NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

LARRY D. DAVIS
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is February 15th, 2007. This interview with Larry Davis is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. The interviewer is Sandra Johnson, assisted by Jennifer Ross-Nazzal.

I want to thank you for joining us today, and I'll start out today by asking you if you'd share some information about your background and your education before you joined NASA and how you first became interested in the space program.

DAVIS: I really can't think of a time when I wasn't interested in the solar system, planets, the universe. I grew up in Tennessee, and just looking up at the sky trying to figure out what was what, so there was always a wonder associated with what was going on out there.

I think sometime in my early teen years I discovered some scientific magazines and some science fiction magazines, so there was a kind of explosion of interest and wondering what was going on. I remember, too, *Look* magazine coming out with some visual articles. Wernher von Braun had described how he would build some ships to go to Mars, and that was displayed in *Look* magazine, and I thought that was really cool. So there was a general interest there.

I guess like a lot of people when I was growing up, you wonder if you will ever be able to go to college or anything like that. I was the first one in my family to do that. When I went off to college, I think I was like a lot of people. I wasn't sure what I wanted to do. Well, I was pretty good at math and science, so I kind of drifted to engineering. But even when I was in

college, I doubted I would ever be associated with the space program. It was kind of too much of a dream or too much of a fantasy to think about that.

But when my junior and senior year rolled around, I remember interviewing with several of the NASA sites, and I got an opportunity to go to work either at [NASA] Marshall [Space Flight Center, Huntsville, Alabama], KSC [NASA Kennedy Space Center, Florida], or here [Johnson Space Center (JSC), Houston, Texas]. I remember with what little I could understand about the job here, it sounded more fun, so I kind of stumbled into JSC because it was fun. It sounded fun, anyway.

It was an odyssey getting here. I remember the HR [Human Resources] people at JSC telling me, "Don't worry about finding a place to live. We'll help you with that. There's all kinds of apartments and housing nearby." So my first day at work I remember coming in and asking about that, and their help was, "Well, there's apartments over here, and there's apartments over there." So it was drive around in Houston in June in a car with no air-conditioning looking for apartments. So that was not a positive experience, and after about a week of that, my wife and I picked one that was furnished and air-conditioned, just to get it off our back and get started.

So my first experience with Houston was a lot of traffic, a lot of cars, and very, very hot weather. So that was kind of how I stumbled into it. I can't say, "Boy, I was going to come to JSC and work here. That's what I wanted to do." It was just kind of a random selection out of the three centers.

JOHNSON: Were there recruiters on campus at your university from NASA that were interviewing?

DAVIS: Yes. In fact, the gentleman who was the recruiter ended up being one of my line supervisors for probably five or six years when I first came to work here. His name was Charlie [C.] Allen. So that was the way I got here.

JOHNSON: What did you know about trajectory before you came to JSC?

DAVIS: That's an interesting question. I remember in college when there was going to be a launch, because I was basically in college for the Mercury Program, we would always gather in a room with a big TV, and we would all watch it, so it was fascinating to me. I had an innate feeling about trajectory. I guess I always felt like—it felt right to me. If you add energy in the posigrade direction, the thing is going to go faster; it's going to go up higher. That always felt—it was just an innate feeling. So I always enjoyed it when I got to work here. It felt like I was kind of made to do that or something. It worked out well.

JOHNSON: When they interviewed you, was that specifically what they were interviewing you to do was to work in the trajectory area?

DAVIS: Yes, it was. But until I got here and saw what it was, I'm not sure I really understood what trajectory meant.

JOHNSON: Well, you mentioned they told you that there would be apartments. When you first came to this area, it was at that same time that they were moving from those leased buildings in

Houston to actually the site here, which was then the Manned Spacecraft Center [MSC]. Did you report at the buildings, or was the site open at that point?

DAVIS: Another good question. The first day I was at work was the day they were moving from HPC [Houston Petroleum Center] to Building 30, so everybody was in chaos. There were boxes everywhere; no work was really going on, and that's kind of the way it was for the first week here. But my first day was the first day in Building 30, so I never had the experience of working up the freeway.

JOHNSON: You mentioned it was a little chaotic, but are there any other memories of that first week that stand out in your mind as far as some of the experiences of coming to this new place and in the heat?

DAVIS: I think there was a lot of uncertainty. When you come out of college, you know you've accomplished something, but as you transition to the work environment—I've discussed this with many people. I know I felt like, "Can I really do this?" There's this I think it's called the imposter complex. You feel like, "Okay, I'm putting on a good act here, but people will see through it and really know I'm not too smart and I won't be able to do this job."

So I think there was a lot of uncertainty at how I'm going to fit in and whether I'm going to be a part of this, because everybody else had been working there for maybe years—maybe months, but to me they'd been working there a long time. This was in the middle of a huge buildup. Just before I came to work and a year or so afterwards, if you go look at how many people were brought on board, it was a tremendous number of people.

I think the other thing I remember was I got all of this paperwork after I was hired about how much the government would pay to move, and I had to make an estimate of how much furniture and stuff I had. I was kind of clueless to what to put down, so I put down a random number, and I think they sent me a check for $2,000, and it wound up being closer to $200 when we got there, and I said, "I should have moved rocks from Tennessee or something and let the government pay for it, and I could have sold the rocks." But it was nice to have that $2,000 for a month or so before I had to pay it back. [Laughter]

JOHNSON: Well, where did you end up moving? Did you end up living in this area, or were you further into Houston?

DAVIS: Just on the border of Pasadena [Texas] and South Houston. There really wasn't a lot of apartments on this side of town. You really had to go north to see any kind of eating or restaurants, grocery stores, apartments. It was a new apartment. It was furnished, and we lived there for a few months and decided we could save money if we moved to a different apartment, and I think we were saving $10 a month or something, but that was a lot of money.

I remember, associated with money, when I accepted the job the salary was like $6,900 a year, and before I started to work I got a raise up to $7,050 a year in this big town. I know my roommate and I in college said if we ever made $12,000, we'd be on top of the world with money. [Laughter] Kind of your perspective on things.

JOHNSON: Right. Times have definitely changed since then. Well, let's talk about your first assignments when you first came to work and what you were working on.

DAVIS: The first few days it was chaos, because everybody was unpacking, and there was no real work going on. Somewhere toward the end of that week they gave me an orbital mechanics workbook, which was about two and a half, three inches thick, and said to digest that and read it. I thought, "Oh, my god, I'm never going to get through this. This is worse than the worst textbook."

The first part of the next week—probably my second week at work—I was rescued. I got assigned to a senior guy. A senior—I found out he'd been working there about a year; everybody was new. But he had me go down to a room where we had a punch card machine to punch cards to submit to a 7094 computer. That's the way we made our data input. So from then on I was punching cards to do parametric studies.

Parametric studies—probably people know—is you vary one parameter, like the velocity of the vehicle, and see what happens, how far it goes. If you add a little velocity, it goes a little further into the ocean, and you change the angle at which it's going, and it goes a little further or a little less. So we did a lot of those.

I was working on Gemini aborts. Basically, they had different modes of abort. They had a launch escape system early on. It would yank the capsule off the vehicle early on. Then they had a mode two abort, in which they would turn the vehicle around such that it burned back towards the Cape [Canaveral, Florida] and landed in a predetermined area near the Cape but in the ocean. If it got to going a little faster, they'd turn around and burn posigrade if something was wrong, and it would go further away into the ocean near Africa and be recovered. If it got to going a little faster, they'd burn some of the fuel and get into orbit. So it was mainly working

with where the vehicle would come down when certain failures happened during the ascent part of the trajectory.

So that was the first thing that I really worked on, and as I said, that felt intuitively right. If it was burning posigrade, it would go faster and thus move towards the orbit. So all of that felt good to me. I felt comfortable with doing that. So that was a lot better than reading the big orbital mechanics book.

JOHNSON: Did you ever get to read it?

DAVIS: No. I carried it around for a while and kept it on my desk. It's probably boxed up somewhere.

I guess I would mention that all the training then was OJT [on-the-job training]. It was hook you up with a guy that had been there longer than you, and he would teach you the ropes and teach you the trajectory software that you had to use to do the simulations.

I guess I would mention, too, the 7094 computer was really, really a fast computer then. By today's standards it was almost nothing, which are desktop; it would be at least comparable to it.

The big thing, I guess, was the day I got my own deck of cards, because I was basically punching cards for several days a week for my senior guy to use in his deck of cards, which was anywhere from two inches to probably eight or ten inches thick, because each card was giving the computer instructions how to simulate the trajectory. So eventually when you got smart enough, they made a copy of his deck, and I could start using it to modify and pull cards out and

put cards in to do different things. So it was kind of a big day when you got your own deck of cards.

JOHNSON: How long had you been there when that happened?

DAVIS: Oh, I would say a couple of months, something like that. Up until then it was punch cards for his deck.

JOHNSON: Did you at some point start supporting the mission or the simulations for the mission?

DAVIS: Yes, before that, and it's kind of hazy in my memory which came first. When I came in 1964, they had had one Gemini flight, which was an abort flight they launched into orbit and then brought back to prove the integrity of the vehicle for the entry process. The first thing I really worked on was some simulations in support of Gemini Titan II [GT-2], which was unmanned and was scheduled to launch about six months after I got there in December of 1964. We had some simulations. I mostly was watching and observing.

The thing I remember about most of the Gemini simulations, they started about two or two-thirty in the morning, and it was kind of simulating real time when they wanted to launch at the Cape. The failure rate of those sims [simulations], you'd get in, and you'd be waiting hours for the start. I would say the failure rate of getting a sim done was about 50 percent in the early days. It had to do with not only the simulators were at the Cape then, but all of the networks that they had to hook in and make work together, so it was just a real chaotic situation to make everything to come together so they could have a real sim.

