NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

DAVID W. WHITTLE
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is February 16th, 2006. This oral history with Dave Whittle is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Sandra Johnson is the interviewer and is assisted by Jennifer Ross-Nazzal.

I want to thank you for coming in today to talk with us. First I'd like to ask you, what motivated you to apply for a position with NASA right after college?

WHITTLE: When I was graduating there was a lot of people coming in, and I interviewed with Westinghouse [Electric Corporation] and went up to Baltimore [Maryland]. As a matter of fact, I interviewed with Marshall Space Flight Center [Huntsville, Alabama] and with JSC [Johnson Space Center, then name Manned Spacecraft Center, Houston, Texas], and I interviewed with an outfit called Schlumberger [Limited], which people down here probably are familiar with. I had kind of an interest in the space program, which was really just kind of in its infancy.

To be honest with you, if it hadn't been for the Vietnam War, I would have gone to work for Schlumberger. I was already working in the petrochemical, in the oil well/logging industry. I was working for a company that did that. But the draft board was hot and heavy on my tail. They'd already called me in. I'd already had my physical and what have you, and it looked like NASA could get me a deferment. So I'd be an oil field worker if it weren't for the Vietnam War.

I got an offer from Marshall and from JSC. I was an engineer. I thought it would be interesting, plus it got me out of the war.

JOHNSON: Why did you choose JSC instead of Marshall?

WHITTLE: Because I'm from Texas. I'm from Texas. I was engaged at the time. I wasn't married, and I was going to come back and see my wife, and I just didn't want to be that far.

JOHNSON: During the interview process, did you have any idea what area that you would be working in?

WHITTLE: It's interesting. NASA was just hiring people as fast as they could get them, and there wasn't much of an interview process. A guy called me on the phone. Says, "Hi. I work in this area right here. I've seen your resume; looks pretty good. Would you like to come work for us?"

As a matter of fact, he was in the area—I've worked with him on and off pretty much my whole career. His name is Jim [James E.] Saultz [Sr.], and the area that they hired me for, I was in that same general area, but really doing something different. They had what they called the Remote Site Group. We didn't have all these nice satellites that we have right now for communications, and so NASA had tracking sites around the world. For each flight, they would send a team of people out to all these tracking sites. That was called the Remote Site Group. I was really supposed to go in the Remote Site Group, and when I came on, that was kind of in the phase-out phase, because they were trying to do it—it was a lot of money to take care of the sites, and new technology was coming in. We were flying the early Apollo flights; we didn't

have computers. We were using slide rules, literally. As we got satellites and high-speed data lines and things like that, the Remote Site Group went away.

JOHNSON: Talk to us about those first days at MSC [Manned Spacecraft Center] and your first assignment.

WHITTLE: Once I got the job at NASA, I was excited about coming down here. I came here in June of [19]'67, 5th or 6th, I think. The site itself had not been open but a couple or three years. It was very, very new. When I came in the first day, it was right down the main drag, right toward Building 1. Ellington [Air Force Base, Houston, Texas], NASA was doing a lot of processing at Ellington, and so all my swearing in and all the preliminary stuff was done at Ellington. Then I came to get my work assignment; I came to Building 1. Talked to a lady named Joyce [E.] Gaddy, and she was in Personnel.

I was assigned to the Lunar Module [LM] Systems Branch, which was the branch that took care of the Lunar Module. There was the Command and Service Module Branch, the CSM Branch, and there was the Lunar Module Branch. I was asked if I wanted to do communications or electrical power. I was always interested in communications, and so I was assigned to the LM Systems Communications, Comm [Communications] and Instrumentation Section. I walked in, and they gave me a stack of books about that tall and said, "Sit down and read all these." Those books pretty much—they described the program and the vehicle and what have you, and how the whole picture fit together. It was kind of an orientation, not of NASA, but of the technical systems. Then I started learning about the communications systems on the Lunar Module.

I came here in June. They'd had the Apollo [1] fire the previous January, and so they were kind of on hold. They were kind of in a recycle mode, trying to get back into flying again. They hadn't flown Apollo up. That was going to be the first Apollo flight; that's the first manned flight, the one that caught on fire. So that kind of gave me an opportunity to have some time to learn the systems. When you get out of college, you basically have the tools to start learning. You're not particularly smart about space stuff. Thought it was great.

The average age at the Center was about twenty-five. The general attitude around the Center was one of—very up, very positive, very "we can accomplish," very "there's no hurdle too high; there's no building we can't leap." It was just a—if you think you can do it, you can do it. There wasn't as much bureaucracy. It was just a really positive, creative type atmosphere, I thought, plus you had a lot of really young folks that do stupid things sometimes.

I was excited. I think I realized more what it was once I got here than before I came. I was sitting in this room with a bunch of other folks and reading and learning and drawing systems and things like that. I worked on a Lunar Module communications. I think that Grumman [Aerospace Corporation] was our contractor. We had Grumman contractors, a couple of them, sitting in the room with us that I knew. The contractor and NASA worked together pretty—we were pretty much a badgeless society for all practical purposes; we did the same jobs, basically.

JOHNSON: Did you have any involvement in writing system handbooks or console procedures or flight rules?

WHITTLE: All of those. Of course, you do that relative to your system. Today, if you could go to the Moon, you could find my signature up there dozens of times on drawings and console handbooks that I made, because those were stored in the Lunar Module, and the Lunar Module was crashed back into the Moon for seismic purposes. So all of those things were left on board. So I did procedures. I got to—I sat down and talked to Neil [A.] Armstrong and "Buzz" [Edwin E.] Aldrin [Jr.] before they went about their communications systems and the modes that we were going to be in and why. So, we were interfacing one on one with astronauts. We got to go to the trainers and things like that. We had our own systems trainer, the LM systems trainer we got to go see, but not operate in. But we had a systems trainer of our own. We developed—as a matter of fact, I think we were the ones who generated the original console handbook. That started in our area.

A guy named [Lieutenant] Fred R. Wentland kind of got that idea. He was an Air Force guy that was with us, and he put together something he called a "goody book." It was kind of a collection of things that was kind of important, kind of cheat sheets, something like that. Everybody looked at this and said, "Hey, that's a pretty neat idea. Maybe we ought to do that for everybody," and it kind of turned into a console handbook kind of thing.

JOHNSON: As you mentioned everyone, was relatively young. You were just out of college and so many others were at that age, and you were talking with astronauts, and you were writing these handbooks and developing these procedures. How much do you think your age or the age of your colleagues affected the space program at that time? You mentioned that it was very upbeat.

WHITTLE: I never thought about that at the time one way or the other. There was a group of older folks that were in the program management, the upper level area a little bit. But when we landed on the Moon, the average age in the Control Center was twenty-six. I don't know that it—if it had an effect, the effect would have been that we were all bright-eyed and bushy-tailed and basically saw no boundaries, no objects we couldn't get around. Most of us had not been employed by the government. We didn't know what bureaucracy was. It's not like it is today over there as far as just getting things done. Having a group that young, I don't know is particularly—you can say, well, you can only go places with young folks. I think there's a need for a mix in there, because sometimes the young people don't see beyond. They don't see the big picture as much as getting stuff done today.

JOHNSON: You also mentioned Grumman and working with the Grumman contractors in the same room. How much interaction did you have as far as did you go to New York and travel to work with them there?

WHITTLE: I went to Bethpage [New York]. That was very interesting. Bethpage was where they built the little Lunar Module. I went up there on a lot of systems reviews, things like that, and always was able to sneak a peak at the Lunar Module, so I got to see several of the Lunar Modules. All the Grumman folks that we knew down here, they were just part of us. In subsequent years, I was not real happy with Grumman's corporate attitude and participation, in that we had systems that we didn't have a lot of information on that they just kind of stonewalled us on. I didn't think that they were as cooperative and as open as I would have liked them to be. I didn't realize that at the time as much as I did later on.

JOHNSON: Looking back at that time, you mean?

WHITTLE: Yes. Well, even then. A few years later I looked back—a good example; I'll give you a specific example. In the communication systems there was what they call a high-gain or steerable antenna. If you were to go look at the Lunar Module, there was a big antenna on the very front that looks down, but that's the rendezvous radar. But on the side there's another antenna that's kind of off at an angle that goes a direction like this, [demonstrates], and that's a high-gain antenna. To get high data rates from the Moon, you need the high-gain antenna, because it concentrated the signal.

We had very, very little information about that, and whenever we would ask for it and try to get details of it, all we would do is get the runaround. I don't know why that was or why they didn't want to share that with us. That particular device was a problem child; technically, it was a problem child. I don't know. It just left a bad taste in my mouth. Now, local people, I didn't feel like that. I didn't feel like they were trying to keep things from us. I think it was a corporate thing.

JOHNSON: More of a proprietary—

WHITTLE: Well, we bought it. We're paying for it. How can you be proprietary, you know? It was built for that system. It's not put on anything else. It's not like they're selling it to everybody else. The only ones that they have are the ones that are on our vehicle that they're building. The Lunar Module as a whole, though, why, it worked pretty darn good.

JOHNSON: You mentioned you got to sneak a peak at it. What was it like that first time you saw the Lunar Module? Do you remember that?

