NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

CHARLES R. LEWIS
INTERVIEWED BY JENNIFER ROSS-NAZZAL
HOUSTON, TEXAS – 7 JUNE 2022

ROSS-NAZZAL: Today is June 7th, 2022. This interview with Charles R. "Chuck" Lewis is being conducted for the JSC Oral History Project in Houston, Texas. The interviewer is Jennifer Ross-Nazzal. Thank you so much for joining me this morning. I really appreciate it.

LEWIS: Good morning.

ROSS-NAZZAL: I thought we would start by talking about what developed your interest in space and working for the space program.

LEWIS: In 1957 I was attending a class at OU [University of Oklahoma, Norman] an engineering class, and someone opened the door and said, "The Soviets have launched a satellite." I was so naive at that point I didn't understand. "What do you mean by satellite?" That was early, that didn't set my sights on space business, but it continued to develop. Of course, the United States got into spaceflight early on, and I tracked that in my mind. I went to New Mexico State University [Las Cruces] after I left OU because of the co-op program they had. I got a chance to go to the White Sands Missile Range [New Mexico] as a co-op student and work six months and go to school for six months. I did that for financial reasons.

I had a great opportunity at White Sands. I was lucky in that another co-op and I were

assigned to an electrical engineer in what they called the Structures Lab. Name was Glenn Mock. He tutored us in designing a data analysis system for analyzing vibrations data they were getting from launches at White Sands: Nike Zeus, Nike Herc [Hercules], and others. That was an immeasurable experience as far as understanding what engineers were. I didn't know what they were. I didn't think there were enough trains in the country for all engineers to have a job.

As I approached graduation, there was a huge demand for engineers. The Cold War was on, and most of us had multiple offers that spring. I could either stay at White Sands where I was working—they'd offered me a job—or there were several offers from engineering companies on the East and West Coast. As I thought about it, the new era was space, and I thought I needed to get in on the beginning. Goddard Space Flight Center [Greenbelt, Maryland] was launching small grapefruit size Van Allen belt radiation satellites. That's about where we were at that point. Goddard had a bulletin announcement—they were hiring operational engineers. I called, talked to them, and decided that's what I wanted to do. I'd get in at the beginning of our space program. I went there initially.

Later the Space Task Group was being formed, and they were hiring. I thought well, that's manned, that's got to be better than an unmanned program. Rumor was that they were going to move the Space Task Group to Houston, Texas. Of course, Lyndon B. Johnson was a politician, and I'm sure he had a lot to do with the move. That was a bonus because I was from Lawton, Oklahoma, and I much prefer Texas. I'd had enough of the East Coast in less than a year.

That's how I got started. I interviewed the people at Goddard about what kind of work it was but you never really know. You take your chances and hope that you get

assignments you enjoy. Mine was not as challenging as I'd hoped at Goddard, but that changed quickly when I went to Space Task Group.

ROSS-NAZZAL: You mentioned you were working on satellites. What were you doing with the satellites at Goddard?

LEWIS: Goddard was responsible for launching the small satellites out of Wallops Island [Virginia]. They were doing studies on the Van Allen radiation belt. [James A.] Van Allen had discovered the radiation belt. They were sending satellites up and sending the data to the ground. They had a network that they used to control and receive data from the satellites. That was the area where I was assigned. I would never had guessed at that point in my life that I would ever have been involved in landing a man on the Moon.

ROSS-NAZZAL: I can imagine. I did want to ask you before we get into Space Task Group. I read in Gene's [Eugene R. Kranz] book [*Failure is Not an Option: Mission Control from Mercury to Apollo 13 and Beyond*] that you were a member of the Army Reserve. You were a tank commander.

LEWIS: Yes.

ROSS-NAZZAL: When did that happen?

LEWIS: When I went to Cameron University [Lawton, Oklahoma], at the time it was a two-

year school and basic ROTC [Reserve Officers' Training Corps] was compulsory for males. If you could walk and talk, you went to ROTC for two years. Then you could go to advanced ROTC and get a commission. At the end of my freshman year I was selected as the outstanding freshman ROTC cadet, which meant I was to be the battalion commander for my second year, it was the top cadet rank at the college. I thought well, I'm going to take advanced ROTC. I'll join the reserves. With the reserve time and a commission, it was about $70 more a month as a second lieutenant.

I joined a local artillery battalion in Lawton, Oklahoma, June of 1956. As I moved from there to OU and then to New Mexico State, you get assigned to different reserve units where you are living. In Las Cruces and New Mexico State University, it was a tank battalion. I was transferred to a tank battalion. At that point I had reached staff sergeant enlisted rank and with that level and for other reasons, you could become a tank commander. I qualified as a tank commander. Kranz remembers it because of an episode in Zanzibar that I went through. It turns out I didn't take advanced ROTC but stayed in the reserves. I was committed for at least six years. That's why I was in a tank battalion.

ROSS-NAZZAL: It was something that I hadn't heard from other folks. How'd you get the nickname Skinny?

LEWIS: At almost the end of the Skylab Program, about a week before the last crew came home, I had to have stomach surgery. They didn't take me in an ambulance, but it was something I had to do. I'd had ulcer problems ever since I can remember in school. Finally got to me, and I just couldn't go on. So Kranz replaced me as the flight director of the Bronze

Team, my team, for the last week of Skylab.

The surgery was extensive including a gastrectomy, which removed half of my stomach; a vagatomy, which removed a portion of the vagus nerve; and an appendectomy. A few months after that I'd dropped from about 150 pounds to about 130 and never recovered it because of the type of surgery they did. It was a pretty good overhaul of my intestinal system. But I lived with it. I lost some weight, and there are some side effects.

I was skinny. Then my friend in the Crew Training Division, Carl B. Shelley, deputy chief of the Training Division—I'd known him for a while—started calling me Skinny. I don't remember if it was after I had been transferred to the Training Branch or before. I suspect it was about the time I was transferred to the Training Branch for Shuttle that he started calling me Skinny because we'd see each other about every day. I was a branch chief at that point. Skinny stuck with a lot of people. Chuck was the one that lasted my NASA career. I had another medical issue we'll talk about later that affected my career.