So we might come in, and out of two days a week and have simulations, and they never get started. We'd go back to doing something else about daylight, and we'd try it again the next day. I do remember throughout this whole time period, from '64 on through Apollo, that kind of the standard workday was six days a week and ten hours a day. It was nothing to work a simulation on a Saturday or a Sunday. It was unusual if you had consecutive Saturdays and Sundays off in that time period.

Associated with that, there was no limitation on overtime pay, and many, many pay periods people made more money overtime than they did regular pay. It was that kind of situation. It's kind of good news and bad news; kind of hard on your family, but it was so much fun, I don't think anybody noticed. Maybe the spouses did.

I guess going on, those early sims were GT-2, as I said, I don't think I really had a good appreciation for what they were attempting to do. It was more of us there, and I was learning by observing, but I really wasn't doing that much to support what was going on. I think I really started feeling part of the team and contributing when I got assigned with my senior to work Gemini Titan IV [GT-4], which was the flight that was scheduled to launch in the summer of 1965.

The first manned Gemini flight was scheduled for March, and that's when it came off. It was just three revs [revolutions] and come back, similar to what John [H.] Glenn [Jr.] did in his first flight. But GT-4 was scheduled to be four days, which was a real leap forward. At that time the U.S. had not flown but one flight that had gone one day, the last Gemini. So that was real exciting to be working on a flight that was going to do something new and push the boundaries of what we had done.

I remember at that time frame we were really touch and go with the Russians. They would do something, and then we'd try to do something a little bit bigger or a little bit better. You may recall, they did the first space walk or EVA [extravehicular activity] early in 1965. So pretty much toward the last minute, probably late April or May of that year, they decided Ed [Edward H.] White [II] was going to do that, too, so that was put into the flight right at the last minute, and that was very exciting, to say, "Okay, that's going to be part, so we're going to do that, too."

So that was the first feeling I think I really had that I was part of the team and contributing; we were working on that, and it was actually going to fly in five or six months when we started working on it.

I remember learning a lesson in that time frame, too. When you simulate a vehicle in orbit, one of the things you have to describe to the computer program is the area of the vehicle, because the bigger the area, the more it's going to drag against what minor part of the atmosphere is there. You know, at 150, 200 miles there's still some atmosphere, so the bigger the area, the quicker the vehicle will drag down to a lower orbit.

Well, the people in our group had been doing Gemini Titan III [GT-3], had used the wrong area, and we copied their deck, so we had the wrong area in. It was wrong in the sense that they had used the area of the vehicle without the big adapter section on the back, so they had a too-small area. For three revs, it didn't matter; everything worked out because it was such a short period of time. Well, when we copied their deck, we had that wrong area also, so when we ran it for four days, the errors started to show up.

McDonnell [Aircraft Corporation] also simulated the four days, and I remember we went to a big meeting, and theirs showed more drag than ours showed, because we had a smaller area.

It was kind of a lesson in you need to check and double-check everything that's in your simulation, because it was kind of embarrassing for us in that meeting to have to admit, "Yeah, you guys are right, and we were wrong. We had the wrong area." So a lesson learned about check, double-check; your work is important. Not only don't be embarrassed, but don't do something to kill somebody. A good lesson learned.

JOHNSON: Well, and that was a simulation before?

DAVIS: Yes.

JOHNSON: Well, let's talk about the actual mission. What were you doing during that? That, of course, was the first time the [Mission Operations] Control Room was used here.

DAVIS: Yes. In fact, in that time period they just had completed building the MCC [Mission Control Center], and they were bringing it on in the early Gemini flights. As I recall, and I may have this wrong, in GT-3 they would do something called flight following, and they did some data transfer there, but they really weren't in charge of it. For GT-4 they were more in charge of it. So it took a long amount of time to go from what we would call our offline applications or offline software to getting it put into the MCC.

When you went into the Control Center, it had to be an extremely controlled environment. Everything had to be tested and retested to be sure that the simulation was correct, and you had to match that up with the tracking data and the telemetry data coming in from the

sites around the world. You'd put that together in the Control Center to make decisions. Once you made decisions, we had to send commands out through the various stations to the vehicle.

That whole configuration had to really be locked down and verified weeks before a flight. So that led eventually to you having two control rooms, and you would configure one for the next flight, and then while you were getting ready for it, you'd configure the other one, and you'd go back and forth, and that continued through most of Apollo, just because the way you had to lock that down and configure it and be sure it was correct.

In contrast to that, the people who were working in the office environment, if they saw a better way to simulate something, they can make changes in their application and in a less controlled environment. So as we started using the Control Center here, there was a sense of uncertainty was it all going to work right, and especially in the trajectory area.

So there was an offline computing facility in Building 30 that was configured, and it was called the Auxiliary Computing Facility or Auxiliary Computing Room, ACR or ACF. We could take our applications, our software trajectory simulations, and run them at the same time as they were running those applications, during the simulations or during the flight, and then we would compare results, and it would give everybody a good feeling that the MCC had been configured correctly and it was computing the correct trajectory answers. So our group would design the flights and then take our same applications and support simulations and support missions by running those applications as a check against the MCC.

So that was begun for GT-4, and the way that was set up we had our group of designers in a room in Building 30, and they were in communication with a Trajectory Support Room in the MCC, and that group of people in that room were talking to the FCR, or front room Flight Controllers. They were doing an application, and they asked us to run it at the same time, and

then when we came back we would compare answers. If it was the same, everything was okay. If it wasn't, well, we've got to figure out what the difference was.

Over a period of a couple or three years, we got more and more confident that everything in the MCC was correct. Mainly the trajectory stuff for Gemini was obviously a low-Earth orbit, and we were concerned about could we maneuver a vehicle accurately. Could we track it and know where it was? Could we get two vehicles together in a rendezvous? That was kind of what the trajectory challenges were for Gemini.

As we moved to Apollo, and I'll just tell this a little bit, the trajectory concerns were much broader, because you were going to leave the vicinity of the Earth and go to the lunar sphere of influence, and that in-between was a lot more unknowns and a lot more trajectories. So because that happened, even though you had got confident of the MCC for low-Earth orbit, you had this unknown again as you went to the lunar or the Apollo phases.

So the need for that unique or offline verification continued on through Apollo. So we kind of did the design, and then we supported sims. It was a do the design, and it keeps changing right up till the flight, but at the same time you were supporting simulations of maybe what you designed a month ago. You still were doing the new version this week, but just kind of back and forth. It was two fun jobs.

What was really, really fun was you would do some work on Tuesday, and somebody would use it on Thursday, and you could see it was being used, and it was, "Oh, boy, this is great," you know. "I've got to be careful; it's got to be right. But, hey, they're using it. It's what I did." So that was pretty cool.

JOHNSON: I can imagine it would be, especially for somebody as young as you were at that time, and so many of the people working there were so young.

DAVIS: Yes, most were in their twenties.

JOHNSON: Right. It was an exciting atmosphere, I would imagine. Well, if you want to, just go ahead and talk about some of the missions, and specifically the ones you worked on.

DAVIS: Going back to GT-4, Gemini Titan IV, it was flown in the summer of 1965. I remember, having been there just a year when that flight was over with, that it was real exciting. Ed White had done his thing, and it was four days. It was getting us back in the competition with the Russians. I didn't have much vacation time, but being a thousand miles away from Tennessee, I was able to slip away for a week. I remember it was real easy to get photos from a flight, so you'd go over, and I got a notebook full of photos. I remember how neat it was taking those home and showing them to people and saying, "Hey, you know, I was part of this."

You'll have to excuse me.

JOHNSON: That's okay. No, that's fine. Yes, I can imagine it made you feel very proud, and I'm sure it made your family feel very proud of you, too.

DAVIS: It was kind of interesting. It was starting to feel part of a team, and that theme will keep coming out as I talk to you. Interestingly enough, there were some people that didn't believe it was really happening, so, those were interesting conversations. I guess I learned over the next

two or three years that you really didn't get into arguments with those kind of people. You would reach a certain point where you would just have to change the subject and move on. But being in a rural area in Tennessee was still pretty much a Bible belt, so there was a lot of black and white. If you believed this, science didn't disprove it or anything.

So it was another maturing process. I think when you leave a small-town environment and go off to college, you go through one transition, and then maybe if you move a thousand miles away and work with a different bunch of people, why, there's another maturing process. So then going back, you have to realize when to shut up and move on to a different subject. That was kind the downside of going home and being proud, but still it was a minor thing compared to the other good feeling.

I guess the next flight I would talk about was—let me mention the Russian thing a little bit right here. It's kind of interesting, because we were all the time getting a—a state vector is a minimum description of a vehicle's trajectory in orbit. It has six or seven parameters, a time, a velocity, the angle it's traveling, latitude, and longitude. If you had those six parameters, you know where a vehicle is and you know where it's going. So occasionally we would get from somewhere—and I guess I found out later it was from the Air Force—we would get one of these, and they'd say, "Okay, what was the Russians doing?"

So another thing that was fun in this time frame was you'd get those, and you'd try to figure out what the Russians were doing. In this time frame they launched two vehicles and they got them close together. They didn't really touch or rendezvous. We got to try to take their vectors and figure out what was they doing and did they really get close. So that was another intriguing part of the job. You were kind of keeping up to the Russians. These things would roll down to us, and we'd try to figure out what they were doing.

At one time they put three vehicles into orbit, and they were trying to get them together, so it was kind of interesting. We were always saying, "Okay, when will we do something that's one up on them?" That was kind of an added cherry on top of the job, to get to do that, so I remember doing that.