WHITTLE: I don't know if I remember the very first time, but it was this big, huge clean room facility, and you got to go up and look at it, and, of course, that's the first time I'd ever really been up close and personal with a spaceship. It's exciting, it really is, to see something like that. Of course, it was a very awkward-looking vehicle, but that's okay. It didn't need to be aerodynamic. Did not get to go inside it, but that's understandable. I was excited to go see it. Everybody was always interested in going and see it. You'd go look at it, and then you would look at it and try to compare it to the books and things like that. You'd say, "Well, I'm thinking it should look like this," and you go and look and see how it really is, because sometimes those two aren't necessarily the same. So you were always trying to get more and more detailed information about the vehicle. In fact, you were expected to be the world's greatest expert on that vehicle, and I was trying to be.

JOHNSON: What were your hours like at that time?

WHITTLE: It was pretty much normal hours. When we were getting ready to fly, it was forty-hour weeks; nothing really special. Now, whenever we started flying, then we did just like we do right here. You would work shift work, and depending on what your specialty was. For the Lunar Module you kind of were doing housekeeping, or you were just there just in case while they were going to the Moon, because the only things that were operating when going to the

Moon was some heaters, and there was a connection in the tunnel between the Lunar Module and the Command and Service Module that ran some power across there. So you kept kind of a skeleton crew of LM folks there, in case there was some need to fire up the LM or something, questions came up, or something like that. But once you powered it up, then you had people; you had a full complement there twenty-four hours a day. The Lunar Module worked on batteries, and so you had a limited time that you were going to be able to use it.

You had ascent team. You had descent team. Those were considered critical times. Those were active times. So whenever you broke away and you were going to land on the Moon, that was descent, and that's when everything's up and running, and everybody is on their toes, because you're doing very dangerous stuff. Once you're on the ground, then you're in a—I've forgotten what they called the mode while you're on the ground. But then every time you get back out into orbit again and connected to the service module, now you're doing that ascent phase, and again, you're in powered flight. You're in a lot of things that are very critical, and so the teams are kind of divided like that.

JOHNSON: You mentioned that you came shortly after Apollo 1 and the fire. What changes were made in the Lunar Module, if any, because of the fire, that you were aware of?

WHITTLE: I'm not aware of anything that was changed in the Lunar Module. The Lunar Module atmosphere—well, I'll tell you what I think the changes were, although I wasn't intimately involved in any of that. The space program was learning a whole heck of a lot about oxygen atmospheres, and there was a lot of combustible materials that were within the Command Service Module that burnt up. So probably the biggest impact that happened, from the

standpoint of the Lunar Module, would be removing of a lot of the stuff that was combustible. So, a lot of the Velcro. I think they made their checklist cards in a material that didn't burn well, and it's treated to retard—it's a flame retardant type thing. I think that their clothes that they wore were modified to be Nomax or something like that that was a flame retardant. It's more along those types of lines. Now, they may very well have looked at some of the electrical stuff, but if they did, I'm not aware of it.

JOHNSON: Of course, Apollo 4, no LM was involved, but Apollo 5 and 6, those first unmanned flights, what were your duties during that time?

WHITTLE: I remember those as LM 3 and 4. [Laughter] LM 3, which was Apollo whatever—5 or 6?—was an unmanned, and I was kind of in the mode of watching. Matter of fact, one of the few times I've ever gotten my picture in the *Roundup* [MSC/JSC newspaper], was during LM 3 while I was kind of a gofer, helper, note taker for Don [Donald R.] Puddy, who was on console. They came in and took a picture, and it looked like I was in charge of the whole room. They published it in the paper, and I sent it to my mother. But, actually, what I was doing was just sitting there learning, because I'd never been to Control Center, in an operational mode. I was just kind of learning, watching other folks that had been around, and doing whatever I need to do. I was not actually working on the console during LM 3.

LM 3 had some capability to do commands from the ground, for attitude. They were checking out the system itself, and so they did some burns and some attitude control stuff. Then I think they reentered that over one of the oceans, because it was an orbital flight. Then LM 4, it

went to the Moon, and they did kind of a practice descent, but didn't go all the way. Then LM 5 was where they landed.

JOHNSON: Well, during that time, also, then, Apollo 7—which didn't have a LM—and Apollo 8 flew, and there were a lot of delays as far as developing the LM with Grumman. Do you remember any of those specific issues when they were rearranging those flights to accommodate that?

WHITTLE: You know, not a whole heck of a lot. I was pretty much concentrated on my systems, and I didn't pay a heck of a lot of attention to this, the Command and Service Module. Those folks were in the same building we were in. We were in building 45; we were on the fourth floor. But at one end of the hall, or on one floor there, was the Command and Service Module folks, and we were the LM Systems folks, and we saw each other and kind of knew each other a little bit, but I didn't know a heck of a lot about their systems. I knew some. I just didn't pay a lot of attention to program-type stuff. I didn't go to PRCBs [Program Requirements Control Boards]. I was just not dealing at an upper level. I was in the trenches, and I was spending a lot of time trying to become an expert on my systems.

We had some computer programs. Now, these were computer programs that ran on the big computer, because we didn't have any laptops or desktops. We didn't even have handheld calculators. But we had some very complicated onboard systems that we had a computer program that we were putting together that if you had three or four things fail, you needed to correlate those things to see if they had a commonality. I was working with that program, trying

to get it to work right, and just the regular Flight Controller type things of being as prepared as you could and as knowledgeable as you could.

JOHNSON: Do you have any specific memories of Apollo 8?

WHITTLE: That's the one that went to the Moon on Christmas, right?

JOHNSON: Yes.

WHITTLE: Yes.

JOHNSON: Would you like to share those?

WHITTLE: That was awesome. We were very, very interested in those. We watched from afar, or from down the hall, those flights. They did a lot of picture taking of the Moon. I can remember sitting and looking at hours and hours of nothing but the moonscape going by, of pictures that they took. They took a lot of pictures of the back side of the Moon, and in fact, the back side of the Moon is different than the front side of the Moon, because the Moon is such that the same side always faces the Earth. So the Earth shields it from a lot of impacts that the back side doesn't get shielded from, and so there is a difference in the two sides of the Moon. We watched that.

There was even one place that they pointed out. Says, "You know, this looks like it could be some smoke coming out of here." We all talked about that. They'd play it back and forth,

and it really did. It looked like kind of a little whiff of something, maybe, looking for geologic activity.

But the Christmas thing where they read the Christmas story, that was awesome. I watched that as it was happening on TV, and I remember very well that he ended the story as he went LOS, loss of signal. As they went over the side, he said the last words of the story as they lost communications. Now, I'm sure they did that on purpose, but it was awesome. It was awesome.

JOHNSON: The next flight carried a LM, and it was the first manned LM flight. What type of training or simulations did you participate in prior to that flight?

WHITTLE: Well, all the simulations, in my mind, were kind of similar. You kind of went through the mission phases. You went through the critical ones. Of course, the things that I would see, the stuff, I worked communications and I worked instrumentation, both of which are critical to get the information back to the Earth. If the instrumentation is not working, then you're not seeing what's happening in the instrumentation systems. If the communication systems isn't working, well, number one, you're not talking to the folks. Number two, you're not seeing the data, either. So we would go through scenarios where they would fail things. They would fail parts of the instrumentation system, or they would fail part of the communication systems or the antennas. So you're just training to react to failures of your systems.

Now, the way simulations go, they tend to concentrate a little more on things that are going to kill you. So there's a lot more of the simulations were things having to do with the

engines and the guidance and things like that that are far more important in getting the feet on the ground down there. So sometimes we would complain that we didn't get as much testing as we would like, because we felt like we were ready to be tested. But it's like when you go turn on the TV, you expect it to work, and they just expect the radios to work. They would kind of throw in a few things every now and then, but nothing major. A lot of that is learning how to use the Control Center, learning how to communicate with people, learning where your data comes in and how to pursue your data, how to help other people who might have instrumentation problems.

So a lot of that is dealing with how to deal with everybody else in the Control Center and across the world, because during those early flights, we still had remote site folks going out, and we did not have data. It's kind of interesting. A pass over a ground site when you're in Earth orbit is about seven or eight minutes, and then you might not have data for twenty minutes, thirty minutes, sometimes an hour and a half, depending on where you are. Where today, if they lose data for ten minutes, they're in a big panic. Well, we didn't have it. Now, once you got to the Moon, that picture changed, because now you have the big deep Earth, deep space satellite dishes, the three 210-foot dishes. So your time of data was you basically had data almost all the time.

JOHNSON: During those simulations, how did they affect the console procedures that you mentioned before that your area first came up with, and flight rules? Were they being updated all the time?

WHITTLE: Sure, yes. That's part of simulation. That's part of the purpose of simulations is to test the procedures and processes that you have in place, and to try to poke holes in them and to try to find areas where you overlooked. That's the name of the game. You do that, and it's not a vindictive thing. It's not an "I got you" thing. It's a, "Hey, you say you're going to do this and this." Well, there's saying and then there's doing, and so the simulation folks would try that and see if you really did it and if it worked out right, or if you didn't do it. So there's a natural process there of testing and improving your procedures, and it's not a matter of you didn't do right if they poked a hole in a procedure or you didn't have a procedure. It was a matter of, "Hey, we found a place where we can be better," type thing.

So, yes, there was a lot of that stuff going on, and that's the same way it is today in simulations. As a matter of fact, you could call up the sim [simulation] folks and say—and we would do that. We would do that. We would say, "Hey, why don't you test this case right here, because I don't think we have a very good procedure for that." They may or may not do it, but they would look at it, and if they thought it was reasonable, they would. Now, you didn't know when. It was not an adversarial relationship. It was a, "Hey, let's talk to the sim folks and get them to try this scenario."

