

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

JAY H. GREENE
INTERVIEWED BY SANDRA JOHNSON
HOUSTON, TEXAS – 8 DECEMBER 2004

JOHNSON: Today is December 8th, 2004. This interview with Jay Greene is being conducted for the Johnson Space Center Oral History Project in Houston, Texas, and is a continuation of his interview conducted on November 10th, 2004. The interviewer is Sandra Johnson, assisted by Rebecca Wright and Jennifer Ross-Nazzal.

I'd like to start today by just talking about the 1972 period when you went to work and moved on to the Shuttle Operations Section in the Flight Dynamics Branch, and if you can share with us about your initial duties at that time.

GREENE: I guess that was when I had Flight Dynamics Officers, the FIDOs, and the RETROs [Retrofire Officers], and I'm trying to remember whether that was post-Apollo or getting ready for Skylab and then ASTP [Apollo-Soyuz Test Project]. We always had FIDOs and RETROs, and they were always at one another's throats. I don't know why, but the RETROs were in charge of backward burns, and the FIDOs did forwards burns, and so I guess it got enough heated arguments, I decided we'd get rid of the RETROs, and we did that. Made a lot of people very aggravated. So we had Flight Dynamics Officers and Trajectory Officers after that, and the Trajectory Officers assisted the Flight Dynamics Officer. I can't remember much more of note back then.

JOHNSON: You moved on to the Range Safety Coordinator in 1973 and '74.

GREENE: That's just something I did. I was tasked by I guess it was [Robert F.] Bob Thompson was the [Space] Shuttle Program Manager, and there was a theory. There was a letter actually signed between the Air Force and NASA. It was actually between the Range Safety guy, who was "Davey" [David M.] Jones, General Davey Jones, and [Dr.] Kurt [H.] Debus was the Center Director at Kennedy [Space Center, Florida, KSC], and they both signed this letter that agreed that since the Shuttle was going to be virtually as safe as [Boeing] 707, there was no need for range safety destruct system on the vehicle.

That lasted for a while, and then we decided—we, NASA, decided—that because of the unknowns during the entry phase for the first Shuttle flights, we'd put ejection seats on. We did that, and the ejection seats, although they weren't designed for launch, could have been used, and in the Air Force's mind, we could have bailed out of the vehicle that was as safe as a 707. Based on the decision to put the ejection seats on for entry, they rescinded their agreement not to have a destruct system on the Shuttle.

So we implemented and designed the destruct system, fighting all the way to not have to do it. As a matter of fact, I was fired from that job, because I couldn't get them to not put a range safety system on. It was inevitable it was going to be there. And that's where we are today.

JOHNSON: You said you were fired from that position.

GREENE: I get fired from a lot of jobs.

JOHNSON: [Laughs] Did they put someone else in that position to keep fighting it?

GREENE: Yes. Yes. Yes. Who'd they put in? [Rodney G.] Rod Rose. Rodney Rose, and though he spoke more eloquently than I did, he failed just as dismally.

JOHNSON: You mentioned in the last interview that you became head of the Flight Dynamics Section, and that was around 1974, about the same time, I guess, that you were fired from the other job, and then Section Head in 1976. Do you have any specific memories about that time period or anything you'd like to share?

GREENE: No, not really. Not really. We had a good bunch of people. A lot of the landing and recovery guys came over to work with us, Ron [Ronald C.] Epps and [Michael] Mike Collins and some other people. [Charles F.] Chuck Deiterich was part of that group. No, nothing.

JOHNSON: Then you moved on to Branch Chief in 1980?

GREENE: Yes, I guess that's when [Kenneth S.] Kenny Kleinknecht took over the combination of Flight Crew Ops [Operations] and I guess it was Flight Operations back then. Had [Eugene F.] Gene Kranz running Flight Ops and George [W. S.] Abbey running Flight Crew Ops, and in addition to the trajectory stuff we'd always done, I picked up some of the flight crew procedures and training stuff. These are the guys responsible for the crew checklist and procedures during ascent and entry. Another good bunch of people and some interesting work; initial phases of planning how you fly a Shuttle.

JOHNSON: Do you have any specific memories? You said it was an interesting time.

GREENE: No, not really. Not really. About that time, though, we were beginning simulations for the first Shuttle flight, and in addition to the other stuff, I was the ascent Flight Dynamics Officer for the first two Shuttles. Long years, long hours. In preparation for STS-1, we simulated I think the number was 1,843 hours of ascent simulations.

JOHNSON: Definitely a lot of simulation hours.

GREENE: Yes, it was.

JOHNSON: Can you talk about that first flight?

GREENE: We simulated for a long time, and I think we probably scrubbed two or three times before the first launch. Everything was going good; we got down around within five minutes, maybe, maybe two or three minutes, of zero. We had a flight rule that said we needed two C-band radars and an S-band, and the C-bands were what we called skin trackers. They didn't have a beacon that they pinged. They painted the vehicle and looked for a return signal. We had never skin-tracked ascents before. We had one S-band, and it was useless by itself, but with the two C-bands, it was supposed to give us a pretty good solution. Two C-bands alone, if they stayed locked on, would have done well for us.