The simulation support that I mentioned earlier we did for every Gemini flight, so it was every one we were supporting. The next flight that I really got to do all the work myself, which felt good, was the Gemini Titan X [GT-10], and that was real challenging. We were planning to rendezvous and dock with an Agena vehicle, which was to move towards proving that we could do that sort of thing. If you probably remember them—I'm going to bounce around a little bit. I'm talking about [GT-]10 now; I'll go back to 8 in a minute.

Ten was the one that I was doing the trajectory design on, so it was one of those things where I had ownership, and we were docking with an Agena. What we were doing was really cool then. The Agena was just a big gas tank with an engine on it. The Air Force had built it for some of their programs, and we were able to use it. We stuffed the nose of the Gemini vehicle into a docking adapter on the back of it. After that was successful and everything, the next day we were able to turn its engine on, and we took our total vehicle up to about 750 miles high, which was way outside the limits of anything we did.

We had to do a lot of work such that the low point of that orbit, which was about 160 miles, was over the right place of the Earth so that if they needed to undock and deorbit right quick for some reason, that they'd have enough energy in the Gemini vehicle to do it, because if you tried to do it at the low point, you didn't have enough energy to bring the high point down and reenter the atmosphere. So it was a lot of extra work to be sure we positioned that maneuver such that they always could get back down if they had to.

Some great pictures came back from that flight, much higher up so you could see a lot more curvature of the Earth and a lot more views of the continents and things. So that again was this great picture. It was just wonderful to go get those.

My wife was expecting in that time frame, and it turned out the due date for the baby was almost exactly the due date for that mission's launch, so I sweated through the whole thing. It turned out my son was born the day before launch. He and my wife were in the hospital during the whole flight, and they came home the day the flight ended, so it worked to be just exactly perfect. But it could have been another day or two one way, so I remember those two and associated some personal events with the Gemini Titan X. It was real cool. So that worked out well.

Gemini Titan VIII, if you remember, it was [Neil A.] Armstrong's flight, and that flew earlier in 1966. In our simulation of the trajectory, when we did a deorbit simulation, the first thing we did was we put in what we called a separation burn—it was about ten feet per second—to get away from the Agena vehicle. You're docked with it. You don't want to start a deorbit burn until you get some separation, so you would back away a few minutes, orient, and do your deorbit burn to come back if something was wrong.

During that flight they docked successfully, and everything was okay for an hour or so. Then the thrusters failed, and Armstrong thought that the thrusters had failed on the Agena vehicle and it was spinning them up. Well, he undocked successfully and found out that he was still spinning, so he had to activate the entry control jets to get control. He had to deactivate the primary jets on the Gemini vehicle and activate his entry jets. Well, as soon as he did that, it was an emergency deorbit situation. He had to come in, and he had to land in the Pacific Ocean near

the Japanese—Chinese continent, which was a contingency we never, ever planned to land on unless something was wrong.

In the time period right after the emergency was declared, we were running emergency deorbit computations in parallel with the MCC, and we kept getting twenty seconds difference. Every time we ran it, it was twenty seconds different. What we had failed to do was to take the sep [separation] burn out. The description of where the vehicle was already had that in it, and we didn't know it, so we were putting a second sep burn in; the MCC was not. We finally figured that out, and then we were back within a second or so.

But that was kind of a scary time, an emergency situation; our simulation was different than theirs. It was a miscommunication. What we were getting describing the vehicle's position in space versus what we were simulating after that. That, again, was an interesting situation. It really came down to communicating, and when you're in a hurry-up environment, it's easy to miscommunicate what was happening. So that was another lesson learned.

I'm kind of jumping around in the questions. They all kind of lump together.

JOHNSON: That's fine.

DAVIS: I think as the summer of 1966 moved on, and we'd done the Gemini Titan VIII, IX, X, it was obvious we were getting to the end of the Gemini Program. There was two flights left. In all of our minds we were beginning to wonder when we were going to move to Apollo, because I would say 10 to 20 percent of the people in the trajectory area were working Apollo, but 80 percent of us were still working Gemini. So there was this feeling of, "This is really fun, and I'm

really enjoying what I'm doing, but the future's out there. When do I take the jump and move over there?"

I remember I didn't do too much work on Gemini Titan XI. I was talking to some people about that. I had almost forgot what we did on that flight. They launched the Agena, and one rev [revolution] later we launched the Gemini. That's ninety minutes, and we rendezvoused with that vehicle less than ninety minutes later, which is just astounding, in a sense. You've got to accurately track the first vehicle. You've got to compute when you're going to lift off, how high you're going to go, and you've got to do all that in a very few minutes. That worked out really well. We were able to do that.

That was a simulation of what might happen on the Moon if there was a failure of the LM [Lunar Module] and it had to lift off right away. We'd have to do that. When we accomplished that, all the goals of the Gemini Program was pretty much over. The only problem we had continually had was with EVAs. The guys would just get very, very tired very, very quick when they were doing space walks, EVAs. We were beginning to learn that you had to have feet constraints and things to essentially lock them down, because any body movement of their arms, hands, would make them unstable.

So they decided that Gemini Titan XII, the one that flew in November of '66, they would focus almost entirely on EVAs, and they were able to build foot constraints and do some really meaningful tests on that flight. As I remember, it was Buzz Aldrin who did all that, and it worked out really well. They didn't wear him out. He was able to do meaningful tasks. It was a good feeling. It was kind of the last thing left to do with Gemini to get ready for Apollo.

I remember the last orbit before Gemini Titan XII deorbited and landed. As the vehicle passes over the ground sites, some of them were not going to be active for Apollo, and I

remember them signing off for the last time. That was sad, but it was neat to be there. So many things that make me feel sad.

JOHNSON: Well, yes, that's perfectly understandable. There was a lot of emotion going into those projects, and like you said, a lot of long hours and a lot of dedication by the people that worked there, so I can understand why there was a lot of emotion attached to the vehicles as well as the people that were in them.

DAVIS: Yes, some of these people had been going to these remote sites around the world for eight years or so, so just the fact they were going to be decommissioned, and that particular site and that particular group of people, it was pretty emotional. A lot of the people were out on ships, too. We had four or five ships around the world, and those guys would be out there for months, because you'd have the launch plan and it would slip, and they'd have to be there on station. It took days, if not a couple of weeks sometimes, to get to these remote sites, because they were remote because there was no land to build a station on. That's why they had to be there. But it was kind of emotional to hear those go down the last time.

JOHNSON: Well, during that time you were working, you explained the Auxiliary Computing Room, but according to my notes, you were also in the Flight Dynamics Staff Support Room [SSR] part of the time as a Trajectory Support Team Chief. What was the difference between those two positions?

DAVIS: That's something I should have talked about in more detail. The people in the room—let's talk about communications. The front room, the MCC, the FCR, or whatever you want to call it, was where they were running the MCC applications to simulate the trajectory. The Staff Support Room that you alluded to was a go-between between that front room and the group of people in Auxiliary Computing Facility that was using our standard applications to do the trajectory simulation.

So the people in the Auxiliary Computing Room were actually running the computer decks on 7094 computers, and if they got a request to do a rendezvous simulation or do a deorbit simulation, they actually were shuffling cards. They were getting a description of the vehicle where it was in orbit, that state vector I talked about. They were slipping a card into the deck to simulate that, and they would go hand it to a computer operator, and he would start the computer. A few seconds or a minute or two later the answer would come out on paper. They would bring it back. Somebody in the Auxiliary Computing Room would either put it under a TV camera or read some information to the Trajectory Support Chief in the Flight Dynamics SSR.

His job was to go between. He'd be looking at the real-time displays that the front room guy had, and he'd be comparing it with the information that he got from the Auxiliary Computing Room. In some cases the MCC could not be configured to do some of the things that the ACR could, because of the limitations on his time to get them locked down. So in some cases, and especially in Apollo, we had more capability than they did, so there was a verification and some additional capability.

That guy in the Trajectory Support Facility had different and more responsibilities. The guys in the room were running their individual decks. The guy over there had to have an understanding of what was going on with the mission control team, understand the processes that

was being run in the ACR, to some degree understand the processors in the MCC and the limitations they had so he could give an intelligent recommendation to the guy out in the front room. So it was a transitional position. They had to know something about both, I guess you would say.

I transitioned from the ACR to the Trajectory Support Chief, Gemini X, I guess. So I was over there for Gemini X and the rest of Gemini and then up till Apollo 12.

JOHNSON: Was that a normal type of progression to start out in the ACR and then move to the next?

DAVIS: Yes. It was interesting. When you start out running decks in the ACR, you were happy doing that, and then after a while you wondered, "Well, it would be fun to be sitting on the com [communications] loop, talking to the guy in the Control Center." Then after a while you think, "Well, I could do that job over there. I'd like to do that. It's more fun over there." So, yes, it was a feeling of I wanted to go do that.

There was still the somewhat military discipline, Gene [Eugene F.] Kranz school of doing flight control, because the first flight I worked over there—I think it was GT-9—and the way you transitioned, you transitioned to an unimportant shift over there, because it was a three-shift operation. So you transitioned to an unimportant shift, and if you did that okay, you moved up to the prime shift or the most important shift.

So I remember that you always made mistakes, so there was always just beating on the head—"You've got to do better. How could you be so stupid?"—that kind of approach to learning about the job. So I can remember episodes of that, and then I can remember, "Okay, I

believe I've got this down," and then as you grew a little bit, you felt confident, and you could teach other people how to do it, and that felt good. So, yes, there's a natural progression, but you went through some screw-ups and some bad days before you got there.

JOHNSON: When you worked those unimportant shifts, did you move first as sitting next to someone else that was doing it, or did you just start doing it yourself?