JOHNSON: Well, during that flight you were in the Staff Support Room. Can you share some of the memories of that flight and maybe describe the relationship between the front room and the back room?

WHITTLE: Are you talking about LM 4?

JOHNSON: Apollo 9, that first manned LM flight.

WHITTLE: First manned one. You know, it's kind of interesting. The two flights that stand out in my mind exactly are Apollo 13 and Apollo 11, and I kind of remember LM 3, whatever Apollo that was, a little bit more, because that was my first flight, first time I was in the Control Center. I don't remember that particular one as being any different than any of the others. I remember being there. I remember being on console at that time. I remember the breaking off and coming close to the Moon.

We were hungry for pictures. Today you've got jillions of pictures. We were hungry for pictures and video and stuff like that on the Lunar Module. We'd get to see a little of that, and boy, we would just pore over them and look at details and identify things and see if things were like they were supposed to be. It was just different than it was today, because there just weren't that many pictures. But as far as that particular Apollo flight, it doesn't stand out in my mind one way or another.

JOHNSON: What about the relationship between being in the back room and the MOCR [Mission Operations Control Room] itself, and the controllers on console?

WHITTLE: Those were our friends. There's a hierarchy there, and the people that tended to be in MOCR were ones that had been there a little bit longer, had more experience, tended to be our Section Heads. I worked for Don Puddy, and he was the Section Head, and our Branch Chief was Jim [James E.] Hannigan, and our branch worked—we were in Flight Control Division—we

worked for Gene [Eugene F.] Kranz. There was not a putting the folks in the MOCR on the pedestal type attitude. They were just one of us. They were out there.

Probably the thing that I was unhappiest about was Gene Kranz decided that there would not be any new MOCR operators, that he had set this team up there and he was not going to take anybody. Now, if somebody left or died or something like that, he would have, but there was not going to be a progression up from the back room to the front room. Because we wanted to be sitting in the front room. That was the place to be. That's where you had visibility. That's where you had control. My guess is that what Gene Kranz's—and I'm guessing about Gene's thought process here—is that this program is only going to last for five, six, seven, or eight flights. I'm introducing some unknowns or some threats or what have you if I bring new people in. I've got these people here that are seasoned, and I'm going to try to stick with them that brought me type attitude.

But I was not happy about that, because that did not give me an opportunity to go to the front room, to excel, to be—that wasn't even a promotion. They didn't give you a promotion for doing that. You didn't make more money for doing that. But I wanted to be a MOCR operator, and I was into trying to better myself, and without that carrot out there, it kind of pokes a hole in your attitude a little bit, for me.

Now, if I go back over the Control Center now and look, it was an antique. It really was. But we thought that we were on the cutting edge of technology. We really were. The thing that I always remind myself about is that 99 percent of the people in the world would trade places with me. That was a place where there was lot of attention to, and so it was—I enjoyed being there. I just felt that that was not fair.

JOHNSON: You mentioned so many people would want to trade places with you, and it was an interesting time in the history of the nation. There were a lot of things going on outside the Center as far as you mentioned the Vietnam War and the Civil Rights Movement and the day of Apollo 6 is actually the same day Martin Luther King was assassinated. So a lot of that attention was off of that. How aware were you personally, being young, of what was going on outside the Center, as far as the feelings of the nation, and being inside the Center working toward this goal?

WHITTLE: I was familiar with the war. That was a discussion a lot in our office. We had a person in our office who was very, very, very antiwar, and we had a person in our office who was very, very, very prowar, and they were at each other's throats every morning. So I was aware of it. I had friends in the war. And to be honest with you, I wasn't antiwar. Had I not been engaged, I would have considered joining. I was in love, and I knew that if I joined that war, that I was going to be—the only way I would go is if I could fly, and you was going to be involved for four, five, six years. I just wasn't ready to leave my wife, or my to-be-wife, and that was a way to do it. I would say that I was probably—I tended to be prowar at that time. I was never a protester or I was never antiwar.

JOHNSON: When you first moved to this area, where did you live?

WHITTLE: I lived at—we didn't know anything about it, and came down here and I got an apartment up at Gulfgate [area of Houston near intersection of Interstate Highway 45 and Interstate Highway Loop 610]. There was like a set of apartment complexes up there called the Gulfway Apartments, brand-new. They had really splashy advertisements. I was going to be

down close to the beach, you know. I was really impressed about coming down and being next to the beach. I had a drastically different attitude about beaches, and it turned out I didn't do a lot of beach hopping anyway.

But a friend of mine that I had went to work for an outfit down in Texas City [Texas], and so he and I had shared an apartment, because, hey, I was making seventy-seven hundred dollars a year. I was rich. So then after he'd been down here a month or so, he went back to Fort Worth [Texas], and then I came out here in June, and I got married in August. Then from there we moved to League City [Texas]; lived in the Las Brisas Apartments at League City, which they subsequently condemned and bulldozed. [Laughter]

JOHNSON: Quite a change. [Laughter]

WHITTLE: Yes.

JOHNSON: Well, you mentioned earlier that you do have stronger memories of Apollo 11, so why don't we go and talk about that mission and what your duties were during that mission and some of the events during the flight.

WHITTLE: When Apollo 11 came along, I'd kind of proven myself a little bit as a comm expert, and so I got assigned to both ascent and descent teams, both. While we were on the Moon—at that time they had beds in the Control Center. They had a bunkroom and shower room and so I was to not leave the Control Center for the whole time that we were on the Moon, in case for some reason or other they had to do an emergency getaway. We were on a high. The way I

describe not just Apollo 11, but in general what we were doing when I talk to people, is that it felt like you were walking about that far off the ground, about a foot off the ground. You just had that feeling. There was a spring in your step. There was this attitude that "Wow, I can't believe I'm doing this. There's nothing I can't do."

I was on the LM systems, the communication and instrumentation system, still in the SSR [Staff Support Room]. Before I went in there, I'd had one-on-ones with Armstrong and Buzz Aldrin and talked about things. Of course, I was just one of a jillion people. They wouldn't know who I was. But the systems level experts go through there and talk to them about their systems and details as they're learning, and I got to do that. And not only that, they just sent me over there. They said, "Oh, by the way, go over to Building 4 at this room, and you need to go talk to Aldrin and Armstrong." It wasn't like there was a big deal about it.

During the descent—let me back up a little bit. There was a lot of discussion about what you would do if you lost communications while you were descending. There was a school of people that said, "Hey, if we lose comm, we're going to abort and go back up and not land." And there was another school of thought that says, "No, we're going to land, and then we'll sort out the comm problems when we land." These things are mission rules that get written about what you're going to do in these cases.

When we took that mission rule to Chris [Christopher C.] Kraft [Jr.], there was a lot of controversy. There was some strong feelings on both sides of that issue. So they took that and aired it to Chris Kraft, who was the MOD [Mission Operations Directorate] Director, and he heard that and he looked at that….He looked at [the guy presenting], and he says, "I think you've got rocks in your head." He says, "I'm proposing the son of a bitch is going to crash. If it does,

I want to know why. If we lose communications, we're not going to land." That solved that problem. Nobody questioned that ever again.

In fact, as we were landing, we started getting ratty signals, and we ended up having to adjust the attitude of the Lunar Module a little bit. This is where sims come in handy, because we'd done that in sims a lot of times. Just the way the antenna works and the way it reflects off the Lunar Module and stuff, the antenna patterns of the antennas were such that you would get very low signal strengths. As the attitude of the Lunar Module changes relative to the Earth, the signal was getting influenced. So we had simmed this, and what we did is we just broke—rotated 10 degrees, and that gives you a little different perspective for the antenna relative to the Earth. That seemed to solve it, and we pressed on.

It was kind of interesting. Sometimes smart people do dumb things. I don't propose that I was brilliant or anything, but a lot of us felt like—the plan was that we were going to land. The crew had had a reasonably good day that day already, because they'd got up early and they'd gone through—and then they were going to go to sleep. And a lot of us says, "That is baloney." Can you imagine them telling the crew they're going to go to sleep an hour or two after they've landed on another celestial body? And not only that, what if, in the time they're asleep, you know, all these systems that were on, if something happens and we have to get off, they're going to get off the Moon without ever having touched it. But the thought of the day was, "We're just going to go to sleep and give the crew some rest."

Well, the crew hit the ground. When they got to their end, it became immediately obvious that they needed to get off and grab something. So they redid the whole time line to get them out the door and do a scoop. As soon as Armstrong hit the ground, he was going to reach down and grab some lunar soil and conserve it, such that if all of a sudden something happened,

that we didn't come back empty-handed. And, in fact, that's what they did. Right after they landed, they were prepared. That was kind of last-minute planning, because it finally dawned on people that maybe it's kind of dumb to try to go to sleep as soon as you hit the ground.

I couldn't go to sleep. We landed. We handed over to the team that was going to be there while we were on the ground. I stuck around for a while. I walked outside the Control Center and looked up, saw the Moon, and thought, "You know, I am part of history. This is incredible. Here I am sitting here looking at the Moon, knowing that there's somebody there looking back." I reflected on that, really and truly, the thought that this is something that's going down in history books, something that I've had a part of, that I've been involved with, that I've helped make happen. I was very proud of that, and awestruck, really. I purposely walked outside of the Control Center and stood there and looked up at the Moon. It was something else.