ROSS-NAZZAL: I wondered if it was something to do with the brotherhood of flight control, you guys seemed to have a lot of fun.

LEWIS: I had cluster headaches. If you've never had a cluster headache, you've never had a "headache" and you don't want one, the pain is so extreme. Women predominately have migraines—my wife had them for a while, not clusters. A lot worse than migraines, we'll talk a bit about that a little later.

We talked about the co-op business, and that was a great experience for me. Basically it is why I got into the area I did for my career. I was trying to think about the Army Reserve—

I didn't go to advanced ROTC, because my folks didn't have the money to continue my college. My first semester at OU in 1957, I mentioned it because that fall the Soviets launched their Sputnik, and I caught the Asian flu. It's in the books, the 1957 Asian Flu. I got it. I roomed with a friend that I went to high school in Cameron with and he didn't get it. It took me out of school. The two weeks before Christmas I was really sick. When I went back and took finals, I failed the only EE [electrical engineering] class I had. I had other engineering classes, but I had a five-hour EE class, and I failed it.

I thought with that failure and the financial issue that I needed to look for another way. That's why I went to White Sands. I could work six months and go to school six months. It worked out fine. Then I married Carolyn in 1958. She could work; she did, had a secretarial job at White Sands. Just before my last semester, we had our daughter Anita. Because of the Cold War with the Soviets, if you were going to college for an engineering, mathematics, or physics degree you could pretty much get a National Defense Loan. I got a National Defense Loan to finish school. The loan was for $500. I graduated in 61 and went to Goddard. That's a summary of my preprofessional career. It was tough.

ROSS-NAZZAL: It sounds like it.

LEWIS: Paid that loan off in a hurry, $500 was big money. I borrowed $500 from my grandparents to travel from Oklahoma to Maryland for the Goddard job. To make a point what a loan obligation meant then compared to what's going on today with student loans, I paid them back on a monthly basis. Anyway, that got me into Goddard, and then the stories go on from there.

ROSS-NAZZAL: Did you transfer from Goddard to Space Task Group?

LEWIS: Yes, I was already civil service. I'd been offered a job and I made a transfer. I still have the telegram I got from them. One thing I'll point out about that telegram—the annual salary would be $6,345 a year. That wasn't much.

ROSS-NAZZAL: Did that stretch?

LEWIS: Tums out my interviews with private industry before I graduated, every job offered a little bit more per month than the government job but it wasn't that much difference, maybe $50 a month, pretty close. It was the lowest paying offer, $6,345.

ROSS-NAZZAL: But you thought manned space was the future, so you wanted to go there.

LEWIS: Yes. I never asked for a raise. They just came, probably in the minimum time. I had managers, bosses I call them, they took care of us, those that came in in early, because we were really challenged to get on the job and get it done. Kranz, [Christopher C.] Kraft, Rod [Rodney G. Rose]—one of the Canadians we brought in—others like that, they were great. They weren't risk-averse; they were very smart people with common sense and commitment.

ROSS-NAZZAL: Did you have any idea that you would become a remote site CapCom [capsule communicator] when you accepted the position?

LEWIS: That's what I was hired to be, a remote site CapCom. I took Flight Control Class 100. I think there were five of us in that class. The plan was for us to be remote site CapComs. Four of us, after we finished that crash course, did go out as remote site CapComs, but only three of us went out the second time. The first trip to Zanzibar was three of us to support Mercury-Atlas (MA)-7, Scott's [M. Scott Carpenter] flight. It was me and another new hire and a Philco tech rep that was already on board; he was a contractor. Several of them were contracted to be remote site systems people.

ROSS-NAZZAL: Can you talk about that crash course? Gene gives a little paragraph about learning Morse code.

LEWIS: Everything was new to us and probably a lot of it was new to those that were already working there, because it was new. Pretty much everything was being developed from scratch. Nobody had ever gone to the Moon, and at that point no American had gone into Earth orbit, so everything was totally new. It was a crash course in Mercury systems, which compared to what we saw later was quite simple but it was new to us. The remote site capabilities varied. Each task to be done was defined. Some had radar, some didn't. Some had good communications back to the Mercury Control Center in Florida, some only had teletype, and it was not very reliable—it was in and out. Communications then was in its infancy compared to where we ended up.

For example, on STS-9, the first Spacelab flight, we had one of the TDRS [Tracking and Data Relay Satellites] up. We had half an orbit of continuous coverage. Early on we just

had a few scattered remote sites with five or six minutes of communication with the crew, then loss of signal, wait a while then another five to six minutes. Totally different than continuous coverage.

A little bit about telemetry and communications systems on the Mercury, more so than some of the other systems, because that's where the interface was going to be. For emergency communications on Mercury we used Morse code on a HF transmitter. It was the simplest thing that you could come up with.

During our crash course, they started teaching us Morse code at night after our daily classes. I never could have done Morse code if I'd been asked. When we got overseas to a remote site there were a number of technicians, including a group called com techs. They were responsible for the voice communications, primarily. We had telemetry techs, radar techs, etc. I'd go to the com techs at the site when we got on site and ask, "Do you take Morse code? Be ready. If it ever happens and we need it, it's going to be an emergency. You're going to be the one to do it."

The remote sites were built and operated by Goddard Space Flight Center. We, the Space Task Group, would be coming out of what was going to become the Manned Spacecraft Center. Chris Kraft defined the interfaces that we as flight controllers would have with the remote site people, because remote sites had bosses. They had managers. We had our own managers. But when the CapCom and the flight control team arrived at a remote site, the remote site was under the control of the CapCom. The remote site manager was responsible to the CapCom for mission related work. It was very clear. There was no dickering over who was manager, or who wasn't. It was spelled out in clear language so there was no problem. That was all set up by Kraft, knowing that you wouldn't want to get out to a remote site and

not know who the boss was. We had to have bosses, like the flight director. He was the boss during a flight. Remote sites were structured to be responsive to the remote site CapCom. That's the way the operation was going to be, how the flights were going to be controlled.