DAVIS: No, it was OJT. You started sitting, watching somebody do the important shifts, asking questions. Then when you transitioned to the unimportant shift, you did simulations and went through a certification process to say, "Okay, in these series of sims, he did okay, so we'll put him on the unimportant shift." The guys out front that you worked with and for, they would give an evaluation after you worked that unimportant shift for a flight, and if you progressed normally, then you'd have an opportunity to move up to an important shift on the next flight. So it was that kind of a progression and that kind of certification.

JOHNSON: Well, you mentioned some of the early Gemini flights, and there were some problems as far as the rendezvous. As you mentioned earlier, one of the purposes of Gemini was to get those rendezvous down for Apollo, but there were some problems in those first ones. Gemini V, it was unsuccessful, and they ended up doing that with a point-in-space rendezvous and the failures of the Agena vehicles. How did those failures affect what you were doing, and were they serious disappointments, or did you look at them as a learning opportunity to move on to the next step?

DAVIS: They were very disappointing. They were disappointing in that we wanted to progress and do more and more complicated things.

I would have to say if there was one reason for Gemini, it was probably to—well, it was two reasons, if you go and read the history. One was to prove guys could survive in space for two weeks. That was kind of the limit that we saw in going to and from the Moon. If we could do two weeks, why, that was probably enough to support all contingencies.

The other one was to demonstrate rendezvous. Today we take rendezvous for granted, but then it wasn't clear—even the Russians hadn't demonstrated they could do rendezvous. They got kind of close, but they never did.

So in the early Geminis, it was really, really important could we do rendezvous, and that was heavily trajectory oriented. You had to know where one vehicle was, and you had to target the second vehicle to go get to that area. That involved you would do a maneuver—you'd have to use tracking stations around the world to tell you how well you did it. You'd get that back in, and you'd compute the next maneuver to take care of any errors. So it was a real back-and-forth job between the tracking stations around the world, simulating the next burn, and that was something that was heavily trajectory, so we felt real ownership of that particular Gemini objective.

The failures of the Agena was very disappointing. Between Gemini Titan V and Gemini Titan VI and VII, we had failures, and we couldn't do that. The Gemini vehicle was okay. We had the "angry alligator," where the Agena wouldn't open up so that we could do the docking.

I would say one of the most unique memories, besides the Gemini Titan and my son being born and all that overlap there, was GT-76, as they called it. We were all set to go launch [GT-]6 and rendezvous with Agena. We had our failure, so the thought that somebody had was,

"Okay, we'll launch [GT-]7 first. Then we'll launch 6 and rendezvous with it, and that will satisfy some of these objectives."

You have to understand we were really, really schedule-driven. We had to get these twelve Gemini flights in and demonstrate rendezvous and fourteen days, and get the EVA stuff squared away, and we had to get that done early in 1966 in order to move on to Apollo in '67, '68. So there was tremendous pressure to try to get the fourteen days in and then keep working on rendezvous.

So we launched GT-7 in December, and I think it was about four days later—it's probably unimportant—a few days later we counted down to launch of GT-6. As I said, I was in the ACR, and I was there. I was the one on the loop that day.

When it ignited and shut down, first of all, it was extremely nerve-racking. In retrospect, the commander said he probably should have ejected, but why he didn't, he didn't feel any sense of movement. He had been a pilot; he said that was more important than doing what the book said, which was the thing lit and we didn't go anywhere, so I believe we're all right. As I remember, they discovered that a dust cover on one of the engines had not been removed, so when it tried to light, there was a failure mode. It just sat there.

We all went home or went to a bar somewhere, because we were through. GT-7 was in orbit. The next team came in, and the rendezvous was off. Well, we got a call within six or eight hours, and it was not. We know what's wrong, and we're going to launch in two or three days, so we did. So we went from a failure to having a pretty neat crew. It was very good. But we left, and six hours later everything had changed.

That happened more than once in those programs. You think you'd had a failure. You thought everything was over with for several days, and you found out, no, it's on. So Gemini-76

was a failure that turned into a very neat flight. I do remember after the rendezvous; it was like on the maybe eighth or ninth day, and they had the nose-to-nose thing, and a really neat set of pictures came out of that, too.

The Gemini VII crew asked about reentering early. If you think about it, they'd been sitting in that Gemini capsule for ten days now, and I'm sure they were, if not claustrophobic, very, very tired of it. So they requested that could they come down early, and because we had this fourteen day objective, "No, we're going to go the whole fourteen days." If you remember looking at pictures of them when they got back, they looked like kind of old men, hunched over. I can't imagine sitting in that vehicle for fourteen days. It looks like—a Volkswagen looks big compared to what they had.

So Gemini-76 was very positive for Christmas.

JOHNSON: What kind of interaction, if any, did you have with the crews themselves?

DAVIS: That's a good question. We had one semi-direct—I won't say every day we saw the crew. We provided trajectory data for them to run the simulators for the crew, so there was some interreaction when we helped set up their particular simulations, they would want to know information about it.

I remember meeting Ed White in that regard. So that was kind of a bond when you really met an astronaut and thought you were doing something to be helpful to him. It was more through helping them sim the trajectory part of their training. That was the kind of an interrelationship we had with them.

I would say, too, there was a situation where we were working late one night, and John Glenn came and just walked around the offices thanking people and that kind of stuff. It was long after his Mercury flight, but it was kind of neat for him to walk through the offices and shake hands. You got a picture of it and had it signed and that kind of stuff.

So those interactions were important. I think that changed later on in some of the work I had, that it was further down the list, because I got to doing different stuff, which made the interraction a little bit different. But in that regard, it was just helping their simulations.

JOHNSON: You mentioned that there were people working on the Apollo trajectory at the same time you were working in the Gemini trajectory areas. How did that work? I know it was a small percentage of people at that point, but did they pay attention to what your group was doing, and was there a lot of interaction between the groups?

DAVIS: I don't remember all the details. In general, there was not a lot of interaction. I would have to describe it as actually we were doing more advanced programs.

I'll give you an example. One of the big deals that they were trying to do early on with Apollo was test the heat shield for the high-speed reentry from a lunar trajectory. The kind of entries that we had if you were in low-Earth orbit didn't require near the heat shield capability, because the velocities coming back were noticeably different. So they had a couple of flights where they essentially took the Apollo vehicle to a high altitude and drilled it back into the atmosphere by burning into the atmosphere.

So they were doing those kind of tests, which were strictly Apollo-related and didn't have much overlap with us demonstrating rendezvous and that kind of thing. So there wasn't a lot of

talking with them every day. They were down the hall; they were in the same branch most of the time. But it was a totally different group of people, and I think that's why we in Gemini were wondering, well, what's going to be our job over there, and how are we going to fit in? Typical, you know. What's our role going to be?

It turned out I would say that we had a lot of experience that they didn't, when push came to shove, so most of our guys stepped right in and took over a lot of responsibilities. The Trajectory Support Chief, the ACR and stuff, that became 100 percent of our job as we moved into Apollo, so they never really supported that function. The ones of us who were experienced in doing that on Gemini pretty much just stepped right up and was 100 percent of the ones that did it. That was kind of neat. That would have been depressing, I think, if we had lost that job, because it was fun.

I remember one of them did the first orbit design, trajectory design, for Apollo 7, but I didn't feel any jealousy or loss of responsibility, because I was doing my other fun job, and it was fine for him to do the preflight trajectory, because I thought the other stuff, the simulation support and the mission support, was much more fun. In fact, we became a section, a group that that was our responsibility. There was ten or twelve of us. That was our prime job. That's kind of a slight organizational change, but that was cool. It was good.

JOHNSON: I think you were probably used to organizational changes before it was over with.

DAVIS: Well, you mention organizational stuff. For the first five years at work I don't think I spent five minutes thinking about organizational and who my boss was and who my Branch

Chief was and if I was going to get a raise or an award. The work was so much fun, it was just all-consuming. Office politics and that sort of stuff was just inconsequential.

Now, in the seventies that changed. [Laughs] We'll talk about that later.

JOHNSON: Well, let's talk about that transition to Apollo, at what point did that happen, and what your first duties were. You mentioned that your group continued on in those same positions, but in those first Apollo simulations on the manning list we have you working on that network simulation, too, in 1966, so if you have any memories of that.

DAVIS: Well, the first thing I'd have to talk about was the Apollo fire. If you remember, we finished up Gemini in, I believe, November of '66, so 1967 was a real downer year. It started with the fire in January, but that really put a halt to our lickety-split pace of launching flight after flight after flight every two months, doing something new and exciting. It just didn't happen in 1967.

That was really the bad news for the program, but it was kind of a breathing spell, and it aided the transition of us from Gemini to Apollo, in a kind of selfish way, because there was less going on. It was easier for us to catch up on some of the nomenclature and understand what had been going on. That was my first experience with a slow time. Us Gemini guys, us simulation flight support guys didn't have much going on. It was, "Okay, what am I going to do when I come to work today? There's not two trajectories to do and three sims to support. You know, what's going on this week?"

I do remember, and I meant to look up the year of it—I believe it's 1967—we flew an unmanned LM. The thing I remember—it had several objectives it was supposed to accomplish.

It was ground controlled. I remember a personal incident associated with that and then the overall feeling about the mission.

The plan was you launch this unmanned LM, and it goes through a series of maneuvers to demonstrate the descent engine and the ascent engine and the computers and the control abilities, and what the guys on the ground have learned how to do, and that whole team of vehicle and people on the ground.