So we had a flight rule that said if we lost the S-band, we'd scrub the launch. We counted down, we started the APUs [auxiliary power units], and wouldn't you know it, the S-band tracking station went down, and after arguing and arguing and arguing for years that we needed the two plus the one, I said, "Let's go without the S-band," and we did.

JOHNSON: Why did you feel that it would be okay to do that at that point, since, as you said, you'd been arguing—

GREENE: I got very smart in the last thirty seconds, and I guess the logic I used was that if we had the C-bands, we'd be okay. If we didn't have the C-bands, the S-band was useless. So two C-bands was the right answer. We launched, and the vehicle started going up on the plot board, and the plot board sort of bent over and leveled out, and the trajectory didn't. The pen just kept—we lofted. Went extremely high in altitude, and it looked like we were going off the plot board.

We were all concerned and had no choice. The guidance was doing what it was doing, and active guidance didn't start until second stage, till after you got rid of the SRBs [solid rocket boosters]. We rode it out, and we were really, really high, and I think the crew made mention of it; I knew they knew about it. Guidance took over, and everything worked out fine, but it was a little scary for the first two minutes of flight.

JOHNSON: I can imagine it would have been. Can you talk about some of the changes to the Mission Control from the time, of course, of Apollo, and then the changes that were made to accommodate the Shuttle?

GREENE: Pretty much kept the same structure. The systems guys changed, because the systems were different. The trajectory guys, we kept on doing what we'd been doing since day one. The main engines were an added complication that we didn't have on Apollo. The F-1 engines, the engines on the Saturn V were pretty straightforward, but there was a lot of thrust variations that could take place on the Shuttle engines that would affect the trajectory and what you do. Also, on Apollo, if you ever got into trouble, you could always shut down the engines and separate and fall back in, land in the water. We had recovery ships all across the Atlantic.

On the Shuttle, though, the plan was always to get the Shuttle back either to orbit or back to the runway, and so we had some—and guys still do have some—pretty complicated processors that would, as we went along in the trajectory, compute what the available abort modes were. We had to come up with the air-ground calls that would let the crew know what to do just in case we lost com [communication], and how to initiate the aborts.

JOHNSON: Did it still operate the same? When you talked about Apollo last time and the back room and the support, and we talked a little bit about the calculations that had to be done, in being almost ten years difference in time, and of course, technology had made some leaps by that time—

GREENE: Not many.

JOHNSON: Not many. [Laughs] Did you still have that same relationship with the back room and those calculations?

GREENE: Yes. We had those guys down in the first floor, and they would run the computers, and they'd make the inputs for us. We didn't get to the point that every trajectory operator had a keyboard and can control his own computations. That didn't happen till after—well, it didn't happen till midway through the Shuttle program, probably.

JOHNSON: Around that time, you moved into training to be a Flight Director. Can you talk for a minute about what that training involves, and how you came to the decision you wanted to do that, or if you were asked to do that? Just some of the circumstances surrounding that.

GREENE: Fortunately, back then you didn't have to apply for a job. You'd sit around your office, and one day George Abbey would walk in and say, "Guess what you're going to do." Throughout my career, George has come in on many occasions and said, "Guess what you're going to do." I don't know if I was fired during some of those or not. I don't think so.

But he came in one day, and he said, "We need some more Flight Directors, and I want you to do that." That wasn't a request, and so I moved down. We didn't do formal training. It was all team up with somebody who was there. In my case, I pretty much followed Tommy [W.] Holloway for a while. I got to—let's see; STS-6, the first flight of *Challenger*, was my first flight assignment, and I specialized in ascents. At least initially, I specialized in ascents. I came back and did them toward the end of my stint there.

That was about the most challenging job you can ask for. The flight day pressures were one thing. The simulations were mental exercises that were as challenging as anything the agency has to offer. There were two things going on. One was the goal to train the crew to work

with the Control Center, and at the same time train maybe a dozen different operators in the Control Center to the max extent possible. So instead of having one failure, which is about the most you'd expect during a launch, they'd try and give everybody something to play with, and the Flight Director would have to coordinate everybody's problems and come out with a solution that got the crew safely to orbit or resulted in a successful abort and recovery of the crew. During the course of a day we'd run maybe eight launch-abort sims [simulations] is what we called them, and every sim had maybe eight, maybe ten different faults that the "Sim Sups" [Simulation Supervisors] would put in, and so by the end of the day you had somewhere between eighty and a hundred problems that you dealt with. It was a challenge and a lot of fun.

JOHNSON: You mentioned that you worked with Tommy Holloway initially, STS-3 and 4. Can you tell us a little bit about backing him up? What you were doing?

GREENE: I was watching more than anything else. Every once in a while I'd take a run myself, but it was pretty much watching.

JOHNSON: I know that all the Flight Directors choose a color for their team. Is there any story behind or any reason behind the emerald, or was it because green was already taken?

GREENE: Yes. Yes. Yes, and [Clifford E.] Cliff [Charlesworth] wouldn't give it up.

JOHNSON: Besides the simulations, and I know that was a lot of hours, and that's what you indicated, is there anything else that Flight Directors were responsible for when they weren't actually on a flight?

