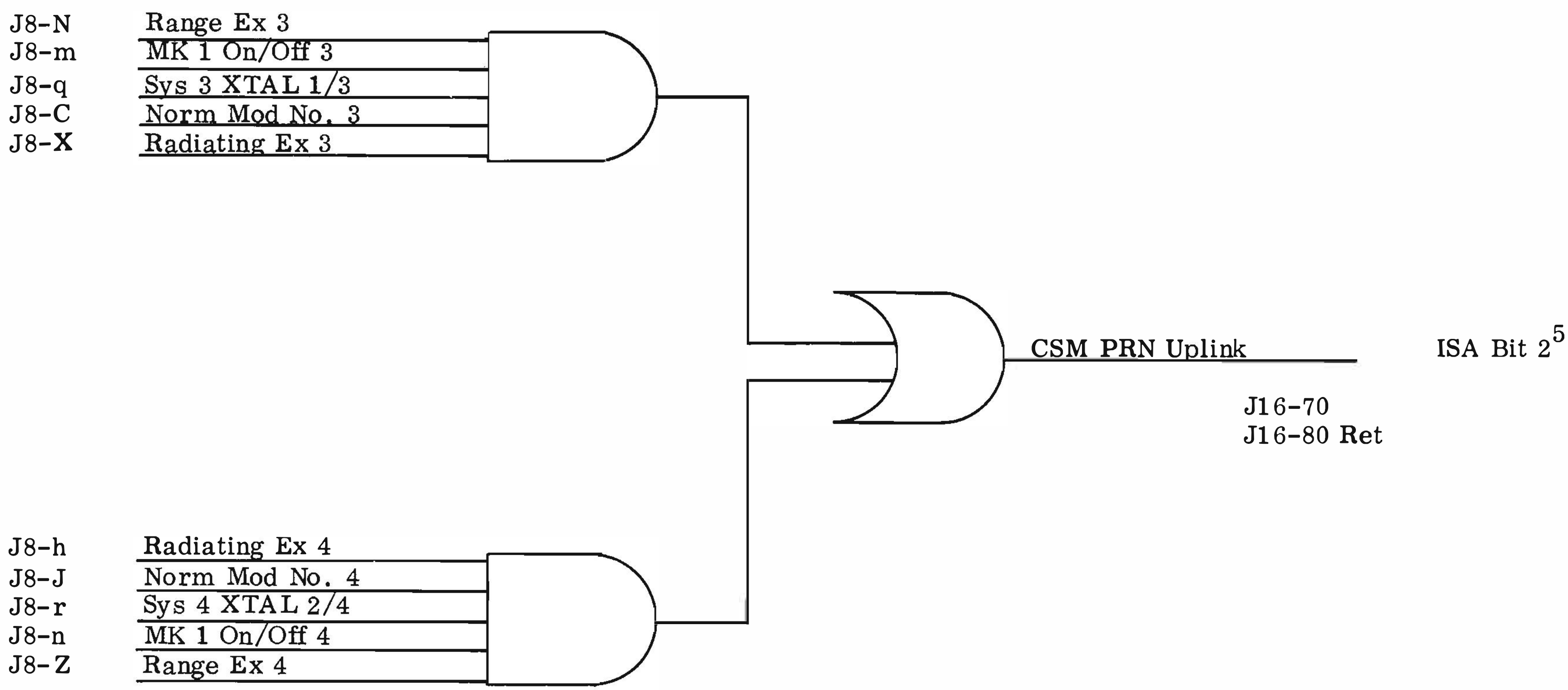


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