ROSS-NAZZAL: What did your wife think of you taking this position? You had at least one young child at that point. Was she happy about this position?

LEWIS: I don't know that we really knew. Carolyn and I were happy that we would be going nearer to Oklahoma. We were almost certain that was going to be the case. My daughter Anita was born in December before I graduated, December 3rd, two weeks early. That threw a wrinkle into my finals for that semester.

ROSS-NAZZAL: I bet.

LEWIS: That's another story. We were so young and naive at that point. I don't think that she realized nor did I that I might be traveling as much as I was going to be. It turned out to be quite a lot of travel. But no, she was glad. I was happy. She was happy. Another opportunity, it was no problem in that respect.

This is maybe an off-the-side story. I married her in May of 1958. I had already been to White Sands for one co-op period. I went home on Memorial Day weekend to get married. She was just graduated from high school, turned eighteen that month. We married May 31st. That May was a full month.

ROSS-NAZZAL: Sounds like it.

LEWIS: In Oklahoma at that time a woman could get married legally at 18. I had to get permission from my mother and dad because I wasn't twenty-one yet.

ROSS-NAZZAL: That's interesting

LEWIS: Setting the time frame of what May was going to be like in our lives: that was birthday, graduation, and anniversary in May 1958.

ROSS-NAZZAL: It was a big month for you.

LEWIS: Yes, it was. But going back and forth to Langley [Research Center, Hampton, Virginia] that was tough on Carolyn because it left her by herself. She stayed in Hyattsville at the apartment, and I was at Langley for about six weeks. They did have an old DC-3 that flew from Langley Field to Washington, DC, airport on the weekends, and I could hop a flight on weekends and go to Maryland and spend most of the weekend with her. Get up there Friday night, go back Sunday night.

We tried to see as much of DC as we could because we really hadn't been there that long. We knew we weren't going to be coming back for a while. We pushed Anita around in a baby carriage and toured DC to some extent.

ROSS-NAZZAL: Nice memories.

LEWIS: After the crash CapCom course, I was assigned to Zanzibar. They started moving Space Task Group people to Houston at that point. They were flying people to Houston from Virginia to look at homes. I ended up taking Carolyn and Anita to Oklahoma—this is in early May—leaving them with her parents. I drove to Houston, left the car, flew back to Langley Field, and took the trip to Zanzibar.

ROSS-NAZZAL: Did you participate in any sort of cultural training? What did you know about Zanzibar before you went there?

LEWIS: First, we never heard of cultural training back then. We were briefed on how to be safe. Zanzibar was about to be overthrown by the communist party, that was the thing Gene put in the book about being a tank commander. We got briefed usually before each trip overseas if there were any local issues to be aware of for personal safety. Most everywhere we went, medically speaking, it was, "Don't drink local water" and "Don't eat fresh vegetables." Otherwise, you know what would happen. Be like Montezuma's Revenge every trip.

For Zanzibar, we were going to get telemetry data and send it to Mercury Control but no specific flight activity was planned. I don't think our government knew if a site was going to be there when the mission flew. It was that close to being overthrown by the communists.

They briefed us about the political turmoil there. This turmoil caused by the communist party. I forget the name of the tribe, but they were backed by the communist party. They lived in huts out in the jungle and had red roosters painted on their grass huts. It was

literally like a Hollywood movie set. Zanzibar City was more or less a modern city, and that's where most of the non-natives lived, and that's where we stayed, at the Pigalle Hotel. No screens on the windows, open air, lots of mosquitoes. That's where we ate and slept.

The British had a platoon of Gordon Highlanders that marched the streets of Zanzibar City every morning early. You could hear their hobnail boots. They were there primarily to prevent an outbreak of violence. I don't know the relationship between why it was British unless the British had some kind of political oversight. The site was a few miles out of Zanzibar City through the jungle. We were briefed before we went over. There may be roadblocks up, particularly at night, and night is when we'd have to travel. To work in Zanzibar, we worked at night when people in the States were working during the daytime.

One night while driving a rented Volkswagen from the site to the hotel, we approached a roadblock. I was the lead for the three of us. Glenn [Parks], he was a student CapCom like me. Larry [Wafford] had been around, he was a technician that had worked with Philco on the military radar line across Canada. Anyway, we're in a Volkswagen. We've been told, "If you see any roadblocks and they aren't uniformed don't stop." I see two guys on the road. As we get closer, I see that they're not uniformed, but they were carrying machine guns. I thought, "Oh, crap!" Glenn said, "What are you going to do?" All I could remember, "If they don't have uniforms don't stop." Larry went down on the floorboard in the back. Glenn got down in front of the seat on the right. I just hit the pedal, blew right through there. I kept looking back in the rear-view mirror watching for any flashes. No flashes, but it was a scary trip that night.

Shortly after we left, the remote site was abandoned leaving everything behind. It was probably the reason we didn't have a flight surgeon, because they were usually military. We

weren't a "prime site." But it gave the three of us a lot of experience in a hurry.

ROSS-NAZZAL: Yes, wow.

LEWIS: That was my first trip overseas.

ROSS-NAZZAL: How did you get over there?

LEWIS: All the way to Zanzibar?

ROSS-NAZZAL: How long did that take?

LEWIS: If I remember right, we left Langley Field and had to go to Washington, DC, to some embassies. We needed some of our visas stamped. We rented a cab to go from embassy to embassy. We were pushing it timewise. We got it all done. We flew up New York to go overseas. Because of the length of the flights and our work as soon as we got there, NASA gave us first-class tickets. We get to New York, we're at the airport ready to board, and we get bumped. We could either take a tourist class or second class or take the next flight. I was the lead so I said, "We got to go. They've got our itinerary. You think I'm going to be delayed because I won't sit second-class?" So we took second-class flights, and as we were getting ready to taxi out, I could see who bumped us because I recognized him. It was General James Van Fleet, his wife, and daughter.