GREENE: Yes. We ran the flight techniques meetings, and those were the meetings where we would talk operational issues in preparation for a flight, be it procedures or flight rules or how to respond to failures, what limit lines to use, what limits to set, and they were an offshoot of something called data priority, and the data priority meetings were what we did during Apollo, and those were [Howard W.] Bill Tindall's [Jr.] meetings. I say that because I met his wife and his two daughters last night. First time I'd seen them in about fifteen years. Bill had this way of getting people in a room and hashing things out and coming to a consensus or dictating a consensus, and that's how we developed all the procedures we had for Apollo. So that followed on into Shuttle.

As I say, I did the ascents for a long time. I did all the rendezvous flight techniques, initially, developing the first rendezvous techniques that we used during the Shuttle Program. We didn't know back then how much we would be rendezvousing. The Shuttle was built without an active rendezvous navigation system like Apollo had, and I remember I went forward to the program with a proposal that we put a beacon on the target vehicles. Bob Thompson, who did a hell of a job as Program Manager for the Shuttle, said, "I don't know why you want that. This vehicle wasn't made to rendezvous." Little did he know that virtually every flight we flew, through the hundred first flights, was a rendezvous flight, be it Space Station or satellite repair. But we developed the techniques for how you did rendezvous.

JOHNSON: At what point was that? Was that before the Shuttle actually started flying or was that after?

GREENE: No. No, that was after I was doing ascents. I think the first time we tried a rendezvous was on STS-10, and it was a classified mission. Then we might have done some stuff on [STS-] 11. We were leading up to the SolarMax [Solar Maximum Satellite] repair mission, which I was fortunate enough to have the lead on. SolarMax satellite was built to be repaired on orbit. We were going to go up and rendezvous with it, and [George D.] Pinky Nelson was going to go out in the payload bay with the manned maneuvering unit on his back, that little jet pack. He flew to SolarMax, and he had a docking mechanism mounted about at his waist level, and he was supposed to line up and snare this satellite. He lined up and bounced off, and he bounced off two or three times, trying to get hooked up.

It turned out there was a little thermal standoff about yea high [gestures] that wasn't in the engineering drawings, and that prevented the mating of the two devices. So he flew back to the payload bay, and he was hanging on. He was out there with [James D. A.] Ox van Hoften, and [Robert L.] Bob Crippen decided he was going to try and grapple the rotating spacecraft using the arm. There was a rather hairy ride for the guys hanging on in the payload bay. Bob got a little overexuberant, and we finally called him off and had almost no propellant left. I mean, he just hosed it out.

So we stood back, and we waited maybe a day or two, planning on how we were going to come in with a minimum propellant usage plan. Then the second try, went in, and he used almost no propellant. We grappled the SolarMax, put it in the payload bay. Spent two days with

the guys going EVA [Extravehicular Activity], and they did some major repairs, redeployed the thing. Beautiful mission, although it didn't start that way.

JOHNSON: Which flight was this, just for the recording?

GREENE: That was SolarMax, which was STS-41 Charlie [41-C], and it was 41 Charlie because nobody wanted to call it its numerical number. It was STS-13, and so those superstitious people changed the whole Shuttle numbering plan to avoid having an STS-13.

JOHNSON: Let's go back for just a moment and talk about, as you mentioned, your first mission as a Flight Director was STS-6, and it was the maiden voyage of the *Challenger*. What are your memories of that flight and in this position for the first time?

GREENE: It felt good. We did the count maybe three or four times. We had a hydrogen leak problems on the vehicle, if I remember, and it took a while to get the vehicle tight enough that we could fly it. Aside from that, like most of the ascents, it was benign. You do all the training and training and training, and you're prepared for all these contingency situations, and you get there and you fly a nominal, and it's almost like magic. Most of them are like that. Some aren't.

JOHNSON: During Apollo and Skylab, Apollo-Soyuz, you were used to dealing with a relatively small crew, two or three people at the most. Then with Shuttle more people were flying. Did that affect anything in the Control Room or as far as dealing with more people or on the simulations or anything?

GREENE: No, not really. Not really. We dealt with the pilot, copilot, and one MS [Mission Specialist], and they were the flight crew we dealt with. They operated as a unit, and we treated them as a unit. We never said, “CDR [Commander], go do this,” or PLT [pilot]. The call was to the crew, and they did their own work management on board, so no, the crew size didn’t affect us.

JOHNSON: Did you get to know the crews as well as you did during Apollo time?

GREENE: Better. Better. Better for a lot of reasons, and we had arguments, not arguments, disagreements. I would spend hours with Glynn [S.] Lunney, and he always advised that we were getting too close to the crews. I think what happened was in the early days, during the early Apollos when Glynn and Kranz were Flight Directors, if they had a beef, they’d go up through Chris [Christopher C. Kraft] and it’d all get settled, and the crews went up through [Alan B.] Shepard [Jr.] and [Donald K. “Deke”] Slayton, and it’d get settled. As Kraft and Shepard and Slayton moved away, neither the Flight Directors nor the crews felt they had the power that perhaps they needed for the job, and so we figured, well, this was a good time. Let’s work together and see if we can get issues solved. The relationships, I think—I don’t know about now, but back then—between the flight crews and the ground crews was extremely close, extremely close.