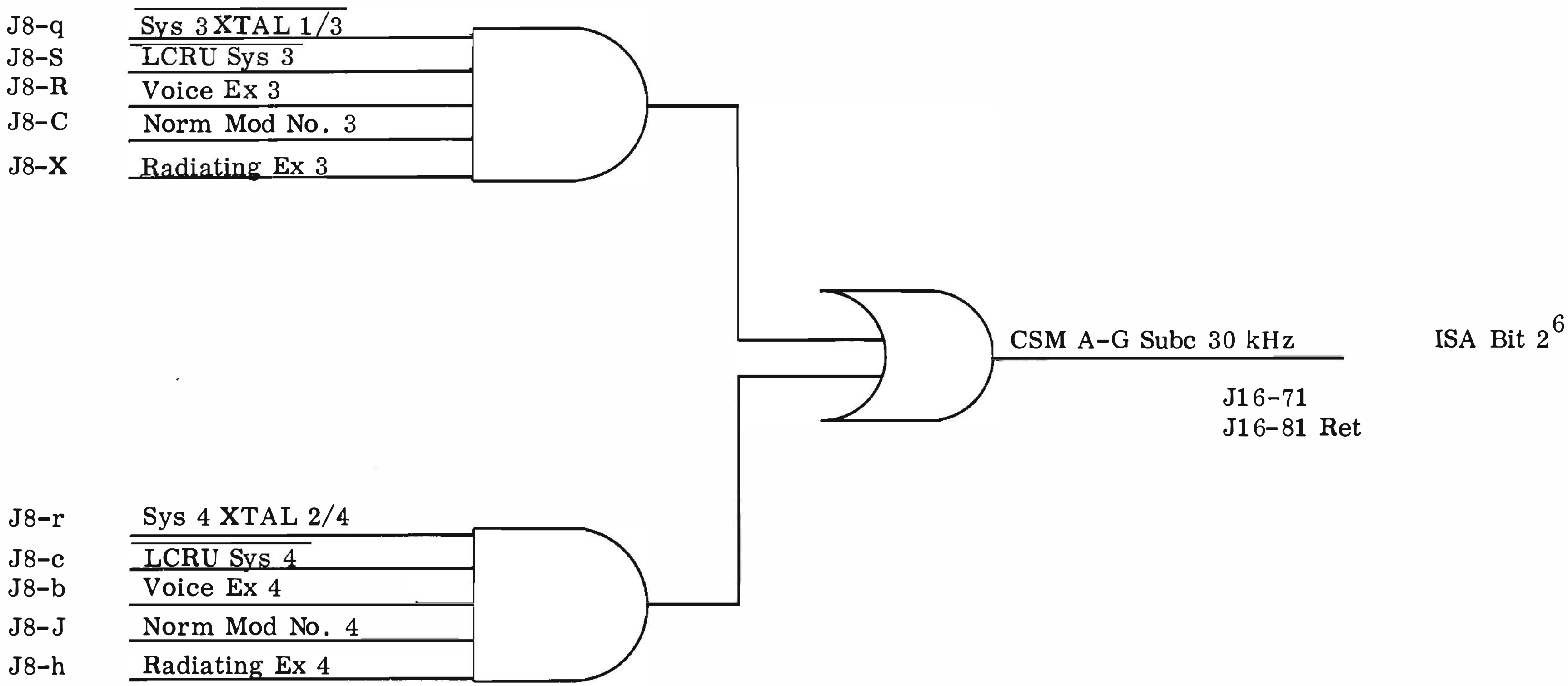


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

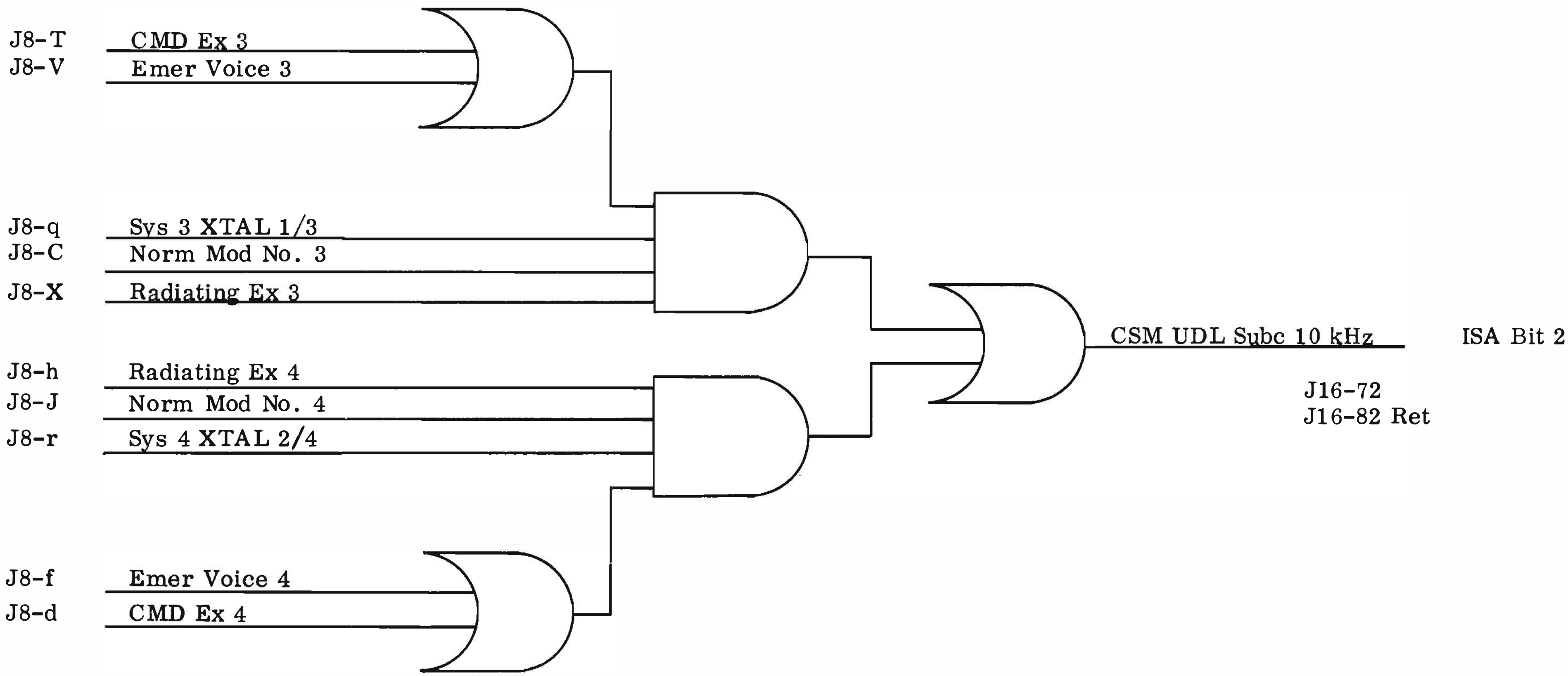