Finally we got to Paris, that was our first stop. There was a message, "Hold in Paris

until notified."

Oh no! So we spent two days and two nights in Paris. I probably spent all the per diem money that I was going to get in two days seeing the sights. Then they said, "Proceed to Rome." We had to go through Rome. We spent a day and a half in Rome. We finally flew to Nairobi, Kenya. I think we took one of the British Comet jets from Rome to Nairobi if I remember right. We flew a DC- 3 plane from Nairobi past Mount Kilimanjaro to the coastline to catch a boat for Zanzibar. Crazy trip.

ROSS-NAZZAL: Yes. Sounds like it took days to get over.

LEWIS: It did. We'd landed on one of the grass landing fields at the base of Mount Kilimanjaro. The technicians, or the maintenance guys that fueled the plane, were natives wearing loincloths. We're thinking my God, they're maintaining this airplane!

ROSS-NAZZAL: How far out did you have to go to a site before a mission? Were you there a month prior?

LEWIS: No, usually you'd arrive a week or ten days before. Probably about a week. They'd try to have simulations. They were crude, but we did have simulations. We carried magnetic tapes that our simulation people recorded spacecraft data on, and we'd play that at the site. Take them to the site, play it back when they told us to. It was like we were having a pass over the site. The Control Center, Mercury Control, was up and running. We had communications with them. It was the beginning of what I would call integrated simulations.

Crude, but it worked.

Usually the first thing I would do at a remote site is meet the guys and the manager. I was twenty-four years old. I was probably the youngest guy on the site when I was going over to Zanzibar and Canary Islands. I was still wet behind the ears so to speak. Then I'd brief them on the flight plan. "This is who's going to fly. Here's the activity we're going to see. Then the flight will be three orbits, or it'll be six orbits." Start teamwork.

We'd run equipment interface tests between the CapCom and the com tech and command tech. We'd run tests on all the voice loops, "How do you hear me," check all that out. Then Larry Wafford, or whoever the system guy was, he'd work with the telemetry. We had strip-chart recorders to be configured and tested.

There was some question about family. No family members traveled with me. I made a mistake of promising Carolyn if I ever went to the Hawaii site, after the flight was over, I'd have her come over and we'd spend some time in Hawaii. I did make it to Hawaii, but I didn't take her over. That didn't sit well.

Usually you went straight back home. I was going to take one trip back from Carnarvon, Australia, through Singapore on annual leave. You did that by exchanging a first-class ticket to tourist or second class. The money break would give you enough to veer off your flight course and then take some annual leave.

ROSS-NAZZAL: Hopefully you got a chance to take her later.

LEWIS: We did later, but not because of the flights. The Zanzibar trip was my first flight. By the way the medical advice, "Don't drink the water" and "Don't eat raw vegetables," was

difficult to follow. We ate filet mignon steak at the Pigalle Hotel every night. It was probably as cheap as hamburger. The cook would come in. He came dressed in khaki pants and a khaki-type shirt, looked like they'd just been laundered. He'd get to the hotel, go to the kitchen, and put on a dirty apron, which had been used I don't know how many times. We finally said, "Well, we won't use ice; we won't drink the water, but we're going to eat salad with our steak." We started eating salad. We got lucky. We didn't have any problems.

ROSS-NAZZAL: Did you have to take malaria pills or get any extra shots before you went to these locations?

LEWIS: Oh, we got loaded with shots. Last two weekends at Langley Field, they waited—of course—till Friday to give you the shots because they didn't want you to lose any work time. I don't know, half a dozen shots on one weekend and another half a dozen the next weekend. Some guys got sick. I didn't, but others got pretty sick. Most of us were in motels, sharing rooms. I think I took a trip up to Hyattsville that weekend. I got lucky. We were kept updated on shots.

We got physicals every year, an upgraded flight type physical. Not as much as pilots do, but it was an upgraded physical for people working, flying, going overseas. That was the beginning. You asked about coming to Houston.

ROSS-NAZZAL: Yes. Did you have a chance to come out and take one of those look and see trips?

LEWIS: No. I took Carolyn to Oklahoma, and I had time to drive back to Houston. I forget now where I parked the car. Got on a flight to get ready to go overseas. Anyway, all I remember about Houston is that it was hot and humid. Rented a house with no air conditioning. No air-conditioning in the car we had.

We worked in air-conditioned buildings at least. Carolyn was stuck in a rental house with just a fan. She was pregnant. It was brutal. That didn't last long. I forfeited the lease, and we moved into an air-conditioned apartment. That is what I remember: hot and humid and no AC. The apartment we rented had a swimming pool in the middle. Across the pool from us, in a similar apartment, was Glynn [S.] Lunney and his family. That's where I met Glynn and Marilyn Lunney.

ROSS-NAZZAL: Are there any other anecdotes from any of those missions as a remote site CapCom that really stand out?

LEWIS: Oh yes, I really got initiated at the Canary Islands. My next trip was Canary Islands. It was on MA-8 Wally [Walter M.] Schirra's flight. I went out again with Larry Wafford. We met the flight surgeon. I think he was Air Force. That was our team for the flight on Canary Islands. Canary Islands is a critical site because it's the first site the spacecraft sees after it's launched. In the Atlantic Ocean not too far from Canary Islands is a Navy destroyer. It's there in case we abort, and the spacecraft comes into the Atlantic Ocean before it gets to Africa. The Canary Islands had radar. We could track it. Then DoD [Department of Defense] had communications to the destroyer if it needed to be called into action. We didn't interface with it, but that radar was mandatory for launch. It had to be working to get a "Go" for launch.

We were on console and into the countdown, when our radar failed. We had voice communications back to Mercury Control and Kraft. He was Red Flight—the flight director. I was the interface to him and said, "Flight the radar is down. We're no-go on the radar." I forget now where we were in the countdown. I'm guessing it may have been about forty-five minutes before launch. He called back and he says, '"What is your ETO?" I knew what ETA [estimated time of arrival] was, only because I'd seen that in the airports my first flight or two. But it threw me! Larry was sitting next to me. He said, "ETO is expected time of operation." We didn't know! Radar tech didn't know. We made a guess. I called back ETO is…" We added fifteen minutes to the current time, and I advised Flight.