JOHNSON: Some of those first missions, the first few—well, they carried some significant firsts on board, including the first woman, Sally [K.] Ride; and then [Guion S.] Guy Bluford [Jr.], the

first African American; the first time we flew with a European on STS-8. Those missions were groundbreaking in their own way. Do you have any comments on that?

GREENE: That was external to what we were doing. Sally was a good person, and they flew a good mission. The fact that she was a woman really didn't enter into it very much.

JOHNSON: Were there beginning to be women in the control room at that point?

GREENE: There had been since early Shuttle, early Shuttle. You see, when I first got there, there were no women's restrooms, and then one day they suddenly appeared without any warning signs. The first day, I walked into one. I'd been using it for ten years, and somebody changed the name without telling me. But that all worked out really well, really well.

JOHNSON: We talked about 41-C. The next one that I have down that you worked on was [STS-] 51-D, and that was the one with the flyswatter. Can you share your memories of that mission?

GREENE: I didn't work that mission initially, and we let this LEASAT [Leased Satellite] out. LEASAT is—Syncom or LEASAT, it's the same satellite; two different names for it. And nothing happened, and so we backed off, and we formed teams. There was one theory that there was a trigger that maybe got stuck and didn't allow the firing mechanism to operate. It wasn't a rendezvous flight, and so we had to put together rendezvous procedures and teletyped them up to the crew. We used the teletype machine to do it back then.

Then we had to develop this thing that we could put on the end of the arm so that the arm operator, if we got close enough, could try and hit the trigger and activate the timing mechanism and fix the spacecraft. So we got all that up to the crew, and we got up close. I guess it was [Margaret] Rhea Seddon was the arm operator. Rhea got the arm out, and she swiped at it about three times and hit it pretty good, and we figured that maybe that was enough playing with a live bomb, so we backed off and left it on orbit. The little thing on the end of the arm looked like a flyswatter; it was a hoop. So that the flyswatter mission.

So that happened, and the crew deorbited, and the Navy had this dead spacecraft on orbit, and 51-I was coming, and it was pretty much a not-much-doing flight. So the guys who were flying that flight lobbied. They went out to Hughes [Communications Services, Inc.] and talked to Hughes about bringing the spacecraft home, and that wasn't too palatable, but we figured we'd go out and talk about it. So we went out to Hughes, and we had meetings for—well, we met for two days.

I was late getting out there. I was on an attempted murder trial, which was sort of interesting. I didn't want to miss this meeting, and I was on this damn jury, and this guy was guilty as hell, and we should have put him away for life, and we had a little old grandmother who was knitting, believe it or not, and, "Can't do that to a man." And tried to explain to her that if he was competent, it would have been a murder trial instead of a robbery trial. But anyway, I had the bailiff taking my tickets, and every hour he changed my return reservation, my reservation out to L.A. [Los Angeles, California] So I think we gave the guy seventy-five years.

I made it out to the meeting on the West Coast, and we met in the bar at the LAX [Los Angeles International Airport] Hilton, and there was about four members of the crew and a couple of EVA guys. During the course of the day what we talked about, which was bringing the

vehicle back to Earth for repair, turned into why don't we see if we could repair it, and the Hughes guys put together a scheme. We sat in this bar, and the EVA guy—I forget his name, but he had a sketchpad, and he drew the tools we'd need if we wanted to do this. We went back to Hughes; talked about it. I made a phone call or two, and I was able to cut a deal, and Hughes wrote us a \$10 million check to bring home to Houston, just to see if we could go do this. I've never been given a \$10 million check. Usually given a lot of \$10 million checks, but I've never received one before.

So in the course of four months—four months—we went from a concept to building the hardware to do the repair to figuring out what exactly the onboard procedures had to be, what had to be replaced on the failed spacecraft. And in four months we flew, fixed it, put it in service. I think it was a fleet of four, and this was the only one that operated the way it should have after we fixed it. It was an incredible, incredible job. That was the one where this thing was about the size of a Greyhound bus, and the arm was broken, and so we did most of it with the crew holding onto the satellite while another crewman was working on it. It was phenomenal.

At the end of it, we had to spin it up, because that's how you stabilize one of these, and we had Ox van Hoften on the end of the arm; he held the thing. He spun it up manually, and every time he'd spin it, the crew would have to catch up with it and spin it some more. He'd hit it four or five times. I won a bet of a quarter from Cliff Charlesworth, who bet we wouldn't do that. That was one of the neater flights we've ever done.

JOHNSON: Did you ever talk to Bob Thompson after all these rendezvous?

GREENE: Not about that. Not about that.

JOHNSON: You mentioned earlier a DoD [Department of Defense] mission. You said that was the first rendezvous. Can you talk about the differences in preparing for a DoD mission and a normal mission?

GREENE: No, they were classified. That was primarily the difference.