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

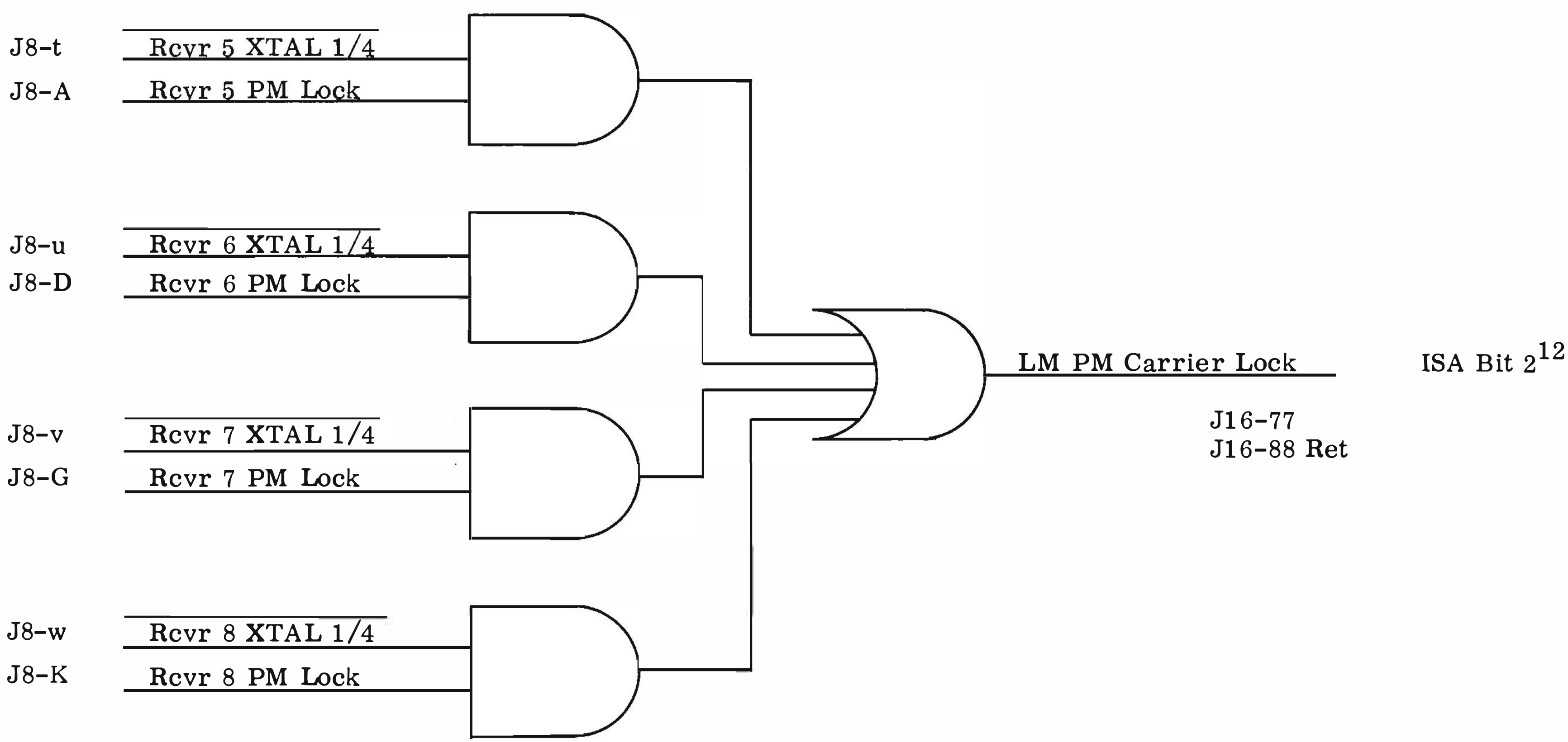