Went back in, and, of course, we're sitting at consoles, and we're looking at the data. I'm watching data, and then time to go to sleep. I went up to the bunkrooms to lay down. My eyes were like silver dollars. There was absolutely no way I was going to go to sleep, no way. I got up, got dressed, went back down to the console, and I sit behind the guy and just watched what was going on. Just listened; plugged in beside him and just listened, watched. I was awake the entire time we were on the Moon. Then we had ascent, and it was really great. I really felt a sense of accomplishment. I felt like it was something I was proud to be a part of.

When you go back and look at the backpacks that they had on the Moon, if you look at the Lunar Module and all that stuff, it looks like something you'd build in your garage today. When you go back and look at the technology that we were using compared to today, it's unbelievable how we were single string. There was dozens of things that if it failed, we would die. It wasn't like you had three of things. The Shuttle has four computers. It can fly on any

one of them. We had one computer, and if it didn't work, you died. Well, we had an abort computer; we had two. We had something called the AGS [abort guidance system], the abort and guidance computer. So there were many of the systems were just antique by today's standards.

JOHNSON: What about the communication systems? Were there any backups? You mentioned the antennas were—

WHITTLE: No. We had an S-band system and we had a VHF [very high frequency] system. VHF system would not talk to Earth, but it would talk to Command Service Module, who could relay if he had to. So, yes, there was some backup, a little bit. Now, the VHF system would not transmit data. I was trying to remember if the S-band system, if there was two of them or one of them. I was thinking there was just one. I believe there was just one.

JOHNSON: Are there any other memories of Apollo 11 that you'd like to share, as far as the systems that you worked on specifically, or the flight itself?

WHITTLE: No, everything that we had worked great. We had no problems. A lot of that stuff is in the detail. A lot of it is looking at data. A lot of it, it's searching through the stuff, plotting trends. Where today the Control Center plots all that stuff for you, we had graph paper. We were plotting that stuff manually. We didn't have computers that did stuff like that.

By Apollo 11, we had a desktop computer, sort of, kind of, called an Olivetti Programma 101. It was kind of a supercalculator. It was probably a foot and a half square, and about maybe

eight inches tall. It would add, subtract, multiply, and divide, but it would remember a sequence of these things, and it would record that sequence on a magnetic card, a magnetic strip that was about a foot long and two inches wide. So you could write a sequence, a programming sequence, and load it in there, and then if you would—the Lunar Module high-gain antenna was not very smart. It didn't know where Earth was. So you would have to call up and give the astronauts some—we had two knobs, a pitch and yaw knob, but you have to give him some angles to put it at. Then once the antenna found the Earth's signal, it would track it, and then you didn't have to worry. But it had to get within a certain range before it would grab it and track it.

We would have to run four separate programs on this Programma 101, and then in between those programs, we'd have to get out our manuals. I don't know if you know what a CRC [Standard Mathematical Tables and Formulae] Manual is, but we'd have to look up trigonometric functions and input the data, which today your calculator does that. So what was taking us ten or fifteen minutes to do, today I could do on my hand calculator in ten seconds. Then we would read out the angles that we came up with to the crew, and they would dial them in, look at the signal strength, the signal strength there. They'd go to auto track, and then they could track it. It was a lot of detail stuff like that. I don't remember any, not just in my systems but other systems, anything that was significant.

One of the things that our Branch Chief did that I thought was great is that he encouraged everybody to learn as much as possible about the whole vehicle. So I just didn't read about and learn about the comm and data systems. I read about computers. I read about the reaction control systems. I read about the electrical power systems. So I became kind of knowledgeable of the whole vehicle rather than just my little knothole. I thought that made you a better Flight

Controller, too, because then you could better understand what was going on and how it affected you, perhaps, and how you could affect it. It made you more of a team, I thought.

Everything worked fine. The Lunar Module, from a technical standpoint, I thought worked pretty darn good.

JOHNSON: When we spoke with Bob [Robert H.] Heselmeyer, he said as part of when he worked with EECOM [electrical, environmental, and communications] and then was in the back room, a lot of what he felt like he did was monitor trends and to look for anything that was out of the ordinary. So is that your experience?

WHITTLE: Yes. Yes, that's what our plotting is, yes. You would look at stuff, and you'd call up printouts of the computer system below, and they'd bring it up. They'd bring you a stack of printouts like that, and you would trend it and look at it. You're just looking for something, trying to find the problem before it manifests itself. Now, is this thing going this way?

Bob worked in the electrical power area. I know Bob very, very well. Bob was originally part of the Remote Site Group, and he eventually became a MOCR operator during that. Bob was in this very same branch that I was in.

JOHNSON: The next flight, Apollo 12, they had the lightning strike on launch. Did that affect the LM at all?

WHITTLE: Not at all. At that point in time the LM is sitting there inside what was called the SLA, spacecraft LM adapter, and has some heater functions going, and that's it. It had no effect

on it at all. Now, we did power up and do a checkout, just to make sure. But it's kind of protected. It's kind of in a little shell there, and you have electrical bonding. Whenever they put a system together, they try to electrically bond all that stuff for EMI [electromagnetic interference] and for lightning strikes.

JOHNSON: Do you have any memories of that flight as far as your duties or any incidents?

WHITTLE: No, not really. Like I said, 11 and 13 are the ones that really stick out, yes.

JOHNSON: Okay. Well, let's talk about 13. Were you again in the SSR?

WHITTLE: Yes.

JOHNSON: Were you there when the accident happened?

WHITTLE: I was there at shift handover. I was coming on. The Command and Service Module SSR, their position was right beside ours. LM systems, Command and Service Module, and there was a chart recorder between us. I can remember so well. I was doing a handover, and when I came in, and they said, "Well, you know, they've got a problem, an oxygen problem," I can remember very well watching that oxygen quantity countdown. [Imitates sound.]

This goes back to something I said earlier. I didn't feel like we were dead. I felt like we had a challenge. I didn't feel like this was the end. I knew this was serious, and my attitude was one of, "Hey, let's talk to these guys and see if there's anything that we can do that will help

them. We'll run their trends. We'll do their charts. Any workload that they can put on us that will let them concentrate on solving their problems, let's do it." We were all there in the same place, and doesn't do a heck of a lot until they start powering up the LM, whatever we can do. And at that point in time, of course, you're thinking about the LM, but I don't know that the decision had been made yet at that instant in time. They were still trying to figure out what happened.

A lot of people don't realize that that problem happened at the very best time it possibly could have. If that problem had happened while the Lunar Module was on the Moon, everybody would have died. And not only that, you'd have got to watch them die on TV. There was no coming back. If that problem had happened while they were coming back from the Moon, everybody would have died.

The only other oxygen that was available was in the Command and Service Module, which was high-pressure bottles that were only good for a few hours for reentry. Oxygen is provided, breathing oxygen in the Command Module, is provided by cryogenics. By getting the oxygen in a liquid form, you get a high quantity. You just can't put enough gas in a bottle to last a long time. It has to be in a cryogenic form, in a liquid form.

So it could not have happened at a better place. If it had to happen, that was the right place. There was a lot of stuff happening that I knew was very difficult. Interestingly enough, we'd kind of simmed that case, and it's one of those things where they say, "Oh, why are we doing this? This is the dumbest thing we've ever done. It is a waste of everybody's time. We will never have to do burn for the Lunar Module." Turned out we did.

Do you remember the DC-10 that crashed at Sioux City, Iowa, where they lost hydraulics and they kind of flew around and they crashed in this corn field? About a couple hundred people

lived, and a couple hundred people died. That particular airport, the guy that was in charge of the emergency system for that airport, had talked them into doing a worst case emergency simulation using the guard and using the hospitals and everything. The scenario that he picked was one where a DC-10 came and crashed in the middle of the airport. He got a lot of grief about, "This is a waste of time. This is the dumbest thing we've ever done. DC-10s don't even land at this airport." And within less than a year, they had a DC-10 crash right in the middle of the airport. It was kind of the same thing there.

A ground processing problem caused that. When it happened, the way the spacecraft was wired, or plumbed, rather, not only did the tank that blew up go away, but it was plumbed such that the other tank that had oxygen in it, it had an open hole. There was not any check valves in there or anything like that. They've changed the way spaceships were designed.

There's two ways to go to the Moon. One of them is free return, and one of them is direct. Free return takes a little longer. Free return means that you shoot for the Moon. Of course, when you make your shot, the Moon's over here, and so you're trying to intercept it. But if you don't do anything at all, the Moon's gravity is going to grab you and take you and sling you around and send you right back to the Earth. Well, that takes a little longer, and so what they would do is we would get off and they would correct it to do it direct.

Then once you do direct, when you get to the Moon, you'd better be able to use your engine to slow yourself down and put yourself in orbit. If you don't, you're going to be slung out into deep space, and we won't be seeing you again. They had just made the correction to do that, and that's when the problem happened. So, now all of a sudden they had some decisions to make very fast. It had two options. Number one is I could go directly back to Earth. It takes a lot of energy, energy being propellant. It takes some precision in your guidance, and the Lunar

Module had never done this. The Lunar Module was dead right now, although they were powering it up at this point in time. But the Lunar Module guidance isn't scheduled. It doesn't have programs in it to go back, so they're going to have to generate this burn on the fly.