JOHNSON: As far as running the simulations and everything, it was just more—

GREENE: Well, except that the simulations were as classified as anything on the flight, and the room was closed, and the procedures were confidential or secret or more. You dealt with a smaller bunch of people, because just “need to know” and classification limitations. We had a very good relationship with the people we dealt with in the Air Force. They all acknowledged that the service they got was better than they expected, and they all wanted to continue it. You know, there’s been a lot of talk, the Air Force versus NASA. A different bunch of people in the Air Force. Anybody we touched, we had super dealings with.

JOHNSON: About this time, you were working as a Lead Flight Director. Can you talk for a moment about what the determining factors were, choosing a Lead Flight Director for flights? Was it depending on what the flight was supposed to be doing?

GREENE: There was one group that was primarily ascents and entries, and that's probably the biggest time-critical—but they were fixed procedures that you'd tweak every flight, but pretty much the same old stuff. Lead Flight Director would coordinate a totally different mission every time we went, be it a rendezvous, a Spacelab, and would be required to coordinate three shifts of activity over a seven- to ten-day mission, and was responsible for mission success for that mission. So it was a different set of talents. It was almost a different job. And you get picked for what assignment you had, based on what your background was. [STS] 41-C was the first real big rendezvous flight, and I did all the rendezvous work, and so I got the lead. Then I got into the satellite repair part of it, and having done all that, [STS] 51-I became a natural, and so I picked that assignment up. Other guys specialized in Air Force missions, because they had the contacts with the DoD and the right clearances and knew the right people.

JOHNSON: Did you have any certain criteria for choosing your team for any given flight?

GREENE: No. No. You had veto authority, but pretty much left it to the organizations to put their best people in whatever shifts they were put on. Manning was left to the organizations.

JOHNSON: The next mission that I have that you worked on was [STS] 61-C.

GREENE: Bill [Clarens William] Nelson.

JOHNSON: Do you have any specific memories about that mission?

GREENE: Bill Nelson. That's the now senator from the State of Florida. He was something else to work with. He wanted to go to dinner one night. Got a call from his aide, who said—he was a congressman—“The congressman would like to have dinner with you.”

I said, “Where?”

He said, “Chi-Chi's.” Remember Chi-Chi's?

JOHNSON: Yes.

GREENE: And I said, “I'd rather die than go to Chi-Chi's.”

So he said, “Well, let me talk to the—.” So he talked to the congressman; he calls back, he says, “Congressman says wherever you want.”

I forget—the Juarez Bar and Grill is where Pappasito's is now? I said, “Why don't we meet at the Juarez Bar and Grill?”

So he said, “Okay. How do I get there?”

I said, “It's right across the freeway from Chi-Chi's. It's easy.”

He says, “Well, tell me more.”

I said, “Well, it's on the Gulf Freeway between Bay Area [Boulevard] and NASA-1 [NASA Road 1].”

He said, “Okay.”

Well, they showed up three-quarters of an hour late, because they couldn't find the Gulf Freeway exit off of I-45 [Interstate 45 south of downtown Houston is commonly called the Gulf Freeway because it is the direct route from Houston to Galveston, Texas and the Gulf of Mexico]. That was sort of a hint as to how the flight would go. That was also the flight—this

congressman had a propensity for finding the camera and getting his face in front of it. That carried on prelaunch when he discovered that the mirror in the White Room outside the vehicle was a one-way mirror with a TV camera behind it, and he'd spent all sorts of time primping and prepping. So we got him on orbit one day, and it was really a routine flight, and we convinced [Robert L.] Hoot Gibson to give us a lot of downlink, a lot of television time.

He said, "Okay. We're going to have lunch, and we'll leave the camera on." And they turned the camera on on the flight deck, and the whole screen is Bill Nelson. He's eating.

So we said, "Hoot, we'd really like to get a little middeck."

Hoot put us off for a while for specific reasons. Eventually he said okay, and I had a guy, the INCO [Integrated Communications Officer] who would command the cameras from flight deck to middeck, and I said, "INCO, switch the cameras," and he raised his hand and he started coming in, and by the time he pushed the button, Nelson had gone from the flight deck down to the middeck, and he was sitting in front of the camera again. So we watched in amazement.

Finally I said, "You know, we've never used—." We had a capability that was never used to do a split screen, use two cameras and put one on either side. So I told the CapCom [Capsule Communicator] to tell Hoot that we wanted to do a split-screen DTO [Demonstration Test Objective], just to see if he could be in two places at the same time.

Hoot knew what we were doing, and he said, "We've never done that before." So we had our little game. After the shift, we had to do a postshift press conference, and guy wrote for the [Houston] Chronicle [newspaper] was Carlos Byers. I think he still writes for them, although he's not the space reporter anymore.

Carlos drags me outside the [Press] Briefing Room, and he says, "I know what you guys were up to."

And I said, "I wasn't up to anything." That was 61-C.

JOHNSON: Talking about those postshift press conferences and, as we mentioned before, some of the firsts during those first flights and then, of course, Bill Nelson, did you have to deal with the press quite a bit after each one?

GREENE: Yes, constantly.

JOHNSON: What was that like?