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

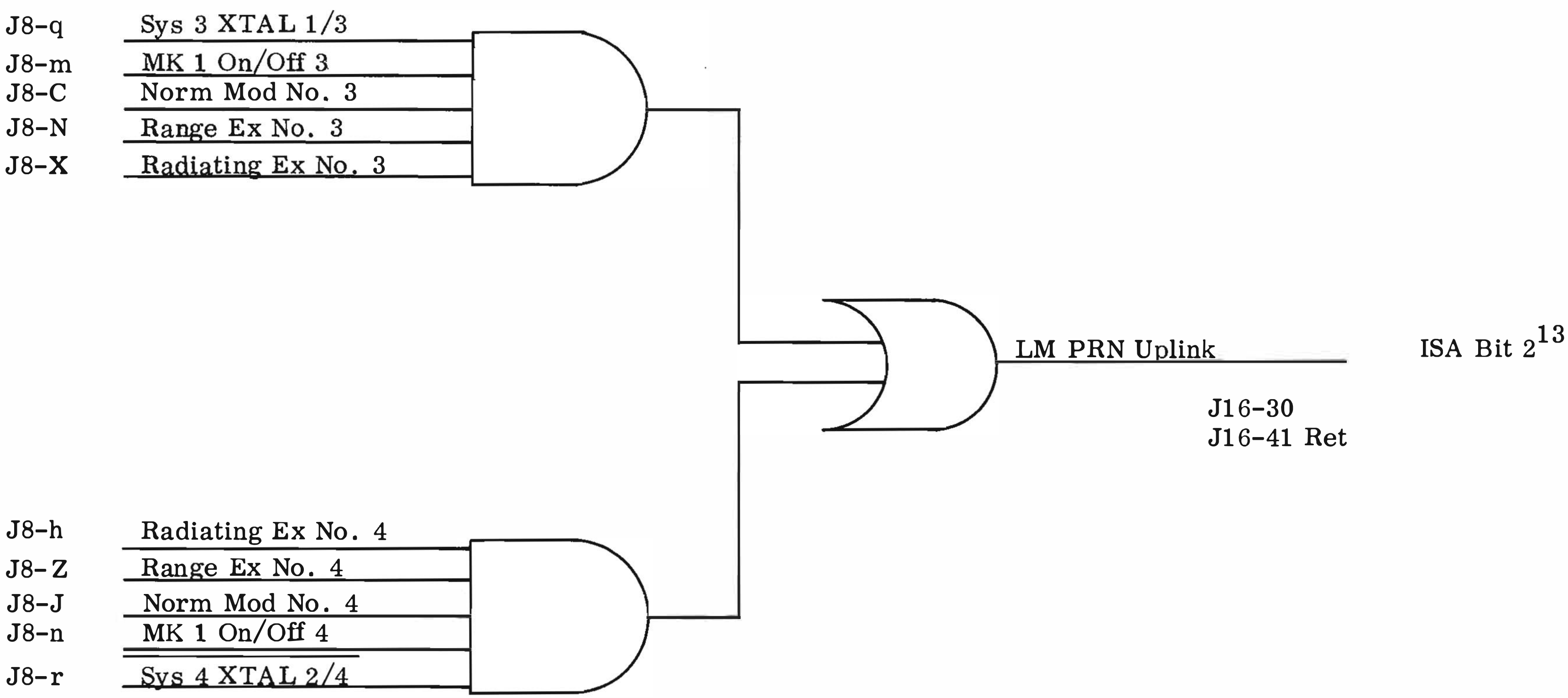


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