One of the parts that I got to work on was the computer on board this vehicle that kept up with where it was wasn't as perfect as the MCC computers at simulating the trajectory, and that was primarily because it didn't get data as often from the ground network to know where it was. Also, it was a pretty small computer. It wasn't one of these big, hunk-up computers like we had on the ground. So it had limited capability to project ahead where it would be and to compute a maneuver accurately. It just wasn't as capable.

So we decided we would do something called double integration. We would take our best information on the ground, and we would take where it thought it was, and we would figure out what it was going to do. It was kind of it'll think it's doing perfect, but we'll know it's really not perfect, and we'll be able to tell it where it's really going. We didn't want it to deorbit itself or do something that would be out of its limit. So whenever it did a maneuver we were going to follow, we'd know really where it was; it would think it was somewhere else.

I remember I had to go explain what it was going to do to Chris [Christopher C.] Kraft [Jr.]. I had a lot of respect before I went to do that, and I had a lot more after I went, because he knew more about what I was talking about than I did. I was amazed that he was knowledgeable enough that this little part of the much bigger picture of the Apollo Program, he knew what we were doing. All his questions were very insightful, and I really gained a lot of respect for Dr.

Kraft in that one one-on-one meeting where I had to go explain what we were doing. So I remember that.

When the mission came about, again we left the Control Center thinking it was a failure, because we more or less lost control. The vehicle, the hardware itself, did not perform anywhere near what we thought. I remember getting up and reading the paper the next morning, and the paper said it was a big successful flight. I was astounded, because when I left the Control Center, it had not performed well at all, and there was a big concern about would the LM be ready for the Apollo mission. That was the only outstanding trajectory thing that I can remember we did in 1967.

It was a very slow year, very difficult to deal with. I think a lot of us were kind of at loose ends. Were we ever going to get back to the intensity that we had in Gemini, because it was this huge gap of we couldn't do anything till they fixed the hardware, and it was not clear to us how that was coming about. We were so removed from that.

I will say that personally the Apollo fire was devastating, but I wasn't smart enough or attuned enough to feel as much personal responsibility as I did later with [Space Shuttle] *Challenger* [STS 51-L accident] or [Space Shuttle] *Columbia* [STS-107 accident]. It was a bad, sad feeling, but I felt so for them in the hierarchy that I couldn't have possibly done anything wrong. But when we moved on with the others, there was much more ownership and feeling of, "Okay, I'm part of this failure." I look back from this perspective, and it was an entirely different feeling.

JOHNSON: Well, it happened on the ground, too.

DAVIS: Yes, and that was probably part of it. Yes, it probably was. That's a good insight.

JOHNSON: Well, let's talk about some of those other missions you mentioned, the unmanned mission. Were there other unmanned missions before Apollo 7 that you worked on?

DAVIS: That I worked on—no. That was that other group that was off doing the Apollo unmanned high-velocity reentries, and I really did not work on those. I came back and did some Apollo 7 work, but it was peripheral. The guy that was doing the trajectory design for that had been working on Apollo Earth orbit for years, so it was normal for him to continue to do that.

Kind of an interesting sideline; after he did that [flight, he] left NASA, and became a State Farm Insurance salesman in Nassau Bay [Texas] for the next twenty-five years. Dave [J.] Griffith. You probably saw his sign.

JOHNSON: Yes. That's a different transition. I wouldn't have expected that. [Laughs]

DAVIS: Yes, I might mention when I came to work, there was no aerospace engineers. It did not exist in 1964. One of the guys I worked with was a math teacher. Another one was a civil engineer. I was an engineering-physics graduate, which was kind of a combination of physics and electrical engineering. But we had no aero-engineers. It was anybody that understood math they would hire.

JOHNSON: As you mentioned, you came from a small town, and then you went to a university in the same state you lived in, and then moving to Houston. People from all over, including Canada

and England and with the AVRO [Aircraft, Ltd.] engineers that were coming in, and people from all over were coming in to work on these projects with you. What was that like to meet all these people from all over and get to work with them?

DAVIS: You might take this story out, but I'll share it with you. [Laughter] It's real personal. Growing up, both my parents were alcoholics, so through high school and college there was a real strong feeling that I will never drink. This is a horrible thing. I saw what it did to my brothers and my sisters and myself.

So the second week I was here working at NASA everybody that had been working these long hours, "Okay, it's Thursday, and we have happy hour at Ellington." So I shied away from that for some period of time, and there was a personal transition because these people I was working with were not at all like my parents. They were not doing bad things. They were carrying on their normal work environment. They were working six days a week, so a couple of hours of happy hour was not the same thing as what I'd been growing up experienced with.

So there was a transition of respect and admiration for these people, and it transitioned into that sort of social interaction was good and okay. That was quite a change for me, and I remember that the friends and relationships that my wife and I developed was almost 100 percent people I worked with, because long hours, you didn't have much chance to meet other people. That was a personal transition for me, and I think it had to do with what you mentioned in your question, a lot of people with a lot of different backgrounds that I had not been exposed to. So it was a broadening experience.

The first Thanksgiving here some people from work invited my wife and I over, so it was kind of a second family that first Thanksgiving, which was kind of a big downer. My not-so-

hidden expectation was to work three or four years here and then move to Marshall, which was two or three hours from my hometown. You can imagine after three or four years this became home, and after one child was born here and he was a Texan, that idea or fantasy kind of drifted away, and Houston became our home. Part of that was work was so much fun. I couldn't imagine anyplace else would be as much fun.

JOHNSON: I know a lot of people lived in the same neighborhoods, and you mentioned you living in an apartment, and a lot of the neighborhoods grew up, and it was just all NASA people, or the majority of it was NASA people, and the kids grew up together. Did you experience that also? You mentioned all your friends.

DAVIS: Yes. I think what we ought to talk about first is there were so many gratuities or privileges if you worked for NASA in the early years. You showed your badges and you got discounts. You showed your badges and you got free entry to places. I know the astronauts got a lot of free furniture or cars or stuff, but if you worked at NASA, it was really special, and not only the interaction with people, but the community in general. So it was very [much a] love-love relationship. So, yes, there was a lot of that going on. You got discounts to the movies; I remember that. You showed your badge, which was kind of hokey at that time.

As I said, the social group that my wife and I got into was almost 100 percent NASA, and part of that was the limited amount of time you had, so for social interaction, it probably was consistent with stuff not going on that particular day or night at NASA, so that was cool. Then there was all the end-of-mission or splashdown parties, which really go into a social interaction.

It was a—you work, work, work, work, work, and then when you partied, it was the dessert afterwards, I guess.

[Pause]

JOHNSON: I want to pick up about the time period we stopped at when we left a few minutes ago. One thing about some of the social activities you were talking about in that time period and how everyone felt like a group or a team, also going on at that time in the nation there was a lot of transition. Of course, it was during Vietnam, and also a lot of the other social transitions as far as minorities and women and that sort of thing. Maybe, if you can, just for a minute talk about that and how it was working at a federal facility and being so focused on a goal, and then what was going on in the rest of the world around you.

DAVIS: That's a real good question, and I had that written down to touch on. I don't know where it is, so I'm glad you asked. One thing that the Vietnam War did touch a lot of us was getting deferments. When I was in college, I forget what all the categories was, but I had asthma, so I didn't have to take ROTC [Reserve Officer Training Corps], and I already had a deferrable condition. But I remember a lot of letters being written to defer people, and that was the only thing that really touched us a lot.

I don't know if I've ever been a part of anything that was so down and in as we were focused. You lived your life to get up and come to work, and it was legitimately sixty-, seventy-hour [weeks]. To start with, there was not the same amount of media information. There wasn't Internet. There wasn't twenty-four-hour news. If you missed the news, you missed the news,

and a lot of nights you missed the news because you were at work, or you were asleep getting ready to get up at two-thirty in the morning and go to work. So I think the down-and-in focus, we missed a lot of that. When we get to Apollo 8, I will mention one thing that had to do with it.

There were no women at JSC to speak of, or MSC, in the Gemini days. The only exception was because we had no computers on our desks to plot things, we had a group of women who did plots for us. The parametric studies I told you about before, it was very normal that you would have a plot, an *x-y* plot of velocity or flight path angle and how different things affected it, and you could get answers by going in and saying, "Okay, if ten is here, I'll go up and see where it is on the plot, and the answer is five."

So we had ten or fifteen of those that worked right in the building with us, and we would take a trajectory printout to them and say, "Okay, plot this parameter versus that parameter," and they would do those for us. And, boy, you certainly did not want to mess up one of those sheets after they spent hours doing it. It was not like you could push a button on a computer and get another version of it. They used White-Out to make corrections.

I bring these up because there was absolutely no women on-site. It was like an event if a woman walked down the hall or was out on the duck pond. People would beat on the window and say, "Hey, somebody's walking by," or something. It was an event. It sounds like when guys are in prison or something. [Laughs]

But this group of women who plotted for us, moved over to the Control Center on flights, and we at times would do computations in the ACR, and they would plot it for us. We had a table with a TV camera, and we could bring it down and display it to people out in the Control Room where they could look at it. And those were the only women in the Control Center, pretty much, during the whole Gemini and Apollo program. There was a couple of women got hired

late in the Apollo Program. If you go and look at the manning lists, you won't find any women at all.

The things that were going on with the minorities in the country, I think pretty much we were oblivious to that. Any hiring that focused on that was really post-Apollo. We were just down in and focused, pretty much oblivious to all that. As your question kind of led me, I've never seen a more focused—you know, forget the world; we've got a job to do, and we've got to do it really quick, and we've got to do it really right. That certainly led to this feeling of being a team, being a social group as well as a work group.

But I think partly you just didn't have time. The part of it that you remarked on just a second ago, if you had a social event, it was probably very unfair to the spouses, because you wound up talking about work 90 percent of the time. Later on in your career you had to make rules that you didn't do that. That was not fun. But people still do that, but it was to the tenth degree.