GREENE: I always enjoyed it. I had some big ones, like when Pinky Nelson bounced off, it was like flies on something, and the Press Briefing Room filled up, and they didn't think we'd be able to pull it off. They could smell the kill. Generally they weren't big deals, and we had some training on how to talk to the press.

JOHNSON: Was that coordinated through PAO [NASA Public Affairs Office]?

GREENE: Yes, sort of. I forget the guys who gave the course. They were ABC [American Broadcasting Corporation] execs. As a matter of fact, they were so good, they were leaving us to go to Johnson & Johnson, and teach Johnson & Johnson how to put a pretty face on the Tylenol [acetaminophen] problem [product tampering in 1982]. We got into that after there were a couple of incidents where some of our guys didn't quite answer questions correctly and got into some trouble with the press.

JOHNSON: Would you like to take a break for a minute?

GREENE: Yes.

JOHNSON: When we left off, we were talking about STS 61-C and that flight. After 61-C landed in January, ten days later the *Challenger* accident occurred. If you would, please share your memories of that with us.

GREENE: [STS] 61-C, number one, wasn't supposed to land as late as it did. They had trouble getting off, and they had trouble landing because of weather, and I forget who it was that quit, who left the Flight Director Office. I was requested to do the launch of the next mission, [STS] 51-L, and so I just stopped supporting 61-C, and I went and simulated with the 51-L guys. It was a routine launch. It was another TDRS [tracking and data relay satellite] mission.

A couple of days earlier we attempted a launch, and we scrubbed because we had a government-supplied handle that went on the hatch of the vehicle, and they couldn't get it off. Had they gotten the handle off, 51-L might not have happened. Somebody else might have had it happen to them, but not those guys. We also scrubbed on a beautifully clear day, based on a bad weather forecast.

Then we got in the day of 51-L, and there was discussion—not a lot of discussion—about the icing on the [launch] pad and the cold temps [temperatures]. The shift prior to mine had worked the problem, and they concluded that as far as the Orbiter [*Challenger*] was concerned,

we had no concerns about the weather. We didn't know about what was lurking on the SRB [Solid Rocket Booster] side.

So we launched, and we went throttle down, throttle up, woops. [Frederick D.] Fred Gregory and [Richard O.] Dick Covey—I was on the Flight Director console; they were the CapComs. I was just working the room, and there was a TV [television] monitor to my left, and I never saw the TV monitor. I did see Fred and Dick. I saw both their jaws drop, and there was the cloud. We got the report that they were tracking multiple pieces, and kept on hoping that some part of the vehicle would come out and everything would have a happy ending, because it was supposed to and it didn't.

I was especially close to that crew, especially close to virtually all of them. Very close to Judy [Judith A. Resnick] and Dick [Francis Richard Scobee]. So that's what happened. I gave a press conference about two days later, and that was tough duty. That was tough duty. But the press was on our side, and they were supportive. There were actually some good human beings out there. So that was 51-L in a nutshell.

JOHNSON: Immediately after the accident occurred, and you said that you didn't see the monitor, as far as the control room, what were the first things that you did as Flight Director once you knew that the accident had occurred?

GREENE: We secured the room; nobody in or out. We secured the communications. We got everybody getting their data together and writing incident reports. We worked for a long time trying to get the search and rescue guys to enter the area. They were worried that there was debris that was falling for an hour after the accident, and they didn't want the choppers

anywheres near it, which was understandable in the light of day, but at the time was disconcerting, that we could have had guys out in the water and they didn't want to get close to them. That's pretty much what we did. Released the operators. Was very calm, cool, and collected; went home and completely broke down. It was a rough day.

JOHNSON: In the days following—of course, you mentioned the press conference—what were your duties immediately following the accident?

GREENE: None. None.

JOHNSON: Did you have any involvement with Sally Ride's report [*Leadership and America's Future in Space*]?

GREENE: No.

JOHNSON: By October 1987, you became Chief of the Safety Division.

GREENE: Yes.

JOHNSON: Do you want to move on to that?

GREENE: I decided, for a lot of reasons, that I'd had all the fun I wanted to have in the Control Room. I went on and I did a couple of months, a few months, half a year—who knows;

something like that—working a lunar exploration group, and then I didn't like that and needed something more challenging. [Charles F.] Charlie Bolden [Jr.] was running the Safety Division. I took over from Charlie.

Charlie did people, and then I brought engineering rigor in, and we developed a pretty good safety operation, and we developed a Shuttle Safety Review Board. We reviewed the hazard reports, not only for the Orbiter, but for each of the other elements, and it took us about a year. We visited all the sites. We had membership from all the sites. I probably learned more about the vehicle in that year or two than at any other time in my career. It was a great education.

But after doing safety for two years, I got a call. I had a buddy at KSC who was my counterpart. He came in at about the same time I did, and he had a strong engineering background and understood they needed safety guys, but why me, Lord? So he called one day, and he says, "We've got a problem."

I said, "What's the problem, Bob?"

He says, "You know, if we stay on this job much longer, we're going to have to read the manuals."

And I said, "Good put." So I forget who I let it be known that I was ready to get out. I left there and went to the Shuttle Program, working for [Leonard S.] Nicholson. I did that for a while, and it got me into program management, and I learned a lot in that that year, too.