The other thing that they could do is they could take out this correction they just made and go to a free return. But now the question is do they have enough consumables to support the crew. Do they have enough electricity? Do we have enough oxygen in the Lunar Module? Can we get a live crew back? So you've got these competing things right here, both of which you don't want to do, and every second you wait, it makes the direct return far more costly in propellant. So very quickly you're getting to the point that that's not an option. So you've got some real time pressure in order to make this decision. And you can't make that decision until you know if you've got enough oxygen and power to get around the Moon and back, or consumables is the key word.

So everybody was in high gear, working consumables. They powered up the LM. They made the burn by orienting the LM and putting a celestial body—I don't remember if it was—I think it was the Earth. They put the Earth in one of the windows at a certain place, and then burnt the engines for a certain period of time. The FIDO [Flight Dynamics Officer] says, "Okay, put the Earth in this window in this position and do an umpteen-second burn." So that's how precision that was. So that got them back into a free return.

So now your problem was not to figure out a way to get the crew back alive. Of course, at this point in time, there was people just scrambling around, saying, "Okay, what kind of stuff do I need to bring over from the Command Module?" They still are in the Command Module and transferring stuff over. They're using the oxygen that they will need to land on the Earth when they come back. So there's a lot of interest in getting the O_2 turned off in the Command

Service Module. So there's a lot of people working really hard, really fast, on something that's got some real significant dead ends to it.

I never, ever remember an attitude or a thought process that says, "We're not going to get back." It goes back to my original thing. Hey, this is a problem, and we're going to fix this. We may not go to the Moon, but we're going to get these folks back. That was just the way it was.

I never did realize how cold the crew was. They didn't complain. We were running very, very little power. Power turned out to be the critical consumable. The Lunar Module had four batteries in the descent stage and two in ascent stage. It was designed to operate with two people instead of three. In the brilliance of design, the way they clean the air is with lithium hydroxide canisters. Well, the lithium hydroxide canisters in the Command and Service Module are square. The ones in the LM are round. They had to bring some of those over from the Command and Service Module, because they didn't have enough round LiOH canisters to support all of those folks, and that's when this famous thing you see with the duct tape and hoses and all of that.

Gene Kranz may have felt like there was more of a threat, and maybe we were just stupid over there, but I just felt like we were going to do it. There was a thump, bump. Something happened on the Lunar Module on the way back that spewed out a bunch of stuff from the side of it. We never did ever determine what that was. That gave everybody a little start for a second, for a while. We looked all over trying to figure out what that was. Some people thought it might have been a battery. Matter of fact, I think they even ended up doing a bunch of modification, changing the batteries, because of that. But it wasn't obvious in the telemetry that we saw. The batteries all worked.

The crew heard a thumping noise, followed by what they perceived was a spray of snowflakes type things that came out of the descent stage. Matter of fact, they took some pictures. I don't think they ever got a really good picture of that area, but they tried to take some pictures of the Lunar Module whenever they separated from it, to see if there was something that they could determine. But I don't think they ever decided that.

It was a nose to your display, trends; you were doing everything you could to squeeze every last second of utility out of that thing. It was very cold on board. Like I say, I don't know if they left any clothes or what in the Command and Service Module, but it was pretty cool in the Lunar Module, and the crew was pretty darn cold. But they didn't complain, at least not—whenever they had their conferences with the doctors or something, they may have said something about it, but it wasn't obvious to us in the back room that they were complaining. They were very compliant.

JOHNSON: Were you there the whole time?

WHITTLE: No. No, I was not. It was shift work, but I didn't stay there the whole time. It wasn't an Apollo 11 type scenario, where I just couldn't leave, because, like I say, I felt very comfortable that we were going to get them back.

JOHNSON: You mentioned that you'd simulated using the LM as far as doing the burns before. Was that a simulation using the LM as a lifeboat, or was that a different situation?

WHITTLE: I don't remember. I don't remember.

JOHNSON: Do you remember discussion about that prior to Apollo 13?

WHITTLE: Not a great deal. Not a great deal, really.

JOHNSON: Since before Apollo 13, the flights had almost become routine, and there wasn't as much interest in the flights, and with Apollo 13, in particular, until the accident. How did you feel about the attention of the world being focused on that situation and the reaction of the rest of the world during it, or were you even aware of what was going on out there?

WHITTLE: Well, it was in the news everyplace. Of course, we knew it. I don't remember my personal feelings being really strong one way or the other. I think it's kind of natural that you're interested in life and death situations. We always talked then, just like they talk about now with Shuttle, about how the general public kind of loses interest in that, and we faulted then, as well as now, the PAO [Public Affairs] Office and how they advertise that. It's a "what have you done for me lately" type attitude, and it's probably just normal, if you look at the way the general world works. Most of them are not space cadets. The thing about it, though, is that up in East Texas we found out a lot of those folks really love the space program, and maybe they weren't writing their congressmen a lot, but they were heavy-duty supporters of it and they thought it was interesting. I wasn't one way or the other.

JOHNSON: How accurately do you think the movie *Apollo 13* reflected what really went on?

WHITTLE: It was pretty good. They added a little bit of drama between the crew on that that I don't think was real, but the rest of the stuff was pretty good. I think the general attitude of most of the people is that it was just pretty accurate.

JOHNSON: Do you remember the simulations and the training after Apollo 13 changing significantly because of the accident?

WHITTLE: No.

JOHNSON: Nothing out of the ordinary?

WHITTLE: No. Nothing that sticks out in my mind.

JOHNSON: Is there anything else about Apollo 13 that you want to share that we haven't talked about?

WHITTLE: No, that's about it. That's about all I remember about it. Apollo 13 has—it's kind of interesting, the view that different people have. If you interview Gene Kranz, he will give a lot of credit to the Command and Service Module folks and to the FIDOs and GUIDOs [Guidance Officer]. If you were to talk to, say, Jim Hannigan, who was our Branch Chief then, and many other folks, they will tell you that a lot of the stuff that happened, from the standpoint of getting back and the standpoint of coming up with the mod [modification] on the lithium hydroxide canisters and some of that other stuff were generated in the LM Systems area, not in the

Command and Service management. They give John [W.] Aaron a lot of credit that a lot of people think belonged to people in the LM area. There was a lot of folks that think Kranz had his favorites, and they tended to be the FIDOs—the FIDOs could do nothing wrong—and the CSM folks.

JOHNSON: Well, why don't we stop and change out the tape and take a break for a second.

WHITTLE: Let's do that.

[pause]

JOHNSON: Okay, when we stopped, we were talking about Apollo 13 and your role in that. Prior to Apollo 14, you began working with James Saultz.

WHITTLE: Actually, I had worked with him before that. Jim hired me.

JOHNSON: Well, I was thinking of the Lunar/Earth Experiments Branch, that thirty-day period of time. Was that something new?

WHITTLE: I didn't spend a lot of time doing that. He started that branch, and a lot of folks went over there, but I don't remember doing a lot with Lunar Experiments. I was working on Lunar Module stuff until I went to Aircraft Ops [Operations]. I just did not do a lot of stuff with Jim.

JOHNSON: Okay. You don't remember an assignment there?

WHITTLE: No.

JOHNSON: Well, for Apollo 14 you were back in the SSR, and I know you said you didn't have a lot of memories other than 11 and 13. Do you have any specifics about 14 at all or any of the activities around that flight?

WHITTLE: No. After Apollo 13 they kind of blur. It's kind of the same thing over and over again.

JOHNSON: Okay, that's fine.

WHITTLE: The last flight, maybe the last two flights, I missed. I had transferred out. It was a case where we were kind of winding down. It was a case where Kranz had made it crystal clear that he was not going to have any new front room operators. So I was losing—I don't know if losing interest is the right way, but I was trying to find—I wanted to do something different. There was a group, the Earth Resources Group. There was a reorganization at the Center, and the Mission Operations Directorate had taken in Earth Resources. I was seeing what they were doing, and it sounded interesting, and so I was really trying to move over there.

After Apollo 11, Kranz reorganized the responsibilities within the division to take the communications away from Lunar Module Branch and give it to the Command and Service Module Branch. Actually, no, he didn't give it to Command and Service Module Branch. He

gave it to a separate organization that Ed [Edward I.] Fendell was in charge of, and I forgot what their name was. But, see, there was communications in the Command Module, and there was communications in the Lunar Module, and they had to talk together, plus they also had to talk to Earth. So there was some coordination issues having to do with frequencies and procedures and things like that that had cropped up on—I think it's on Apollo 11, really.

Kranz didn't want to make any changes before Apollo 11, but after that, he took all the communications stuff and gave it to a single group so that it would be a single coordinated effort, and Ed Fendell was the one who was—it was his group. They did the communications and the TV and stuff like that that was taking place, and also even the comm system on the Lunar Rover and all that.

So that left me with doing instrumentation, and then they added pyrotechnics to that. So, you know, the job was a lot less—it had a lot less meat to it. It was a lot less challenging, and couldn't go to the MOCR. So I was kind of looking around for someplace else to go.

JOHNSON: Well, they were making some changes to the LM, also, to get ready for the [Apollo] 15, 16, and 17 flights, as far as the batteries and those kind of things, at Grumman.

WHITTLE: The extended-duration stuff, yes.

JOHNSON: Right. Did you travel to New York to work with Grumman at that time?