Then a few more minutes went by. Kraft said, "How good is your ETO?" I didn't know what the hell to say. Larry, being a more seasoned and older than I, said "Flight, it's only a guess; we don't know what the problem is yet." We didn't. The guys at the radar shack were frantically trying to get it fired up again. Then Flight said, "I'm going to put a hold on the launch. I'm going to hold down for fifteen minutes. You guys get that radar up." This brings back memories.

ROSS-NAZZAL: Oh, I bet.

LEWIS: We went into the hold, and radar finally called and said, "Radar is Go." We launched within that fifteen-minute hold. First thing Wally said, "Good show on the radar." I get emotional thinking about it. It was a long time ago.

Anyway, that initiated me really quick. I was so shook up that when we got acquisition of signal and Wally called, I could hardly speak. I guess my adrenaline was so high. It went

okay, but I will not forget it. It was my first site where I was full up CapCom. I learned a lot at that site, in just a few minutes. Be prepared!

For Gordo's [L. Gordon Cooper Jr.] MA-9 flight, I went to Muchea, Australia, a place just outside of Perth. MA-9 was the last Mercury Program flight. To put things in perspective, John Glenn's MA-6 was the first American manned orbit flight with a flight duration of three orbits; Scott Carpenter's MA-7 was three orbits. Wally Schirra's MA-8 was six orbits. Gordo Cooper's MA-9 was going to be a full day. Turned out we actually flew close to thirty-four hours, twenty-two orbits. It was a big deal. We had never put anybody in zero G for that long. That was the objective, put somebody up for a day and see how he does. We normally stayed in Muchea in a hotel, but for the flight they took caravans [trailers] out to the site so we didn't have to leave. We were going to be there around the clock. Even though you couldn't see the spacecraft most of the time. It was just the unknown. You think back. Now we send them up for six months. Jesus, things changed a little.

Australia was great, the Aussies. The Australian sites during Mercury, Gemini, Apollo, and Skylab were all manned by Australians. Other sites were manned by contractors like Bendix. Goddard hired them, but Australia did their own thing. Of course we could speak Australian or English. They had an accent. We had an accent? Then we came home to get ready for Gemini.

ROSS-NAZZAL: What were your responsibilities when you came back from a flight? Did you start working on your next mission?

LEWIS: Yes, during those Mercury flights. We also worked on Gemini site requirements.

When we got into the Gemini flights, we flew twelve flights in about two years so we were flying at a high rate. We were turning them around about every two months, so you came home and got busy on the next one. Changing objectives of the flights—Gemini was the was the proving ground for Apollo. Rendezvous was new. Dockings were new. Station keeping was new. We brought on fuel cells. They were going to be required for Apollo. A lot of new things in Gemini.

I'll get into what I did after. I stopped Gemini support at remote sites about halfway through Gemini. You got busy on the next flight normally. It was between programs. Apollo was coming, and there were new things to do. There was a new vehicle. You had new documentation. You had new flight rules. Crew flew it differently. Everything in the documentation world that we relied upon had to be changed to suit the program, and each program got a little more complicated. There was more to do. Vehicles become more complex. There were gaps in responsibilities but not often.

There was a gap for me during Apollo, after Apollo 15. I'd been doing AFD [assistant flight director] work. Before 16 and 17, I and three other deputy flight directors were assigned to work Apollo 16 and 17 to give us a quick real taste of the flight director console duties on quiet shifts, like the crew sleep period or translunar coast. It gave us a chance to do simulations with an Apollo flight control team. It wasn't our team because we were just subbing on the shifts. Integrated simulations were invaluable. They pulled everybody together.

You keep me straight about where we are. I'll go back to Gemini. I flew Gemini II, III, IV, V, VI and 76. Then Kranz pulled me off. I was still the head of the Remote Site Section, but he pulled me off to lead Apollo requirements for the remote sites. Probably because I had a little more experience than some of the new guys. I had been out to the

Mercury sites. On the remainder of Gemini, I worked Apollo.

GT-III [Gemini-Titan III] was John [W.] Young's first flight, John Young and [Virgil I. "Gus"] Grissom. We had a site in Guaymas, Mexico. I was there for GT-III. We had two tracking ships; I haven't brought that up as far as the remote sites were concerned. *CSQ* [*Coastal Sentry Quebec*] and the *RKV* [*Rose Knot Victor*] were the two ships. They were converted World War II cargo ships. Equipment was put on so we could see data and talk to the crew. No radar, but they could be strategically positioned to give us some coverage when contact with the flight crew was limited.

I went to the South Atlantic on GT-II for the first unmanned flight. The test flight fired downrange. I'm trying to remember GT-IV. I went back down to Canarvon, Australia. It was the new site in Australia. It was a four-day flight with [James A.] McDivitt and Edward [H.] White. That was the last flight that we flew with just batteries. You couldn't go any longer without fuel cells—just batteries wasn't enough power.

I don't remember anything unique. Then I went the *CSQ* ship on GT-V. It was stationed off Okinawa in the Pacific. For some reason Ed [Edward I. Fendell] usually got the *RKV* and I got the *CSQ*. I don't know why that happened. You probably have met Ed. He could tell you all kinds of stories. Some of it you could believe too.

ROSS-NAZZAL: He is kind of a character.

LEWIS: I remember V because Harold [M.] Draughon, another guy that was training to be a remote site CapCom, went with us. We had two systems guys. We were on the *CSQ*. We went out in rough seas. We had to take a Navy launch to the ship. It was out in the harbor

somewhere. The launch was a landing craft like the Marines ran onto beaches, open in the front with a big door that dropped down. We were standing down in the front being jarred, just bang, bang, large waves hitting the front. Got to the ship, and the seas stayed very rough for almost the entire flight. We were in what was called typhoon conditions in the Pacific. The console chairs had pads on them. The ship would roll and pitch, your chair slid back and forth. It was an interesting flight. We had total power failure in the Operations Control Room during an active site pass. We experienced total darkness because the backup generator failed to switch over.