JOHNSON: Do you want to share with us some of the things you learned?

GREENE: Well, budgets and schedules and resources. It was a whole different thing than anything I'd ever been used to. That didn't last too long, because one day George called, and this was after the first President [George H. W.] Bush decided we'd go back to the Moon, this time to stay, and on to Mars, is what he said.

George said, "We want you to go to Washington [D.C., NASA Headquarters] and be a Deputy AA, Associate Administrator for Exploration." See, they named this guy [Michael D.] Mike Griffin as the AA, and I had worked some stuff we can't talk about with him. He used to be part of the Star Wars guys, General [James A.] Abrahamson's guys. He was their head of technology. Well, Mike got named as the AA for Exploration, and I became his Deputy.

I turned George down twice for that job, and I figured I had beat him. Then he had the audacity to have Chris Kraft call, and they were both singing the national anthem and waving the flag and so I went to Washington, and I did that, two years. We put together a proposal on how we'd go back to the Moon, and we only had about a \$10 million budget. It wasn't much. At the end of two years, the budget got canceled, the program got canceled, all my friends got canceled, and I was back at the Johnson Space Center.

JOHNSON: During that time period, did you work with the Department of Energy [DOE], discussing nuclear power and propulsion?

GREENE: Yes, I did some of that. When [Daniel S.] Dan Goldin came in, among other things he put together these study groups to how NASA would team with Department of Energy on about ten different areas. I was given cochairmanship with a guy from DOE, and we ran a board on nuclear power and propulsion, something I knew absolutely nothing about, but if you surround

yourself with the right number of Ph.D.'s and nuclear physicists. We did that and put together what I think is still a dynamite piece of paper; it was about fifty pages in length. And Goldin never read it, because he said it was too thick. So there you are. Still a dynamite piece of paper.

JOHNSON: How was it working with the Department of Energy and working with another agency like that?

GREENE: We had a very good relationship, very good.

JOHNSON: Were you in the D.C. area the whole time, or did you commute back and forth?

GREENE: Commuted. Commuted. I commuted when I was in D.C. all the time, which wasn't a bad deal.

JOHNSON: Well, in the early '90s, you moved to Engineering Directorate?

GREENE: That's after Exploration went out of business. I needed a place to escape to.

JOHNSON: What was your role in that directorate?

GREENE: I had a Technology Group, and it was ahead of its time—or behind its time—and it wasn't what I wanted to do. So I sat there and waited for the next time George came to call. Eventually he came, and he said, "We need an Orbiter Project Manager." I did that for a few

years. That was an amazingly good feeling, owning four Shuttles. Going down to the Cape [Canaveral, Florida] and visiting them and actually feeling ownership and responsibility for them.

JOHNSON: What were some of the duties that you had in that position?

GREENE: It was technical, schedule, and budget for the entire Orbiter fleet, and a very close working relationship with our contractor, which was North American Rockwell [Corporation], and then later, Rockwell. Very good friendships; very close relationships with the guys at the Cape, contractor guys, government guys. A very fulfilling position.

JOHNSON: What was the move after that?

GREENE: George came to see me again. Yes, I probably antagonized a lot of people, because I was dead opposed to the [Team] USA Concept [for Global Space Commerce] and the effects it would have on the Johnson workforce. I was right, but they decided it was time to put me somewhere else.

JOHNSON: What concerns did you have?

GREENE: That we'd turn the technical responsibility for Shuttle engineering over to a contractor, and they might or might not have been able to assume those responsibilities. We did great damage to the NASA workforce, and they couldn't assume those responsibilities.

JOHNSON: You went on to work as Deputy Manager for Technical Development for the ISS [International Space Station] Program.

GREENE: Yes, I did.

JOHNSON: Would you like to talk about that for a moment?

GREENE: That was great fun. George knew that that station was in deep, serious trouble, and he asked me to go over and see what I could do. So I went over and did things and made things happen, and we got a pretty good Space Station up there. So I feel very proud of that.

JOHNSON: How closely did you work with the contractors that were involved in that program?

GREENE: Very closely.

JOHNSON: Can you describe some of the issues that you worked on or encountered during that time?

GREENE: We worked on every piece of hardware, on the node, on the lab, solar arrays, the ECLS system, Environmental [Control and Life Support] System, com system. I was able to go down the Cape and climb in the lab before it launched; climbed in the node before it launched, and was

able to just do 360s, and wherever you looked, there was a story about that piece of hardware or that piece of hardware. It all came together, and it's working far beyond anybody's expectations.

JOHNSON: Can you talk for a minute about working with the international partners?

GREENE: I didn't. My job was to get the American elements and get them launched. We had things like we put in an altitude chamber at the Cape. We didn't put it in; we took the old Apollo altitude chamber at the Cape, and we used it to leak-test the node and the lab. So we reconditioned that whole facility, and it works great. Found pieces of it lying in the grass field behind the building, and we had to recondition it. We went in there the first day, and we wanted to take over the facility. We looked at it, and god, it was dirty. When we toured it, there was the ASTP paperwork, blueprints folded out, and the facility was abandoned in place.