WHITTLE: I don't know if I was there at that point in time or not. Again, the batteries were the electrical power systems folks. I didn't do electrical power systems. That was somebody else's

responsibility. One of the things I did was that I worked on an emergency power cable. The Lunar Module was in two pieces. It was an ascent and descent module, and whenever it left the Moon, it separated between the two and just the top half left. It was held together by pyrotechnic bolts and had some other pyros in there that separated connectors and things like that. There were two pyro batteries that were probably three inches wide and three inches tall and about eight or ten inches long, that provided power to explode those bolts to separate the things.

So I worked a project to do a cable that would connect into the main battery systems and go over and plug into the pyro systems to blow those bolts in case there was something that happened to the pyro batteries. Because if you couldn't separate, you weren't leaving the Moon. It kind of gave you another way to do that. That's about the only real thing I remember that I did. I was kind of in the mode of trying to move to another organization at that point in time.

JOHNSON: From the notes I found that when you were in New York you also talked to Grumman about potential Space Shuttle designs. That was in 1972.

WHITTLE: Yes, I was put on the early teams to do Space Shuttle design, and I was working with a guy—I was put on a team that included engineering folks. The guy's name that kind of led the team was an engineer and his name was Don [Donald R.] Smith. We were trying to do lessons learned from the Lunar Module and Command Module days, problems we'd run across, things that we would want to do different on the next spacecraft. So the types of things we were doing was when we design the Shuttle, what are the instrumentation and communication changes that we would like to make. Matter of fact, we even published a book of lessons learned—we called it the *John Commonsense Handbook,* to document the lessons learned, basically.

JOHNSON: Do you have any memories of consulting with any of these other—like North American or, I think, British Aircraft Corporation, about possible Shuttle designs in those—

Whittle: BAe [became British Aerospace in 1977], they were pretty active and all of that. They were doing the Concorde [Supersonic Transport (SST)] about then. They had just finished the Concorde, and it was kind of leading-edge, high-tech. I attended a lot of briefings where they came over and talked to us about here how's we're doing things, and here's why, and here's stuff that we found out.

Jim Hannigan and I went on a whirlwind tour. We went to General Dynamics [Corporation] in Fort Worth. We went to Lockheed [Aircraft Corporation] in Palmdale [California]. We went to the [NASA Dryden] Flight Research Center at Edwards Air Force Base [California]. I think that's the places that we went, to try to get a handle on flight testing, the instrumentation for flight testing; what do you need to put on the vehicle, how do you do it, how do they do it. Just trying to get smart about flight testing this new vehicle and the types of instrumentation that you would need to do that. That was interesting, and particularly to go see how everybody else was doing it. We saw the B-1 bomber before it was even on the street. They had a big mockup, and we went to the [North American] Rockwell [Corporation] facility right there close to the airport in L.A. [Los Angeles, California]. They had a big, huge, full-scale mockup. We went in there and talked to them about flight testing. It was kind of interesting, that piece of it.

One of the things I learned in all that is I hate the design, the early-on concept design phases of vehicles. The reason is that you work, work, work, work, work, work, work, and

everything's in a hurry. Then next week you throw it all away and start over again. So when they started doing Space Station, I stayed away from that.

That wasn't something that I thought was a lot of fun. During the flight test stuff, you know, interviewing those folks and trying to come up with flight tests, that was great. But when you start designing a vehicle and capabilities and things like that, I hated that. I tried to avoid that like the plague. I just didn't like having everything thrown away all the time. There's other people who love that. There's other people who really—that's an atmosphere they like. But it's just not something that I liked.

JOHNSON: And, as you mentioned, you moved into the Aircraft Applications Branch.

WHITTLE: Yes.

JOHNSON: Was this around Apollo 16 time, or those last flights?

WHITTLE: Yes. I think I missed the last two flights in the Control Center. Kranz's organization had taken over the Aircraft. I've forgotten what organization they were in. But somebody said that, well, that looked like an operations type thing, and so they put it in Ops.

We called it the Earth Resources Branch, and they had a number of aircraft out at Ellington that did—I don't know if research is the right thing, but they provided products to third parties, and those third parties might be other government agencies. It might be colleges. It might be special studies. Most of which was associated with environment or Earth resources

type stuff. It might be information on forest infestations. It might be atmospheric type sampling. It might be land usage type stuff.

A lot of the stuff that we did was associated with under flight of Skylab, where they had sensors on board, and we had a similar sensor on our aircraft, and so when they were going to fly over an area, we'd fly over with the aircraft. There would also be ground teams at that area to kind of do ground truth of what they had. We had a helicopter that we had up at Amarillo [Texas] where every nine days we had a wheat field up there that we were studying with a sensor that was on Skylab. So the orbital track was such that they got over that area, every nine days. So we would go up with our helicopter and we would fly over this field, too, same field all the time, and that way you provided some ground truth to what they were doing. That would help calibrate or verify their sensor, and then they could take that information and use it in other places, because they had this one place.

So every nine days we'd go up and fly that. That was a lot of fun. We had a P-3 aircraft that had a bunch of sensors on it, infrared and microwave and photographic. We traveled all over the world in that. Had a C-130. Had two B-57 F Models, which are very high altitude aircraft. All of them, each one had its own kind of unique characteristics. I really liked that. I had a good time there. Number one, it's kind of exciting, the types of stuff you're doing. You're flying. You're going places. You're doing things.

But I also felt like our products, what we were doing, was worthwhile and was good for the nation and the environment and the country. We felt like we were doing good. That was kind of an attitude of everybody there, I thought. As it turned out, Chris Kraft didn't think that it was consistent with the mission of our Center, and therefore he kind of didn't give it a lot of attention and eventually gave it away to Dryden. It wasn't a lot of money. It was like a million

bucks a year or something like that. It was small potatoes, and some of the money we were getting from the people that we were doing that for.

But I've been to Alaska, all over Alaska, way up off the north coast of Alaska, way past the Arctic Circle. We went down to Panama and flew down south of the equator, doing particulate sampling of the upper atmosphere and looking for ozone type stuff, the ozone contents at the various altitudes, and gathering air samples for—and that was by a government agency, a U.S. [United States] government agency that tries to keep track of that stuff. So, you kind of felt like you were doing good.

But after a few years—they didn't quit it until after I left, but along about the first part of the Shuttle, about late seventies, Gene Kranz called me and asked me if I wanted to come back down to the site. That is a case where—sometimes in life there's things that are fun, and there's things that pay the rent. You can choose to be a full-time surfer, which doesn't pay very well, or you can choose to go to work. That was a really fun environment out there. I had a great time, flying and doing all that.

But I'm a nonpilot in a pilots' organization. Nonpilots in pilots' organizations don't get promotions. They do, to a point, but if you go out to Aircraft Ops, you don't find any GS-15 [General Schedule] nonpilots out there. They promote pilots, and you will never, ever find yourself being a Branch Chief that has pilots underneath you. Now, you might be a Branch Chief in Maintenance or you might be a Branch Chief in some other area, but you're never going to be a part in the Ops area. So it was becoming pretty obvious that from a career standpoint, my best plan would be to go back down to the site.

People will tell you that if you're going to progress in your career, you need to be in the program. You need to be working in the area that the Center is focusing. You can't be in some

little ancillary place. Those don't get attention. Those don't get money. Those don't get promotions. So you need to be where the action is, basically. So I came back down and went to work in Shuttle.

JOHNSON: While you were there, you mentioned you were a nonpilot in this pilots' organization. But you also said you flew on some of these.

WHITTLE: I was what might be best described as a crew member. Early on, I was something called a Project Manager. My purpose in life at that point in time was you had all of these requests from these agencies out there, wanting you to do certain things. It might be infrared. It might be IR [infrared] scanning. It might be pictures. It might be microwave. We had a bunch of tools. So what would happen was these people that we did this stuff for would actually do mission requests. So my job was to go put together all these mission requests into a mission for the aircraft, and to make sure that the aircraft was properly configured, had the right equipment on it, had the right everything on it, in order for it to go do that particular flight.

The Mission Manager was the one who had the primary responsibility for that, and he would say, "Here's what we're going to do," and then you would go make sure that the aircraft was ready, and even fly, take a flight on it, where you tested all the sensors. So you flew occasionally. You would fly as—and look at the data and see that the sensors were ready to support that mission. Then the Mission Manager would take that flight and go off, and they might do that flight from Ellington. They might deploy. They might hop around the country, depending on the airplane that you're talking about. And I did that, and that's one of the areas where I was involved with Jim Saultz.

I had tried to be a Mission Manager. I had applied for a Mission Manager job, and I ended up with a Project Engineer's job, which was fun. It was touching the hardware and being on the airplane. We had a guy that was a Mission Manager on the B-57s, John [H.] Cooper, that died in a climbing accident in South America. So I took his place, and now as a Mission Manager on the B-57s, which is a very, very high altitude aircraft, and you get to wear pressure suits like an astronaut does.

So, Mission Managers, they are in charge of missions. You take the airplane, and you might deploy it to someplace and stay there a week or two. Every week I'd fly. I'd be in the aircraft going someplace. It was not uncommon to go to work at eight o'clock, and go to Canada and back, and be home at four-thirty. Or I could go anywhere, basically anywhere in the United States. It was like a normal workday for me. I could go to work at seven and be home at five, and have been to the East Coast and back. It was just fun, plus you felt like what you were doing was really, really worthwhile, that you were really contributing to something worthwhile.