It was a critical flight because it was the first long flight. I think [Frank F.] Borman and [James A.] Lovell flew for two weeks. We had batteries for entry. Fuel cells were still in an early stage of development but were needed for Gemini's longer flights. Crews were very concerned about taking the go/no-go that I gave them at the *CSQ* to continue the flight off the network because it was committing them to contingency landing sites if they had to come down. Borman expressed his concern, "Are you sure everything's okay to go on with the fuel cells?" I think I finally said, "I don't think Flight would have given a go if he didn't think you would be okay."

I remember this pass very well. On that pass we had a go/no-go decision to last past the planned landing area. The flight surgeon was to personally take data from the crew. He would use the air-to-ground and talk with the crew, not the CapCom. It was always a battle between the Medical Office at JSC and Flight Operations. They thought they had to talk to the crew, and they did some.

We had to dump the tape recorder that was on board the Gemini. It was a busy pass. Ted [A.] White was the systems guy. I said, "Ted you take the data dump." Normally, I

would dump the tape recording. "You take the dump; I'm not going to have time." I said, "Surgeon, I'm going to take the air-to-ground report from the crew." I changed everything right on the spot just before the pass. We did that, and I got almost everything done. Ted got ready to hit the command to tum the recorder off and the Control Room went black, totally. You couldn't see anything—not your hand, not a light anywhere. We just sat there. What do I do? What do I do? You can't talk to anybody. Probably a minute or so later, the power started coming back up and finally got to a point where I could hear Kranz talking to Stu [Stewart L. Davis] at the next site Hawaii. I don't know what happened. I could hear them chatter back and forth. I remember saying, "Break Stu, break. The recorder is still dumping. We didn't get it shut down." We got everything else done. That was an interesting pass. It reminded me of a Sim Sup [simulation supervisor] scripting an unrealistic failure. No such thing as an unrealistic failure.

The power supply on the ship was designed to switch over automatically to a backup just like Mission Control Center. Something happened, and it didn't switch over. But they got the power up. I'm telling too many stories.

ROSS-NAZZAL: That's what this is for. These are probably not in a technical report anywhere.

LEWIS: We got on with the flight, a long flight. Like I said rough seas, seemed like the entire flight. I found out from the site manager of maintenance and operations that one of the elementary antennas on the structure was damaged by the storm. They sent a tech up on the structure to repair it. I said, "You get his butt back in here." We didn't need to send anybody out in a storm. We still had a backup antenna.

The commitment was just amazing. Back then the commitment by everybody was just unquestionable. They'd do anything. On GT-VI, I went to Hawaii with Stu Davis. The Agena blew up on launch. All I remember about that flight is we were sending Agena "power on" in a search pattern hoping we'd get a response but it never happened. Then I went back on Gemini 76. I had a lot of time on the *CSQ*.

ROSS-NAZZAL: Sounds like it.

LEWIS: Anyway, that was my last Gemini flight, 76. Gene pulled me off. It was before Apollo. We were still planning to have remote sites even for Apollo, not all of them. Communications were improving around the world. Australia had communications but didn't have the rate of data needed to send a remote site team there. We had two new ships that were better equipped. We remoted all the remote sites. They were no longer manned. We could bring back the data, the radar, and talk air-to-ground all remotely. Everything was done out of the Control Center. Mercury Control's last flight was GT-III. The Mission Control Center in Houston ran in parallel to check the facility out. On GT-IV, Mission Control was in Houston.

Apollo came. I don't know where we are in our description. Then they got into this AFD stuff. Frankly, we were losing some of the positions Gene had, the remote site CapComs he managed. He also had a position called procedures in the Control Center. They did premission work, and they did some of the real time coordination in the Control Center for moving data, setting up the computer checkpoints, etc.

Lunney still had FIDO [flight dynamics officer] and GUIDO [guidance officer]

positions. Kranz was pushing hard for the AFD. He got it. I don't think that some of the other flight directors thought we needed that position. Gene called us his "wing men."

ROSS-NAZZAL: What exactly was the role of the assistant flight director?

LEWIS: The Flight Control Division branch chiefs provided a list of personnel to man their respective positions. Lunney for FIDO and GUIDO, systems branch chiefs for CSM [Command and Service Module] and LM [Lunar Module], etc. AFDs would do anything that their assigned flight director asked them to do, if they even got asked anything. Some flight directors didn't think an AFD was necessary.

ROSS-NAZZAL: You would just sit in Building 30?

LEWIS: To some extent they manned the AFD console during simulations and the flight. The AFD work was self defined, and he assisted where he could contribute. You asked me about Apollo 11. I was lucky to be sitting right next to the guy that was in control of landing a man on the Moon. I was watching it but not specifically assign to a task. You can't have two bosses in a Control Room.

So there were limitations. The flight I remember the most as far as my AFD work is Apollo 9. I'll back up and say that overall my memory of Apollo other than some specifics was Apollo 8.

ROSS-NAZZAL: What's your memory of Apollo 8?

LEWIS: It was my birthday when they were flying around the Moon reading from Genesis. It was not planned until the Lunar Module was behind schedule and that's when somebody proposed, "Hey, we can go to the Moon anyway but quicker." There was always the threat that Russia was going to get there before we did. If we get a guy on the Moon, we'd beat them. I don't know who actually thought of the idea. I suspect George [M.] Low or Bill [Howard W.] Tindall, one of them probably said, "Damn, we ought to go do this." I don't know.

Apollo 8, the risk we took—to go back to the topic of risk-adversity. These guys, our managers, weren't afraid. They knew what their objective was and that was to land a man on the Moon in 1969 and no later. They were going to do it. There was risk involved. For example, if Apollo 13 had happened on Apollo 8, when we didn't have a Lunar Module, we'd have lost a crew. But we didn't.