As we were leaving the facility, another group was coming to look at it, and that was the production crew for *Armageddon* [1998 movie], and they wanted to use it. That was their weightless training facility. I talked to the guys at the Cape. I said, "Hey, we've got to get this place cleaned up. Maybe they'll be willing to pay for the cleanup."

We tried that. They came back and said, "Nah, they like it dirty."

But we did that. We instituted integration testing, where we took all the modules and moved them closer together and verified alignments and wired them together. We flowed fluids between them. Did a lot of neat stuff that made Space Station a success.

JOHNSON: What was it like seeing it launch?

GREENE: Wonderful. Wonderful.

JOHNSON: You also received some prestigious awards for your work on Space Station, the Distinguished Service Medal for NASA, the Stellar Award for the Rotary, and a Silver Snoopy [Award] in 2000. Would you like to talk about any of those awards?

GREENE: None of them had any money. [laughter] So I got a nice piece of rock for the Stellar Award. That was nice. That was nice. Distinguished Service Medal, that's usually an end-of-your-career award, and I think people gave it to me hoping it would be. And the Silver Snoopy wasn't—I don't know. But that's nice to have, too.

JOHNSON: From that position you moved into your role as Chief Engineer.

GREENE: Yes.

JOHNSON: Can you describe what you do in that position?

GREENE: I advise the Center Director, primarily. I have a group that's a Systems Management Group that does cost and schedule analysis and systems engineering support for the center. I have a group that does the ISO [International Organization for Standardization] support for the center. As a result of the CAIB [Columbia Accident Investigation Board], there was a move to get what they called independent technical authority going. We waited for [NASA] Headquarters and waited for Headquarters.

We implemented an Independent Technical Authority [ITA] organization. I have about seven engineers working there, all highly talented people, and they're dispersed to the programs in the onsite organizations, and we have signature authority on all Shuttle and Station change paper, as a result of this ITA. We're still fighting Headquarters on how it ought to be done.

JOHNSON: In 2002, Director [Jefferson D.] Howell [Jr.] established the Engineering Review Board.

GREENE: Yes, and that's something I use to technically review whatever I feel needs to be looked at.

JOHNSON: What is your favorite part of this job?

GREENE: Which job?

JOHNSON: The one you have currently.

GREENE: Getting ready to retire. Trying like hell to do that. I don't know.

JOHNSON: The *Columbia* accident happened while you were still working. What were you doing that moment, and what are your memories of the *Columbia*?

GREENE: I was up in the [JSC] Center Director's viewing room. We heard the com outages. At first, didn't think much of it, and then the Flight Dynamics guys reported failure to lock on with the C-bands. Remember, the C-bands are skin trackers, and they don't require an active system, and the fact they couldn't lock on said nothing was there. Another bad day. Although, personally, I wasn't as close to this crew as I was to the *Challenger* guys, but it's been tough.

JOHNSON: In light of your experience going through *Challenger* in the Control Room, were you able to provide any sort of guidance or support for anyone?

GREENE: No. They did all the right things, and it was a different situation. It was a different situation.

JOHNSON: Were you involved in any of the recovery or the investigation?

GREENE: Peripherally. Peripherally.

JOHNSON: Anything you'd like to talk about?

GREENE: No.

JOHNSON: During your career, since it's run quite a few years, you've worked with a variety of different Directors and also NASA Administrators. Do you have any comments about any of their management styles or any of those people in particular?

GREENE: Kraft, he was probably the best. [Glynn S.] Lunney was a good man to work with. Worked with Crippen a lot, [Richard H.] Dick Truly. Good people. Dan Goldin, not so good. The current Administrator [Sean O'Keefe]—don't tell anybody I said this—not so good. We're lacking a leadership organization with a lot of space experience like we used to have, and it's going to hurt.

JOHNSON: What would you consider your favorite position while you were here?

GREENE: Flight Director, Orbiter Project Manager, and the [International Space] Station job. I liked them all.

JOHNSON: Which of these positions do you think were the most challenging?

GREENE: Flight Director, Orbiter Project Manager, and the Station.

JOHNSON: [Laughs] I get the feeling you like to be challenged.

GREENE: Yes. Yes.

JOHNSON: Is there anything we haven't talked about that you'd like to talk about?

GREENE: My bicycle.

JOHNSON: Okay, talk about your bicycle. [Laughs]

GREENE: I ordered a bicycle about fifteen months ago—no, seventeen months ago—from a little mechanic in Chester, Connecticut, and when it comes, I told the Center Director seventeen months ago, I'm leaving.

JOHNSON: What are your plans for your retirement, other than riding your bicycle?

GREENE: I'm going to ride my bicycle.

JOHNSON: Are you going to ride it anywhere, or is it just around here?

GREENE: Just around here primarily. For what this guy charges, I've got to ride it a lot.

JOHNSON: Before we stop, I'm just going to ask real quickly if Rebecca or Jennifer have any questions.

ROSS-NAZZAL: I don't think so.

JOHNSON: Okay. Well, we appreciate you being here.

[End of interview]