So the terminology is—you tend to say, "Well, I flew on that airplane." Yes, you did, but I was the nonpilot. I love airplanes. As we got a little bit closer to the –like I say, they were giving the airplanes away, except for the B-57s, to Dryden. So at that point in time they were starting to talk about the Shuttle Training Aircraft, and I became—I was the first flight sim engineer on the Shuttle Training Aircraft. I got to participate in the early design and flight testing up at Grumman again, but out at Peconic [New York], as opposed to down at Bethpage. That aircraft was a G-II [Gulfstream II] that was drastically modified to make it fly like a Shuttle. So I spent a lot of time up at Peconic, working on that thing, watching, doing the flight tests, that type of stuff. Then when it came back, I was involved a lot in the computer systems on it, in

doing the checklist on it, in the procedures and processes that we were going to use to train the crew, the earlier tests doing that.

It was very interesting. Of course, a lot of people would think it was very interesting because you were flying with the astronauts, and all of the ALT [Approach and Landing Test] crew, Joe [H.] Engle, [Fred W.] Haise [Jr.], all of that group, we were flying with them routinely. We would go out to El Paso [Texas]. We were flying out of El Paso a lot, and some out of Edwards. We'd go out there, and we were all staying in the same motels. Most astronauts are not on pedestals. They're everyday folks, and you really didn't think much about it. It's just that you were out flying with them. It was a lot of fun.

The con is that I was on travel three or four days a week, sometimes more than that. That is not conducive to having three young boys that are in baseball and doing things like that. My wife was very supportive. She never said not one word about that. She never, ever suggested that "You stop doing that," or "You're gone too much," anything. She was absolutely supportive 100 percent, although that was a pretty dangerous job. You were really diving at the ground and pulling out at the last minute.

So when Kranz called and asked me if I'd like to come back down to the site, I said, "Well, number one, although this is a fun job, I think I would like to get a promotion someday, and number two is I really need to be a dad." So I made that move back.

JOHNSON: While you were there, were you involved in the modifications that were made to the T-38 for the chase plane?

WHITTLE: Remotely. Larry [Arthur L.] Schmidt was the Chief Engineer on that. Larry's a good friend of mine. When we would fly approaches, I could walk in the back and look out the windows, each window, and we'd have a T-38 right on our wing, so close that if I could have walked on the wing, I could have stepped on theirs. They were right tucked in really close. The modification that they made was that they made the speed brakes a lot larger. As it turned out, that resulted in some cracks and some other things having to do with this speed break system that they didn't anticipate. But I only knew it from the standpoint that I knew that they had big speed brakes, and if I saw one of those things, I could tell you that was one that was modified.

The Shuttle Training Aircraft, it had flaps that would help it kill lift, and it also had its engines in reverse thrust, which would help it not speed up. T-38 is a very slick airplane and very aerodynamic, and you point him at the ground, and it accelerates. You pull off the throttle, and it still accelerates. It doesn't have enough drag to keep it slow enough to keep up. So I know they had a lot of crack problems on those things. Matter of fact, I don't even know today if they still use those big speed brakes. I think they didn't. I think they decided that there was a plan B to do that, plus they don't chase like they used to, either.

JOHNSON: On the STA [Shuttle Training Aircraft], what type of modifications—it must have been a challenge to turn those planes into a simulator.

WHITTLE: Those planes, yes, they had a lot of modifications. If you walk into the cockpit of the STA, the right-hand side looks like a normal airplane. It looks like a normal G-II. The left-hand side looks like the Shuttle cockpit. So that, in itself, is a major avionics change. In the back of the thing is a pretty significant computer and some recording devices so that you can record your

landings, your simulated landings. The Shuttle is much larger, and just by virtue of that, it has different—if you were to sit in it, it's sort of like if you were to go drive a Mac truck and then you get into a Corvette. You would notice a lot of difference in the way it handles.

So what they did is they had a digital computer, and so the digital computer had a model in it of the way the Shuttle flies, and so whenever you were in the sim mode, and the astronaut or whoever's flying in the left seat would put—it had a hand controller. Whenever they put in commands, those commands would go to the digital computer. The digital computer would change those to commands to this Shuttle model, and so try to make the airplane fly more like the Shuttle would.

They redid the flap system. On a regular airplane like you would fly, they have something called Fowler flaps, where if you look out the window, they kind of roll out and roll down. You've seen those, I'm sure. Well, that's the type of flaps that the G-II has. Well, they took those off, and they put something called Plain flaps on them. Those flaps, if you look out on a normal airplane, look out toward the end of the wing, you'll see the ailerons, where the ailerons go up and down like that. [Demonstrates] Well, in a Plain flap, the flaps do that, so that whole section of the rear wing is now a flap, and that flap goes down, goes twenty degrees down and goes thirty degrees up. So when it goes up, it kills the lift of the wing; makes it fall faster.

The G-II is also a very slick airplane, and it tends to—slick meaning it doesn't have a lot of drag. So, when you point at the ground, you're trying to make it fall, but you don't want to get too fast, because you're trying to match descent rates. The Shuttle is not very aerodynamic, and it falls out of the sky pretty fast. So these flaps can go up and down, and they can go from twenty degrees down to thirty degrees up in one second, so they're very quick. The computer uses that to help simulate the way the Shuttle—that comes into the equations.

Then the other thing that they did is the engine reverse. Whenever you're in a normal airplane, whenever you land, you notice after you land, you hear the engines go [makes engine noise]; they come up. Well, they have thrust reversers come out, and the engine thrust goes forward instead of rear, and that helps you stop. Well, the Shuttle doesn't have engines, but the Shuttle Training Aircraft, in order to reduce how fast it gains speed going down, they operate the engines in reverse thrust. Say you level off about 42,000 feet, and you put both engines in reverse thrust. Now, the computer controls these engines, the throttle level of these engines, and so depending on how much drag you need to induce, these engines might run anywhere from just 10 percent, or 20 percent to 90 percent reverse thrust.

All of that is a part of the modeling technique of making the person who's sitting in the left-hand side of the cockpit and putting in controls, feel like they are in a Shuttle vehicle. All of that is something that's been iterative over time to get better. The crew would fly it a little bit, and then they would go fly on the Shuttle, and they would come back and say, "Well, you know, it did this and that," and they would tweak it. The crew will tell you today that that's probably the most realistic training they get, as far as flying the actual vehicle.

JOHNSON: You mentioned the B-57. That was a high-altitude plane and with the pressure suits. You flew on that, also, in pressure suits?

WHITTLE: Oh, lots of times. Lots of times. I've got over a thousand hours on that airplane.

JOHNSON: What was that experience like, being in a pressure suit and being at that altitude, which is almost space?

WHITTLE: It's above 95 percent of the Earth's atmosphere. You know, some people are claustrophobic or something like that. I never felt like that about the pressure suit. I always felt very comfortable in the pressure suit. If you sit in the cockpit of a B-57, you do like this, and each elbow is touching the sides [demonstrates]. Once you're strapped in, you can go forward like this and back like this, and that's about it. You can move your feet both forward and back a little bit. I've flown lots of flights where I was sitting there for seven hours.

It's a great view. I always enjoyed flying that airplane. You could take it and go out on a day when it was yucky and rainy and not too nice around here, and in about two minutes you're in the sunshine. It is clearer and a million [miles visibility], and you've got clouds all below you, but you're just climbing out, and as far as you can see—you don't notice it so much with your eyes, but if we would take and get big cameras, and I've got some really neat pictures, where you could take and bank up like that and take a picture, you could actually see the curvature of the Earth. You could see the really dark space stuff.

Pilots didn't like that airplane a lot, because it was kind of boring flying for them. It was not particularly fast. It had long legs. T-38, in two hours in a T-38, you're going to land, or you're going to crash. It only has two hours of fuel. Well, I flew nonstop from Anchorage, Alaska, to Ellington in a B-57, seven and a half hours.

I liked it. I liked our missions. We'd get up there and turn on the ADF [automatic direction finder] and listen to the radio. Matter of fact, my first John Denver song, *Annie's Song*, I heard on the ADF. We were up over Kansas, headed for Canada, tooling along a little over 60,000 feet—twelve miles high—and just on top of the world, just a smile on my face. That was

one of those days when I went to work at eight o'clock, and went to Canada and back, and got home at four.

That airplane, it has a lot of capability, from the standpoint of high-altitude stuff. They're using it for the Shuttle right now to take pictures of the launches. They have both of them down there during a launch with special cameras on it to photograph it going way out, trying to look at debris. But I've got a lot of fond memories of that. That was a spy plane. There was only about twenty-one of them built. It was a Korean War vintage spy plane that was built that they took a derivative of a British plane, and they took the body of it, and then put new wings and tail and things like that on it to make it to that. But NASA didn't do any spying.

JOHNSON: [Laughs] You did air sampling and that sort of thing with that, right?

WHITTLE: Really. Really. That sounds like that "yeah, yeah, yeah," but it's kind of interesting, though, because when you go places, they would think that you were spying. Most people have never seen anything like that. It has a very unique sound. You've seen it flying around here, I'm sure. There's no doubt about the sound of it. We frequently staged out of Air Force bases with that thing whenever we deployed with it, because we needed a lot of support to support the pressure suits, and we breathed oxygen generated from cryogenics. So there was a lot of things necessary to support that that we would stage out of Air Force bases. Of course, whenever you come into this thing, everybody was standing out there wondering what in the world this thing is, and then they think that you're spying.

JOHNSON: Well, all the planes that you flew while you were in that section, what was your favorite?