Apollo 8 was, I thought, unique. It was just something I'll never forget for two reasons. One personal, and one just the risk they took and the success of it. Then Apollo 11 obviously and Apollo 13. I was assigned as an AFD on Apollo 13 as I was on Apollo 11. The flight director was the boss, and there was no need for an in-between guy. The experts that were doing the work trying to figure out how to get the spacecraft back, like John [W.] Aaron and others. Kranz didn't want somebody between him and John Aaron. Aaron was the one for electrical power status and at the simulator doing the work.

I told Lunney, "I never did view the AFD as something that was right for real time." They could be used doing preflight work. That's what I did on Apollo 9, mostly. Pete [M.P.] Frank was coming on as a new flight director, and Apollo 9 was his first

assigned flight. I don't think he was lead because it was his first flight, but I got assigned to him as AFD. I did a lot of flight rule work. He had worked over in MPAD [Mission Planning and Analysis Division]—he hadn't worked in flight control.

Apollo 9 was the first time we were going to fly full up, in Earth orbit, and all elements were included. Remote Sites, CSM, Lunar Module, an EVA [extravehicular activity] off the Lunar Module—all those elements had to be integrated and coordinated flying in Earth orbit. I worked on a lot of the flight rules and flight procedures because this was the first Lunar Module and Command Module combined flight.

I remember Kranz asked me to brief Dr. [Robert R.] Gilruth, our center director, on how we were going to string up the communications for this flight because it was all elements trying to talk to one another and they were all in Earth orbit. It wasn't somebody walking on the Moon. This guy was standing on the porch of the Lunar Module in Earth orbit. It's totally new. It wasn't going to be that different, but it was the different pieces we were trying to put together to make it like the full up flight. So Kranz asked me to brief Dr. Gilruth. I asked Ernie [Ernest L.] Randall, he worked in the Flight Support Division, he was a network controller; he knew the network. I knew more about the flight stuff.

Although I wasn't a console operator for communications, Kranz occasionally leaned on me in for Communications and Instrumentation. Later, I was selected branch chief of the Communications and Instrumentation Branch. Kranz asked me to do the briefing, but I had very little time. Ernie and I got together and we developed a presentation. I used hand drawn symbols to represent the CM [Command Module], LM, EVA pilot and ground stations linked by lines illustrating the different frequencies for each. I was drawing lines between icons. I

had a Command Module here and a Lunar Module here. I had the frequencies of the different communication systems marked on them to illustrate how it was going to be tied together and also to illustrate that if somebody got out of configuration it would be difficult to put it back together again in a short time. If you try to talk to somebody and he's on the wrong frequency and can't hear you, things can get screwed up trying to coordinate a correction.

We got it ready and called Kranz. He says, "Come on over at 5:30, and we'll go over it." It was nine o'clock the next morning that we were going to give the briefing. Ernie and I went over and went through it with him. He did not seem pleased, but he wasn't giving us any specific feedback. The presentation was the next morning. I don't remember if he just came right out and said, "I don't like it." I thought maybe my symbol graphics were oversimplified. But he wasn't really happy with us; he had his doubts, I'll just say it that way. He was almost expecting us to go back and do something different. It was already 6:00 pm. We used viewgraphs back then. We needed a secretary to do that work. On the way back, I told Ernie, "Ain't no way in hell we're going to change this thing. We haven't got time."

I was going to be giving it, so I thought we're just going to go with what we got. The next morning, I'll never forget it. It was one of those heavy Houston rains, and we had to go from Building 30 all the way to Building 1. Gilruth was on the ninth floor. God, it was raining hard. I'll never forget. Ken [Kenneth B. Gilbreath] was the chief of the Center Operations Directorate. We had to cross some of these low areas on the sidewalks. Water just filled your shoes. I got to the briefing. When I walked you could hear the water sloshing in my shoes. It was that bad.

Anyway, we went on with the briefing. Room was packed. Every significant manager was there. Gilruth had meetings like that, anybody that can get in is going to be there, all the

directorate chiefs and staff. I think Dave [David R.] Scott was there from the crew. Dave was the CM pilot, McDivitt, the commander, and [Russell L. "Rusty"] Schweickart the LM pilot were the three Apollo 9 crew.

I remember Apollo 9 as a distinct and gratifying period during my career. The communication briefing to Dr. Gilruth apparently went well When walking back to my office I wondered if Kranz and Kraft were pleased. If they were pleased that was what mattered. Usually, if they felt you could have done better, they would subtly suggest positive follow-up.

That was Apollo 9; I did a lot of hard work. I remember working all night trying to get the flight rules document put together for the rest of the team. Go home, take a shower, come back out, work. Two or three times. It was a push. Apollo 9 was the dress rehearsal, in Earth orbit, to demonstrate readiness for our lunar orbit activity for the first landing, Apollo 11.

I had a similar experience on STS-1. I'm jumping all over.

ROSS-NAZZAL: That happens in oral history. Don't worry.

LEWIS: Like I said, we couldn't have had better managers. I didn't know a lot of them but I knew some of the program managers. [George W.S.] Abbey was one of my managers back when Kranz was deputy. He was manager of Flight Ops. For STS-1, the major issues were, of course, the tile and our new Shuttle engines because they were blowing them up during development. The tile was always a questionable situation. It's not clear it was going to work the way it was intended to work. I remember thinking back on the 40th anniversary of STS-

1, just last year I guess it was. Yes. I was interviewed by a newspaper and of course the tile came up. Thinking back about it, the tile was very questionable. It was quite a procedure to get them on the spacecraft. You're fundamentally hand-gluing over 20,000 tiles onto the Shuttle. I thought back, and at the turn of the century the Wright brothers were developing their first airplane, the Wright flyer. I thought it was kind of funny. They were cutting pieces of canvas, stretching them across the wings, gluing them to the spars and the ribs and the wings. Here we are, the most technical advanced vehicle that's ever been built, and we're hand-gluing tiles onto the skin. I remember thinking this is ironic.