JOHNSON: Just a question that popped in my mind, do you remember when President [John F.] Kennedy made the speech saying that we were going to go to the Moon? You would have probably been in college at that time.

DAVIS: I was in college. I missed it. Obviously, I have seen it a thousand times since then, but no, I didn't see it then.

JOHNSON: I was just wondering if you ever thought that you would be working on that at that time.

DAVIS: Well, I remember watching the Mercury flights, and this imposter complex, I wondered if I could ever be good enough or ever got the opportunity to do that. I think at that time I knew I wanted to, but it was more a fantasy than, "Hey, this is where I'm going with my career." It was not until NASA was interviewing off-site, and I said, "Wow, that's something I want to go do. I want to see what they're about." But even then I didn't expect to get that opportunity.

It was scary when I got the job offer, because now I've got to go do this thing. [Laughter] It was not clear exactly what this thing was at that time. Until I'd probably been here a couple of years until some of the feelings, "Okay, I've accomplished something. I'm really part of this team. This is really something I can do and be good at and have fun doing it." I think it was a couple of years in.

I've talked to other people about this. You have semi-nightmares where you needed to go to class and you weren't prepared for a test, and I think I had them. I had those about work, too. Am I really going to get this done? Am I going to screw something up? It takes a while to grow out of those, and I've talked to other people; they had the same feeling. A lot of people did that.

JOHNSON: I imagine, like we touched on before, the age had a lot to do with that, too. You compare how young you were, and then think about that same age group of people now and the differences.

DAVIS: Yes, I think there was—and I've talked to people about this, and I've heard other people talk about it without even asking them.

I think, on the other hand after you've got some degree of confidence, you wondered if you could fail. The other side got to be, too, "Hey, we can go do this," and you hadn't had a failure, and for a while you thought you were kind of bulletproof, because of success, success, success. The Gemini flights, every one of them went really, really, really well. So sure, we can go do this. It was kind of the other side of that hump.

I think kids who come out of college today, they're so much more career path oriented. Career path was never a word we heard in our twenties or probably even in our thirties. The kids that come out of school today, they know where they want to be in two years and five years, and if they're a year late getting there, they're a failure, and they look at their peers. Two high performers that worked for me, and one of them was, "I'm going to get a degree. I'm going to get group lead. I'm going to get another degree." Very, very competitive, very oriented towards that.

There was none of that going on in the Gemini-Apollo era. We were focused on this joint goal, and careers would take care of themselves. As I mentioned earlier, that kind of changed in the seventies, but in '64 to '71 or '72, it was marching to a goal.

JOHNSON: Well, let's talk some more about those Apollo missions. You mentioned Apollo 7 briefly. Then Apollo 8, that was the decision to go ahead and orbit the Moon at that point and move that forward, if you want to talk about that mission and your memories.

DAVIS: Yes, I'll mention Apollo 7. I think the way I would talk about Apollo 7, as I mentioned, that during Gemini the group I worked with had kind of dual responsibility to do the proof like trajectory design, create all the products, send stuff to the simulators for the crew, and go support

sims and then to support the flight. That got divided, and luckily, I got into the group that supported sims and flight, and that was great. But the people that had been working on Apollo did the trajectory design for Apollo 7.

That was kind of okay. Apollo 7 doesn't grab me or stand out. We had to demonstrate that the vehicle had been fixed and it was ready to fly, and it did that.

But the group I was in was already head over heels into these new trajectory software applications that had to do with going to the Moon and then getting back. One of the first things you had to think about is once you leave on a trajectory to the Moon, it takes days to get home, so the aborts that we had on the Gemini and Earth orbit flights, where you could get back in ninety minutes, now became days. So the whole set of mission rules, criteria, software applications, were changed, and a tremendous amount of work that had to be done as far as creating the processors, verifying them.

We didn't know a lot about the Moon's geographic makeup, and we found out later on our models were not correct. If you think about it, we had all these Earth models to put into our trajectory applications, but the Moon was somewhat unknown; we had very little knowledge. So a lot of the stuff we were worried about was the unknowns of the Moon and getting a vehicle back as quick as we could.

You get halfway to the Moon, it takes two or three days to get home. The quickest way to get home after you get so far out is to go around the Moon and come back. Of course, that's what happened on Apollo 13. You can't just do a burn and go back home quickly. So a lot of agonizing and a lot of work to get to the trajectory tools.

So while they were getting ready for Apollo 7, we were getting ready for the flights next year that were going to go to the Moon. When they pulled Apollo 8 out of their hat and we had a

couple of months to get ready, all of that stuff I just talked about took on a lot more importance, and there was a lot more time-critical decisions and work that had to be done.

So I guess you'd say we were happy as could be because we were back in a time-critical environment, and we were working to get our applications that were offline ready to support. Because of limited time, MCC had problems getting all their applications that was needed up to speed for the lunar stuff, so what we did offline was much more important than some of the previous flights. So we were in heaven. We were back in the spotlight again; this was going to be great.

So we all had to learn different things. Being the guy in the Flight Dynamics SSR, part of it was exactly the same. It was communicating with other Flight Controllers. It was communicating with the competing facility back in the other room. But the technical aspect of it was totally different. These applications were different. Verifying them had to be done. There was a whole new language, a whole new [set of applications]. What's a processor do and how long does it take to run?

We'd been running the other stuff for years, and we knew exactly. It took two minutes to do this; it took thirty seconds to do this computation. Well, some of these took longer, and why they did that, and how could we make them run quicker, and how will we know when we've done something wrong. We had all this in the back of our minds for Earth orbit and going to the Moon. It was a new ball game to us. It was fun, but it was scary.

But for years the Apollo Program had decided there was going to be a series of flights, and they named these C, D, E, F, G, and C was Earth orbit, Apollo 7. Then we were going to do D, which was take it to a higher altitude, 1,000 miles, maybe. E was taking it even higher, maybe 10,000 miles, and this was building up our confidence in the vehicle and allowing us to

plow back into the atmosphere with higher and higher velocities to check out the heat shield and the guidance and everything. F was going to be orbit the Moon, and then G was a potential landing.

Well, Apollo 8 we skipped two or three of those steps, and we were going to go, so it was stressful, but it was as exciting as can be. Apollo 8 was in December, and as we talked about, the focus was down and in and on the flight. I remember we had to reschedule our family Christmas around the flight and the shifts. My wife, we had a son then who was one and a half, would get him up, give him a bath, stall him till I got off the shift, which was about midnight to nine o'clock in the morning, so we could do our Christmas later than we normally would.

I remember something that I read later, and it was in the series of shows about the Apollo Program that was done. You mentioned the political environment. I believe this was true. Anyway, NASA got a telegram from a lady that said—

JOHNSON: Do you want to take a second?

DAVIS: Oh, that's okay. That Apollo 8 saved 1968.

JOHNSON: Yes, we've heard that before.

DAVIS: In retrospect, that was as meaningful as really what we did, because there was a lot of bad stuff. It was all negative. So that was really neat.

JOHNSON: To be a part of that.

DAVIS: Yes.

JOHNSON: To be able to be proud of the fact that you had helped save the year, and save the nation at that point.

DAVIS: Yes. It was a positive thing. I knew I was going to have trouble with it. [Laughter]

JOHNSON: That's okay. Most people have problems with Apollo 8. We've had a lot of people. It was an emotional time for everyone.

DAVIS: That year was tough. You almost have to look back on it to appreciate that. When we get close to the end of this, I think you—I feel like when I was in the middle of it, it was fun, but you don't have perspective on what you're really doing and how it fits in. So that was something that I think was more emotional to me in perspective versus when I was just down in and doing it.

JOHNSON: Well, when you were in it, I'm sure you were just focused on doing your job, and that was the most important thing at that point.

DAVIS: Yes.

JOHNSON: Of course, Apollo 8, being Christmas Eve and the reading and everything, it was a special time.

DAVIS: I think it was really unbelievable. We just sat there in the Control Center and watched the pictures coming back of the lunar surface. People were just in awe. People would talk about what they were seeing, because a lot of the times—because I was on the shift when we went into orbit and then they came from behind the Moon, and they started showing pictures. I got to be the prime shift, so that was neat. But there was a lot of times where people were just totally quiet. I don't think anybody knew exactly what to say. It was a meaningful time.

JOHNSON: Being in the back room, you could see the pictures at the same time they could in the Mission Control Room?

DAVIS: Yes. Yes, it was piped to all of us, and there was a lot of people there then that—I don't know; it was entirely different. I think it was back to doing something first and being part of that. It had been a couple of years since we'd had that feeling, so it was good to get it back. If you think about it, it had probably been in late '66, and here it was late '68, and we finally felt like we were back on track again.

Apollo 7 was important, but it kind of was hardware related, and trajectory-wise, we had done that several times. This was entirely different.

JOHNSON: And it was that free-return trajectory. Maybe for a minute, if you don't mind just talk about the free-return as opposed to a non-free-return trajectory?

DAVIS: When you take a vehicle toward the Moon, you have obviously a variety of trajectories you can initially put it on when you leave Earth orbit. The decision was made, and everybody thought it was a good idea. You can put it on a trajectory so once you leave the Earth, you do what we call a TLI [translunar injection] burn, which is the big S-IVB burn, to leave Earth's orbit to target a trajectory so if nothing else is done, it will circumnavigate the Moon and then come back to the Earth. Other trajectories you put it on can be more efficient fuel-wise, but they require a burn to put you back on the return trajectory to the Earth. So the early flights were targeted to a free-return, i.e., if you don't do anything after the TLI burn, you'll come back to a safe reentry in the ocean on the Earth.