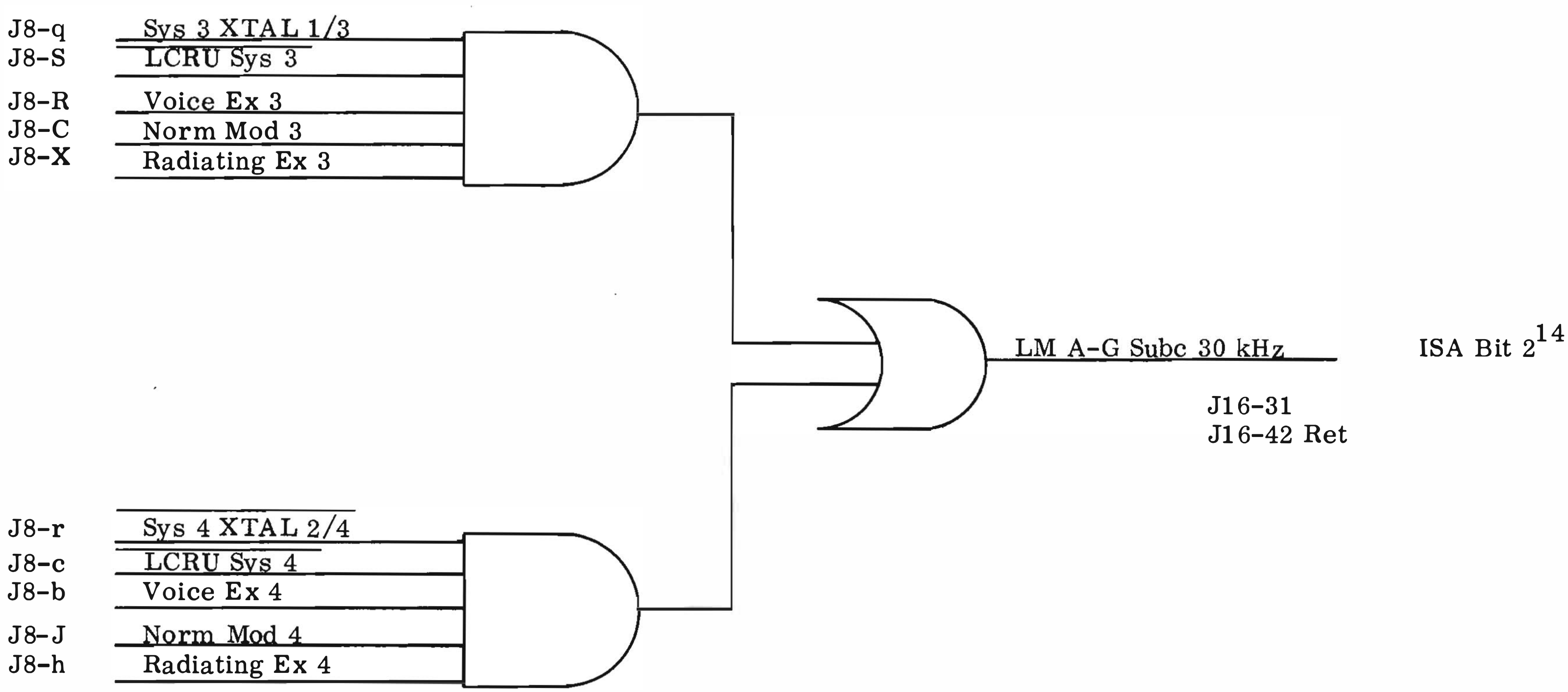


Figure 2-13. Station Status Word (Wing Stations Only) (cont)