But the big risk was the tile. It was a concern up to launch of STS-1. It was high-risk, and there was no way to test. I went over prior to STS-1 to brief the media. I should have known better; I'd briefed the media before. I should have gotten up to speed on the tile situation, the application process and as much as I could on the engines. I got a question from somebody in the press about how they put the tiles on. I had a vague idea, but it was too vague. I just kept trying to explain not really knowing what I was talking about. Finally, I realized I wasn't getting anywhere. I recognized too as I left and walked back to my office, I said, "Man I really screwed that one up. I was not prepared obviously."

I got a call from Gene, "Kraft called." I thought, "Oh, this is the end of my career." He said, "Tell Chuck, 'I was never afraid to say I don't know.'" Then Kraft said, "Call Horner Dotts over in E&D [Engineering and Development Directorate], and he'll brief you on the tile." He was always helpful.

ROSS-NAZZAL: That's good.

LEWIS: Those are some personal stories. I'm jumping ahead. Now I don't remember some of the questions on Skylab.

We were squeezed to transition personnel for Skylab coming off Apollo. The four new flight directors were being called deputy flight directors at that point and were picked in December of '71. Deputy was probably put in front of our names just to give them an option if none of us worked out as they expected.

Skylab, we got different assignments. I got the easiest one frankly. Neil [B.] Hutchinson was responsible for the workshop activation when the crew arrived on orbit. That probably included some flight rules and procedure sequences to power up and verify proper systems operations rules.

[Donald R.] Puddy was assigned to do the launch phase of the unmanned workshop, Skylab 1, early unmanned activation and subsequent deactivation and entries. Phil [Philip Shaffer] was flight director for the manned launches: Skylab 2, 3, and 4. We all did orbit work so I had no special assignments that I remember.

One of the significant differences between Skylab and Apollo was flight planning. About the only planning we actually did was getting it up and activated. Then at the end of a manned period getting it deactivated and putting it into an unmanned operating mode. Those things we preplanned. The rest of it was day-to-day. It was everyday planning but not like Apollo.

They had support systems to manage scientific and payload disciplines, like EREP [Earth Resources Experiment Package] and the Apollo Telescope Mount [ATM]. Was a class of things to do. The details of those were already worked out so that was some preplanning. The targets, what time you were going to execute was all done, basically, in real time. Apollo

activity was all predefined and documented. We had things to do, click, click, all the time, click, click, click. You were time limited. It was all basically done prelaunch, and they executed the plan during flight operations. It was kind of a different concept, long duration, a series of months, on Skylab versus a quick two weeks. It was usually about ten to eleven days for Apollo.

Big differences. We had never done long duration type planning. One of the things I remember getting involved in before we flew was we needed more than just voice communications. We were still using the old Gemini network, with six–seven-minute passes scattered around the world. All this took planning. How'd you provide details to the crew? They didn't fly with a flight plan, and there was inadequate A/G [air-to-ground] voice time. Challenge!

I fought hard to get a teleprinter on board early on, and I'm sure others did too. But I remember getting involved in that and making a point that we've got to have a way to get information to the crew in addition to air-to-ground voice. We didn't have the time; it would take us forever to tell them what to do. Half a day would be gone. We ended up with a teleprinter and that's how we got the flight plans to the crew every day. We had three shifts. We had the typical daytime shift (execute), matched the crew when they were most active. We had the evening shift (planning). Then we the night shift (graveyard).

Execution was the day, general planning during the evening, at least getting everything blocked out for the day, and the late shift during the night. The worst one was getting all the details ready for the teleprinter. The paper was about three inches wide. You sent up three strips: commander, pilot and co-pilot timed together. That was the total flight plan. It wasn't big enough to send a page. These are three strips with each guy's assignments. It was done

with the FAOs [flight activities officers] in the backroom SSR [Staff Support Room]. That's how we got flight plans up.

There was one difference that was brutal. Shifting schedules was brutal because we started with four teams when we launched just Skylab 1. When we launched and had the disaster with the thermal shield on the workshop, we went on orbit with an immediate problem. The loss of the thermal shield exposed some of the interior of the workshop to high heat. There was no shield left from the direct sunlight. It hung up one of the solar panels, and it didn't deploy. During the flight DoD sources gave us a photograph showing the Skylab in flight.

As we suspected we had lost one of the solar panels, but one had partially deployed. We were getting a little bit of electricity out of it. You could see an angle on the panel where it looked like one wing was partially out. It verified what we were seeing in out telemetry.

We went to two teams per day on the console for ten to twelve days while they worked on how to get something designed to cover the thermal area that was exposed and how they thought they could get that solar panel fully deployed. We needed the power. We were basically rotating the vehicle in and out of the Sun. We put it into the Sun to get the batteries charged up. You could only go up so high because the interior was getting too hot so we'd roll it back to increase the battery charge. We did this right on the edge of losing the program. The program would have been lost.

I worked one team on, and I forgot now who the other team was. It was twelve hours a day for that period. For the flight director it was probably fourteen hours because you briefed the media after your shift. That took a little time. Then you had to come in and do handovers with the guy coming before and after you. We did that for about ten days until we launched

the crew up, and they could go to work on the fixes. Got to hand it to Pete [Charles "Pete" Conrad] and Joe [Joseph P. Kerwin]. That was risky business going out on an EVA to break that panel loose. It was under tension. It was damaged. I thought risky to go out and try a repair without knowing the circumstances of the damage. We weren't that great on doing unplanned EVAs at that point in Earth orbit without proper "tie downs."

It was different in that sense. I think we changed shifts so frequently that your circadian rhythm never caught up. Then we changed again. I guess it was a good thing we were young. At the end of that I had the surgery; that it was probably part of it. We ate chili dogs at a little place in the cafeteria—it was sandwiches and chili dogs. Probably ate too many chili dogs with the stomach condition I had. Anyway, where are we? Time for me to go to work.

ROSS-NAZZAL: This might be a good stopping place for us, if that's okay with you.

LEWIS: It's fine with me. I'm sorry I get emotional about some of this stuff. I think as you get older you get more emotional. That's part of it.

[End of interview]