JOHNSON: Okay. Well, let's move on to Apollo 9 then just a few months later. Again, you were the Trajectory Support Chief, and this was the initial flight of the LM and then the docking with the Lunar Module.

DAVIS: I'll probably disappoint you here. I worked on that as Trajectory Support Chief, but I wasn't prime, because I was working on [Apollo] 10 and 11. It was a neat flight to see the LM finally flying and to see it occupied, but to be honest, I was down and in on 10 and 11, trying to get ready for those flights.

JOHNSON: Okay, well, if you want to go ahead and talk about 10?

DAVIS: Yes, 10, and I'll mention that 10 was the last dress rehearsal for 11. We were going to go within ten miles of the surface of the Moon. The idea was to do everything we were going to do; to get to the point—let me back up.

When we go into lunar orbit, we do a burn. It puts us in about a sixty-by-sixty nautical-mile orbit. You stay in that until you're ready to do the descent to the surface. What you do is you go behind the Moon the day of the landing, and you do a burn. You wind up, when you come from behind the Moon, in a sixty-by-ten-mile orbit, and the ten-mile height will be on the front side of the Moon. When you get ready to do the final descent, you get near that ten-mile point, and you start doing retrograde burns to slow you down and gradually you turn from a strictly retrograde to a down velocity burn.

Apollo 10 was going to do everything except stop that last burn, and mainly it was to check out the vehicle. But it also was to see how well we could track from the Earth. We had three large tracking sites, California, Spain, and Australia, so one of the keys was to be able to track that and know where it was so we could tell the LM what to do. The LM was not smart enough to know where it was. We had to track from the surface and send up a series of data that would tell it where it is, so with the onboard computer it could do the right thing, get to the right point on the surface.

It all went pretty well. We did have some problems as I remember, with the onboard software, and I believe it was John [W.] Young had to take over and do some manual things. The importance to the trajectory world from Apollo 10, we discovered some irregularities in the lunar surface. I may have it wrong, but they were named *mascons* [mass concentrations] later on, and these had a gravitational effect that essentially says the lunar surface wasn't consistent. Certain places affected the trajectories more strongly.

So one of the things that people that worked in my division—not me, but people that worked in my division—they had to create a model for these irregularities as far s the Moon's effect on the vehicle. Otherwise Apollo 11 would not be able to navigate the final descent correctly. So there was a tremendous effort between Apollo 10 and 11 to update our models of the Moon such that the vehicle had that on board and knew what to expect, and so we could model the trajectory correctly.

That's probably the thing I remember coming out of Apollo 10. We were adding trajectory capabilities for the real descent, to simulate those in the ACR, so we were very busy through the Apollo 9 and 10 time frame with adding those capabilities. So I remember Apollo 10 because of that navigation work, we had a lot more activities than we expected in that last couple of months.

I think the other thing I remember was that we were flying these flights every two months, so as soon as you get through with one, you're very, very hard into the next one. You've got two months to do it, and if you could get the MCC and the simulators ready, sometimes you started the simulations before the next flight, so you were even into it before then. So we were getting to the point where people kind of leapfrogged. They didn't do every flight, or if they did do every flight, they weren't in the lead role on one, and then they jumped to a lead role on the other one. That was almost by necessity, there was so much work going on.

Talking about Apollo 11, I guess the first thing I would say is I was proud that I got to be on the shift where they were going to land on the Moon. That felt really good.

The second thing I would say, I've never seen so many people in the Control Center. We literally, at one point, I believe they were afraid about structural support and the floor and stuff, because it was just everybody who you'd ever seen and people you hadn't seen. You could go

dig out some memos and it told you which headset people could plug into. There were more people than there was headsets that could be plugged in. Everybody wanted to be there, so everybody on every shift was there, and people in the management chain that had never been to the Control Center were there. So it was a full house, I remember that.

In all the recordings, they talk about people holding their breath. I think everybody literally was. Apollo 8 was exciting, but I think it was really unbelievable. I think it took days for it to make any—it did not seem real. It was just amazing. I remember we had a display in the Control Center, and you still see it today. It moves along the trajectory. Well, when the LM landed, it didn't move, and that's the first time we'd ever had a vehicle that wasn't moving, because it's sitting on the Moon. That was part of the trajectory; it was very strange to look out there, and it was always sitting there.

The biggest thing that everybody wanted—I don't know who started giving them away—was a little green button about a inch wide. It was just sitting there, "Lunar Contact." So everybody was wanting that, and I think anybody that was there probably still has theirs.

I remember running into the Center Director—I believe it was the Center Director—in an elevator a couple of days before the landing, and we were just talking about how great everything was going. He was still concerned about getting three good chutes. We were on our way back, and everything was going well, so I guess that was just another reminder that you never know how it's going to turn out until it's over and done with.

There was a lot of preparation for how we were going to celebrate after a lunar landing. I know the group that I was working with, we wanted to make [coffee mugs] and this and that and the other, and we quickly figured out we couldn't put Apollo 11 on it. You had to do something like "First Lunar Landing," because you didn't know if it was going to be Apollo 12 or 13 when

you actually pulled it off. I still have some of those. The parties were superb. I remember the day when Apollo 11 was over with, obviously it was hot in Houston, but most of NASA [Road] 1 was shut down. It was—take Christmas, Mardi Gras, and everything rolled into one.

JOHNSON: Everybody was celebrating.

DAVIS: Yes. There was a lot of alcohol flowing, but I think people were "high" before they ever got there. The emotions went through me. It was a great feeling.

JOHNSON: It was a big thing, especially in this area and in the community surrounding this, because so many people lived in these communities. We've talked to some people who have talked about, as you mentioned on Apollo 8, what you were doing here was so important to the goals that NASA had, but what it meant to the nation as a whole, that it was almost a surprise after Apollo 11 to realize so many people were so aware across the world, not just in our country, that what you were doing here was so important to everybody. They were surprised a day or two later when they started seeing the news reports or went out in the public and realized that people were talking about it and how important it was to them.

DAVIS: Yes, I think that was—again, we were so down and in, I think it took a little while for that to sink in. I think in one sense we were aware of what you were relating to, but I think in another sense we almost had to back off. The time period between July and November when we flew Apollo 12, I think there was more time for that to sink in. It was an unbelievable time. As we talked about, a bunch of us were twenty-seven, twenty-eight years old, and it had been just

one high after another. It was hard to believe the, I guess, transitions, that it was ever going to change. That was a great feeling.

I have to add this here and in the missions probably later, whenever I think back to those, the immediate impact is not only, "Hey that was neat. That was the first time, and that may be a part of history." But I immediately think of the group of people that was part of it, that I was close to then, and how, in a greater sense, almost all of those have dispersed. I won't say they're dead, but they're dispersed around the country, around Texas. A few of them make it back for Apollo reunions, but a lot of them don't. It's sad that they don't. It's kind of like class reunions, but probably even more important. But I remember them like they were and what we did and how much fun it was, so it was good.

JOHNSON: Okay. Well, if you want to move on on your involvement past [Apollo] 11.

DAVIS: Not really, but all right. [Laughter]

JOHNSON: Was there anything else about 11 you want to talk about that we haven't talked about? Anything else you want to mention?

DAVIS: I think I need to talk about 11 and 12, and then moving on from there. I think if you relate to what we were doing, it was so much fun. We essentially were building a lot of capability and a lot of confidence in MCC, so we essentially did the same thing for Apollo 12 as we had done, but as you might imagine, we had built up the capabilities and the confidence during Apollo 8 and 11, and there was a much higher confidence level in the MCC capability.

Although we did exactly the same thing for 12, it was not the same excitement. You start getting a little bit of the Buzz Aldrin emotional letdown, as far as build up, build up, build up. We've accomplished this and it still was scary to land, but it wasn't quite the same. The camera got broken. As I understand, it was focused on the sun and it burnt it out, so the pictures from the surface were not there until they got back, so it was kind of a letdown from that.

From a personal standpoint, for the first time budget started to come into the picture after Apollo 12. One of the ways they could save money was to stop our function as far as verifying the MCC, because Apollo 8, 11, and 12, you've got a lot of confidence. You've seen it for three flights. Why have some people in the room doing the same things when we know we don't need it? So the function was essentially eliminated after Apollo 12.

So now I had to find a new job, essentially, and this system had taken care of me for the first six years I'd been there. It was work, work, work. The system at that point, and I don't know the exact date—1971, I guess it was—there was no management initiative to say, "Hey, you used to be doing this. Here's some important work. Let's move you to this." It was kind of you drifted for a while. Given the intensity of the work, I think for a while that wasn't a big deal. It was like, "Whew, okay, I don't have to work seven days a week. I can take a little vacation this year." It wasn't so bad.

But after a few months the feeling of contributing and wanting to be a part of everything was beginning to get lost, and so you were kind of bouncing around. There was a job I moved into, but it felt like paper pushing. It was helping get some things ready for preflight. It was called data packages that other people were generating for trajectories. The importance and the contribution seemed somewhat limited, in comparing to what we had done.

As we moved into the later Apollo, there was less and less challenging work in general in the whole trajectory area. If you can imagine what we'd been pushing to do, from can you do Mercury at all, or will it burn up on the way in; Gemini, can we do rendezvous; Apollo 11 and 12, can we do lunar landings and all that kind of stuff. There was nothing out there on the horizon that says, "What's the next big challenge?" Flights were getting cut off at the end of the Apollo series; as I remember, they killed Apollo 20 first, and then they killed Apollo 18 and 19.

So it was kind of a coming together of a bad situation. The flights were getting cut, so there was less real trajectory work, and the new work was not there, because there was no new challenges. So it was almost the opposite of what we'd had for the first five or six years of my career.