WHITTLE: I think I liked the B-57 best. The other one I spent a lot of time on was the P-3. I went to Alaska one time on a P-3. I was up there for about three weeks in Alaska, and some other places, and that was a fun plane. It had a lot of people on it. With a B-57, it was just you and the pilot, and you were in charge of the mission; you did your mission, and you didn't have to coordinate the activities of a lot of people. Where you're on a P-3, if you're Mission Manager on a P-3, you had probably another half dozen people traveling with you that you had to take care of and coordinate with. We took care of their rooms. We took care of everything. That, and we had a couple of helicopters that I flew on some, doing things.

But I think the B-57 would be my favorite. It's kind of unique, and you were doing fun things, plus now you're all of a sudden in a group of people that there's not many people have flown twelve miles high. You've done something that not everybody gets to do, and maybe not everybody wants to do, I guess. A lot of people could not believe that they would ever want to be locked up in a pressure suit, particularly sitting in one seat for seven hours.

Never bothered me. I'd take and we'd fly to a place, and my head was on a swivel, just enjoying it. Took my camera. Took a lot of pictures from up there. Then whenever we'd get to the place, it had curtains I could pull down, and I could just block out the whole world. I was in my own little office there, and I could do the work I needed to do. Then when my work was over with, I'd put my curtains up and be an observer. For the most part, most of the pilots, they treated you as one of the crew, and you participated as a part of the flight crew on that thing. You were part of it. It was kind of a team atmosphere.

JOHNSON: You mentioned early on that if you had gone to Vietnam, you would have wanted to be a pilot. Then you were in this group and working so closely with pilots. Had you ever thought of taking flying lessons and becoming a pilot yourself at that point?

WHITTLE: Matter of fact, I did. For what it's worth, I considered that several times, but when I got to thinking about it, I said, "You know, number one, that's five thousand-plus dollars that I'm going to take away from my family for a hobby." And that doesn't count flying on the weekends and things, or just going out and flying to have fun, which you're talking about a hundred bucks every time you go get in an airplane and fly. If you own your airplane, you're talking about hangar rent and things like that. If you're going to be a half-decent pilot, you need to fly periodically to be current. I just felt like that was an expensive hobby that took money away from my family that I could not justify. So I didn't.

I've been very fortunate in that I've been around airplanes enough, and many, many people let you fly. I got to fly a lot during *Columbia* [Space Shuttle recovery, East Texas]. I got to fly the King Airs and what have you, and I've flown a T-38. Now, the pilot was there to make sure I didn't kill myself, but frequently many, many, many pilots will let you have the stick. So I've gotten a thrill a little bit. I've landed a T-38, and I've landed a King Air.

Now, the B-57 did not have a stick in the back, nor would you want one, because the B-57 has aerodynamic characteristics at those altitudes that you're flying in a very small envelope there that either side of it kills you. So you kind of let the autopilot fly. [Laughter]

JOHNSON: Well, you got to experience it without the expense, then.

WHITTLE: Exactly right. If they'd have had a stick back there, I would have used it. Actually, the B-57 has a steering wheel, a yoke type thing as opposed to just a stick. But the back seat did not have any of that. Now, I did have the navigation system, and I took care of that. So if they wanted to go—if they wanted George to fly to a point, I was the one who put that in. [Laughter]

JOHNSON: As you mentioned, Gene Kranz talked to you about coming back and working in I believe it was the Electrical, Mechanical, and Environmental Systems Branch again, is that where you went after that? In the Flight Control Division.

WHITTLE: Yes. Yes.

JOHNSON: What we have is that you were developing systems handbooks for the Space Shuttle? Do you want to talk about that assignment?

WHITTLE: I came back down before that. I was trying to think of the scenario that went on there, the sequence. I ended up working for Dick [Richard A.] Thorson in the flight techniques area, and I worked with Harold M. Draughon. Rod [Thomas Rodney] Loe was the Branch Chief of Electrical and Environmental, I think. I went there and I went to work in the Comm area, working for Ed Fendell. I was there for a while, and then I went to work in flight techniques area. Again, Rod Loe was the Branch Chief. Ed Fendell was the Section Head, and I was in the communications area. We were doing handbooks and procedures and things like that, getting ready for the Shuttle flying.

In fact, they'd done some ALT stuff already. They'd already flown the ALT flights, or they were doing that at about the time that I came back. I did that for a while, and then I got a chance to go do flight techniques with Harold Draughon, and I did that for STS-1 and [STS]-2. Then they gave flight techniques to the Flight Director's Office, and so then I had to go look for a job, and that's when I went to work for Don [Donald J.] Bourque in Guidance and Navigation Control. The Branch Chief—I've forgot who the Branch Chief was at that point. I don't know who the Branch Chief was.

JOHNSON: Okay. Well, during that time period, also, you served as one of the leaders of one of the five flight control teams, monitoring Skylab for the reentry.

WHITTLE: Yes. Yes, I did. That was fun.

JOHNSON: Do you want to talk about that experience?

WHITTLE: That was really great. Charlie [Charles S.] Harlan was kind of in charge of all that, and he called me and asked me if I would be a team lead for that. I jumped at the chance to do that, and I'm not even sure what the timing on all that was, which pieces fit—that was before my flight techniques days.

We had several teams of about four or five people, six people. Early on there was a desire to try to save Skylab, and they were doing some work and had let some contracts to do a reboost vehicle. It was going to have to be kind of a smart vehicle. It was one that they were going to launch, and on its own, it was going to go up there and dock and reboost. They sent

some folks down to Bermuda Tracking Station and fired up the thing again, because it had been turned off except for the receiver, and kind of got it started and saw what it was and what it was doing and what the systems were, and just kind of take a look at it and see if it was feasible.

So they decided what they would do is they would put us on, and our job was to minimize the orbital decay. We operated around the clock. We did everything. We scheduled the sites that we were going to pass over. We were our own mini-Control Center of just five of us, and we were stuck up in the Control Center back in one of the back rooms there. We would see the vehicle; usually it was about every hour and a half, we'd see it once for about seven or eight minutes. But if we had an emergency or something that was really critical, we could schedule more sites up, but it was a trade-off between taking these sites away from other activities and us getting it. And it would come over; we'd send some commands, bring it up, look at the attitude, make sure that we were keeping the right attitude. We were having systems failures. The [Control Moment] Gyro [CMG] is acting screwy. We're having problems with some of the batteries, and so we'll just basically look at it and manage the systems, make sure the attitude was still hanging in there. Then shut it back down and wait till, the next site, it popped up again.

We did that for a long time until they finally figured out and decided, "Well, we're not going to get this reboost vehicle done, and so now we need to reenter it." Marshall was involved in that, too. Marshall had some really smart people having to do with the orbital dynamics involved in all of that.

Space is not without drag, and so we were keeping the vehicle oriented in a way such that it minimized drag. Well, that is harder than it sounds, because this thing has solar cells on it, and we depend on solar cells to charge the batteries. So there's a trade-off. There's some trade-off

you've got to do in keeping the solar cells to the sun and at the same time minimizing drag, because if I go around where I'm always facing the sun, then for a long time I've got the velocity vector to this big, huge mass here that is slowing me down. There's a trade-off that needs to take place. So we were trying to manage that, where we didn't run out of power, and at the same time, you know, minimize drag.

Well, later on we decided we weren't going to do that. We were going to reenter it. We did not have any control over where it landed. Probably the best way to say it, we did not have pinpoint control. We could orient the thing where it would come drag, but once it finally got in the atmosphere and really started to come in, you could not pinpoint this thing like a Command Module, where it's going to land right there within ten miles or so. So we did the best we could to bring it in over the ocean, and I think some of it ended up going into Australia.

But we were out there by ourselves. I did not have to call anybody to make decisions about can I do this, can I do that. I was a mini-Flight Director. There were, like I say, several teams, and it was shift work. We had a lot of time off between passes sometimes. The Control Center was a lot more open then than it is now. My family came out and visited a few times. We even had barbecue dinners in there. You kind of became close to those folks that you were there with and spent eight hours a day or night with.

Of course, the press always looks for the negative side of things, and according to the press we targeted Australia, but that's the press.

JOHNSON: How long were you in that assignment, as far as monitoring it?

WHITTLE: It was several months. I'm thinking six months, maybe, or three or four months, something like—it was not a week or two or three or four. It was two or three months. It was a fun job; it really was, even though I was working shift work. We would kind of rotate our shifts so that you weren't always on the midnight shift. But I enjoyed it. I had good time doing that.

JOHNSON: Is there anything else that you'd like to add today? If not, we're getting close to the time you wanted to leave.

WHITTLE: Not that I can think of. The Skylab stuff was fun. It was interesting, the information that was not available that we had to go back and try to recorrect and pull out, the stuff that just was not saved. We had to send everybody home to fill out their books and come in and copy them and everything, because I didn't even work Skylab. I was at Aircraft Ops during Skylab, so I had to learn a lot about Skylab and how it worked.

JOHNSON: How did you get chosen for that assignment? Is that something you volunteered f?

WHITTLE: No. Charlie Harlan just knew me, liked me, thought I'd be interested in that, and called me up.

JOHNSON: Well, I guess we'll stop for today and pick it up next time.

WHITTLE: Okay.

[End of interview]

David Whittle provided a number of photos that you can view from the following link.

Visit a photo gallery provided by David W. Whittle