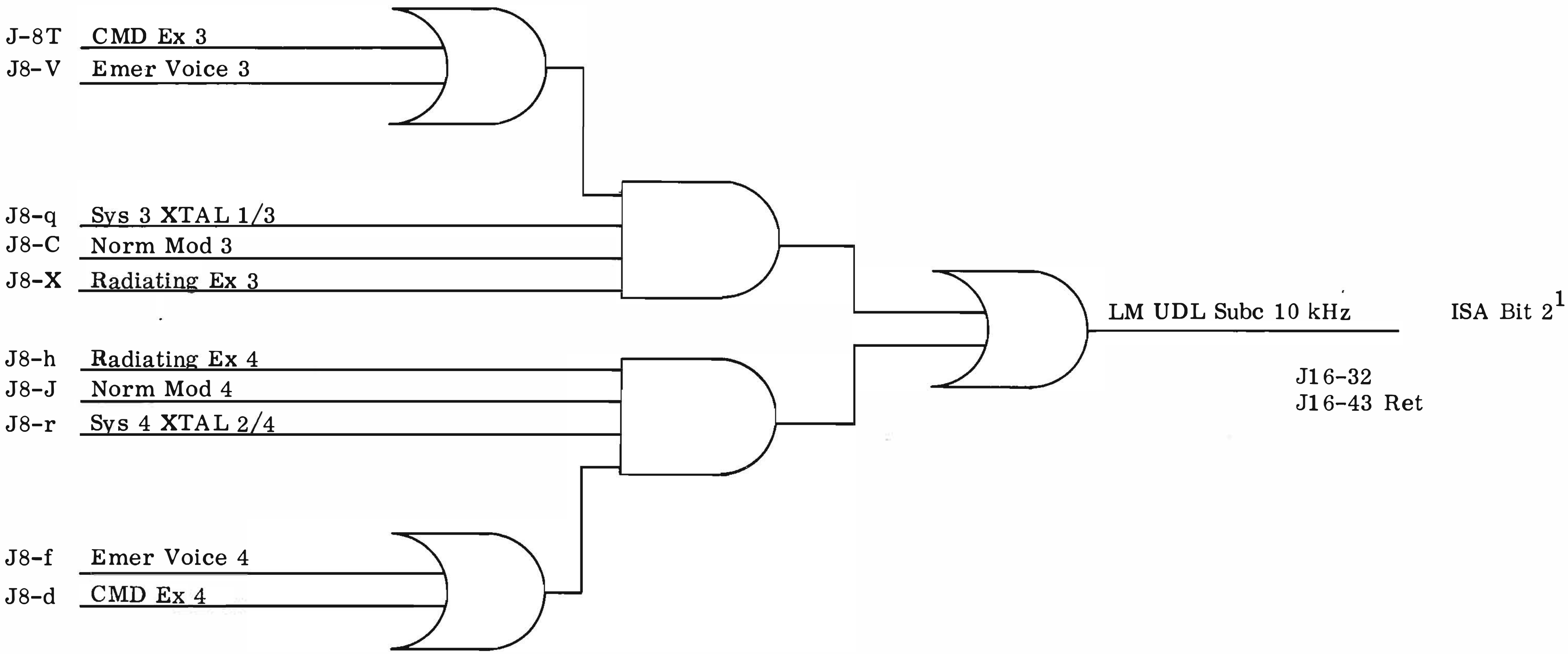


Figure 2-13. Station Status Word (Wing Stations Only) (cont)