I believe one of the challenges that JSC and NASA had at that time was people had not been selected into the management chain because they had any real people management skill. It was because they were best at a particular technical job. As they moved up the management chain, they tended to—sometimes stay in the job they had had before. They might be a group lead, but they still ran decks and did technical work. They might be a Branch Chief, but if a fun job came in, they tended to take it instead of dispersing it to the people that might need to continue the challenge.

So I think it was the whole—I don't know—'72 to '78 time frame was a time where I felt underutilized, and I saw a lot of my peers struggling with the same situation. If you go look at the workforce and the work content and you're honest with yourself, I think it had decreased significantly for JSC in those mid-seventy years. Personally, it was compounded by people like my Branch Chief doing some of the work that was way, way below his grade level, because it

was fun. It was the only game in town. Those of us who didn't get as much technical content to work on were at our own [to find ways] to contribute.

So that was a real tough time, and I think it was made extremely tough in going from "Hurry, hurry, hurry, do this; boy, you're doing important stuff; you're really contributing," to "Well, go find this; go look at that." I don't remember; I did some documentation. It's still around today, but it wasn't very much fun. It was something that probably was good to go do, but it was worse than school projects and that kind of stuff.

So it was hard for me, and I guess in that time period I found out that, yes, you had to do some career planning. You had to look out for yourself. You had to worry about—if not you want to progress and move into management, you at least want to find some fun work, some challenging work, some work you can contribute again. So I struggled with that for a few years.

I finally decided that this moving of paper around wasn't near as much fun as maybe doing the basic trajectory work, so essentially I had to take a step backwards; go back and say, "I want to do some real technical work. This paper movement doesn't challenge me as much." So I volunteered to go back and work the orbit trajectory for STS-1, and it felt good. It felt like I'd been here before, but after doing it for a year or so, it felt good again. It was definitely something was going to happen. It definitely was something where I was contributing. I could see that the work was being used, and it felt like it did five years before.

So the fact that the first Shuttle flight slipped three years, was very frustrating, but compared to those last five years, that was a small frustration.

The other thing I decided in that time period was that if I ever moved up in management, I was going to do a better job of helping my employees in career planning for them, and doing good evaluations, good or bad, and being a people manager versus just a technical manager.

That was a real eye-opening to me, because the first fifteen years I was there, I don't think I ever got a fair evaluation. I don't mean most of them were bad; most of them were good. But several of them was, "You've done a great job this year. Sign this card."

I think part of it was the system was okay with that, but I think part of it, the management chain wasn't as comfortable with sitting down and saying, "You know, Larry, you can do this well and this well, but you ought to go take a course and improve on this." You know, there was none of that. It was, "Sign here. You did a great job," and you had the feeling everybody got told that. So that was, I guess, if there was something positive out of that time period, I kind of set a goal for myself, if I ever have the opportunity, I'm damn well going to do that better than what was done to me.

But I believe if you interviewed enough people at JSC about the seventies, they struggled, and if they were honest, there was too many people for the amount of real work that was here. There were some of my peers that never recovered from that. They did not snap back into being very productive as the Shuttle progressed. They had gotten too much into "If I work two hours a day, that's a full day." That was very discouraging when we started rehiring and bringing in young people, because you'd see a young guy who was ready to go do a terrific job, and you saw this person who'd been around fifteen years and had really bad habits.

I continually ran into that in the early Shuttle years. People just could not bounce back from those unfortunate years in the middle. It bothers me a lot that there's still some people out there that they're not challenged, too. I guess that's part of what I'm saying. If you're a good manager and you have those people, you have some responsibility to make them better employees. The first failure is their part; the second failure is whoever their supervisor is not to demand a real day's work and a real contribution, because it trickles down into the whole

organization. I think that was one of the negative things that came out of the seventies. Now I'll quit beating that horse. [Laughter]

JOHNSON: Let's go back a little bit. You talked about Apollo 12 and then the fact that what you were doing was eliminated. Apollo 13, of course, came along, and at that point that was an exciting time because of the accident and because of the unknowns during that mission. What are your memories of that mission, and where were you when you heard about the accident?

DAVIS: This will be short and sweet. I didn't have any responsibilities. I felt very lost. I was not in the Control Center during that flight. I remember going over there a couple of times, but there was no position; there was no need. You have to understand that the failures they were dealing with was probably 10 percent trajectory related, and it was 90 percent environmental, computer. Even if you see the movie, you know the guy working long hours to have enough electricity to have the right amount of equipment on, to be sure that the computer could respond, to be sure that we could remove the CO_2 and that stuff, none of those were trajectory related, so I was really oblivious to those.

I do remember that they were struggling to initiate the simulator with some of this information, and I know some of the people that I had previously worked with that were now doing a different job were involved with fixing that. There had been a transposition of two numbers, and they couldn't get the simulator initiated because of those numbers. They finally found it. The fourth person that checked it found out—transposed a couple of numbers.

But I felt very lost. That was really kind of the pinnacle of—Apollo 11, being directly involved; being directly involved in all of the Gemini flights; Apollo 13, not involved at all. It's

kind of random, you know. Nobody did it on purpose, but I hardly felt like celebrating at the end of that, because I didn't feel like I had been involved, didn't contribute. I was happy. I was glad everything worked out. But I felt really at a loss for not being directly involved.

JOHNSON: In the position you were talking about you moved into that was more of a paper—was that the data management area?

DAVIS: Yes, it was. Basically, it was assembling trajectory work that had been done by a variety of people, and it wasn't that I was doing hands-on generating of the data. I had some responsibility to verify it and be sure it was consistent, but it wasn't the hands-on work that I had done for early Gemini. So the feeling of contributing was a degree or so less.

JOHNSON: And that's what you did through the rest of the Apollo Program?

DAVIS: The truth is that I went once and told my boss I needed more to do, and his response was, "Well, don't tell anybody that. We're trying to get more work."

I didn't want to go behind his back, but that was part of what motivated me to go and say, "Hey, I'd like to go back and work in this other branch," and kind of start over where I was three or four years ago, because I felt like I could contribute more. I don't think it made anybody upset, because I think the area I was in had too many people. The fact that I chose to go find something else was probably okay with them.

JOHNSON: When did you move into that other area?

DAVIS: I don't remember exactly. I would say '77 or '78. So there was a period of about five years there where I felt adrift.

JOHNSON: Did you have any involvement at all with Apollo-Soyuz [Test Project, ASTP] or Skylab?

DAVIS: The data management time, yes. That was another example of—and I'll throw stones here—where the Branch Chief wound up doing some of the basic work and wound up doing the travel to Russia and that sort of thing. I might have done the same thing if I had been Branch Chief; I'm not being holier than thou. I would say, roughly, we had work to keep 25 percent of the people busy, and so it was not a good time for a lot of people as far as having heavy work content.

JOHNSON: As you mentioned, the seventies was a little bit different time as far as that transition, and there were a lot of people, and I think some of the RIFs [Reduction in Force] were starting in the seventies. So the whole atmosphere at the Center, not in just your area, was a little different. Do you feel like everyone was feeling that everywhere?

DAVIS: My gut-level feeling is yes. I think some areas, for example, if you look at the engineering folks, my evaluation would be that they always work to a lesser schedule-driven activity. In other words, they're not working toward their launch day a month from now. They're working towards a Critical Design Review, which might move a month, which is no big

deal. So I think the intensity or the schedule-drivenness in the engineering part of JSC is then and is now, is a little bit different.

So I have a feeling that they didn't get stressed as much, because they were working on early Shuttle, and the type of work they were doing was developmental, and that was what they were accustomed to, whereas the type of work we were was what we call operational. It was get something ready to fly, simulate, train the crew, go fly, do it again. And if you think, we were doing a flight every two months in the sixties, and we went to ASTP, that was four years. We got ready for it for a couple of years, and then it was five years until Shuttle. So us operational people were not doing what we do best, what we like doing, for five years there.

Just an aside, that scares me for the operational people after the last Shuttle flight, before the first CEV [Crew Exploration Vehicle] flight, because if you look at history and if you target 2014 for the first flight, it will probably be 2016. That's a huge gap for people. So it's going to be a challenge for the management team to keep them operationally sharp. You can use [International Space] Station ops [operations] for some of that, but Station operations doesn't have ascents and entries and rendezvous, and that's some of the time-critical stuff that you have to deal with. So I think that's going to be a challenge.

JOHNSON: Well, is there anything else about that time period, about Apollo or the time period following Apollo that we haven't covered that you'd like to touch on?

DAVIS: I'll just mention that I tended to get more involved with activities outside of JSC because I wasn't challenged as much at work. I was active in church. I was active in things like the Indian Princess and Indian Guides. The JSC community has what they call the EAA, Employees

Activities Association. I wound up being Vice President and President of that off and on for ten years, so looking back in perspective, not being challenged totally at work, I think I went outside that environment to get some challenges. And I actually wound up, I think, educating myself, taking some courses and having some personal growth in that time period. So it wasn't maybe a total loss, but it was so different from the sixties. The work environment was just very frustrating.

JOHNSON: Well, I did see your name quite a few times in the [Space News] *Roundup* as far as the picnic and organizing those things.

DAVIS: Yes. I think I developed some skills there that eventually wound up back at work, and I took some courses, like I said, but it was kind of filling the void.

JOHNSON: Well, if you'd like, we can stop for today before we move on into Shuttle. It's getting close to the time. Do you think that would be a good breaking point?

DAVIS: That's a good breaking point.

JOHNSON: Okay. Why don't we do that?

DAVIS: That's worked well.

JOHNSON: Okay.

[End of interview]