

**NASA HEADQUARTERS ORAL HISTORY PROJECT  
ORAL HISTORY TRANSCRIPT**

N. WAYNE HALE  
INTERVIEWED BY SANDRA JOHNSON  
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JOHNSON: Today is May 28, 2014. This oral history session is being conducted with Wayne Hale in Houston, Texas for the NASA Headquarters Oral History Project. The interviewer is Sandra Johnson, assisted by Rebecca Wright. I want to thank you again for coming in again on this rainy morning.

HALE: My pleasure. Glad we broke the drought.

JOHNSON: Yes, no kidding. Last time, when we ended, we were talking about your move into the Flight Director Office. I want to start there, and just talk about some of those issues around that. First of all your opportunity to do that, and what do you think were the determining factors in choosing the people that were going to go into that office?

HALE: Good set of questions. Let me start a little bit earlier. When I came to work in 1978, the Mission Operation—or I guess it was Flight Operations Directorate in those days—under Gene [Eugene F.] Kranz realized they were getting a large influx of fresh-out-of-college young people, and so they decided they needed to put together a plan to indoctrinate them, bring them on board, and make sure that they were presented to senior management. So we all had to put together a career plan.

At about a six month or one year point, I think we all had to go in front of Gene Kranz, which is very intimidating, and tell him what we'd been doing. His whole senior staff with him, tell him what we'd been doing in our first, I guess it must have been year, at NASA and what our career plans were. I still have a copy of my slides that I made for that. In those days, you know, it was viewfoils [transparencies]. My career goals were to get certified to be a front room operator in Mission Control, to advance to be a flight director, and then go on to senior NASA management, in that order. I think I did pretty well in that, but those are pretty broad. I think everybody who went through that little program probably had about the same goals, so I wonder if they got tired of hearing those goals.

It was pretty clear from the day that you walked in the door in the flight control team, Flight Systems Division, that aspiring to be a flight director was what you wanted to do. That was the road to advancement. There are line management jobs—in those days, a first-level supervisor was a section head, and then the second level was branch chief, and then you had your division chiefs, and on up to the directorate head—but you wanted to aspire to be a flight director. They were the heroes. I should say there were a lot of people that came in that wanted to be astronauts, and repeatedly applied, over and over again, to be an astronaut. My eyes were so bad I knew from day one that that was never going to be an option for me, but flight director was, and that's what I wanted to do. All my peers kind of felt the same way.

The first step in getting to be a flight director is it became very clear that they wanted people with some level of supervisory experience. It wasn't just enough to be a good or outstanding front-room console operator—and that was a prerequisite—but they also wanted people that had supervisory experience. They picked people from the ranks of section head or branch chief level, really mostly section head. I don't think anybody ever sat me down and told

me this, but it was pretty obvious. We all talked about it—who got selected, how they got there. The first flight directors for [Space] Shuttle had come out of the Apollo era, and so the first selection—and I can't remember exactly when the first selection of crewed Shuttle flight directors came—it came after I got there, but we all paid very intense attention to that, at the parameters.

First step was to get to be a section head, and so after a few years—let me think about this a minute. I started in '78, and in the early '80s, about 1982 or '83, I was a GS [General Schedule]-13 and eligible to start applying. Every time a section head vacancy came open in the Flight Operations Directorate, I would apply. I think I applied seven times before I was selected, and I don't think that was very unusual. There was a lot of intense competition among the young troops to move up. While we had a lot of good camaraderie, there was a lot of competition. Don't mistake that.

Tommy [W.] Holloway was the chief of the Flight Director Office at the time I became eligible to apply, and it was a very formal process. There was an announcement, you had to turn in an application, you had to have some endorsement letters, as I recall, and it all went to Tommy. Of course it went to NASA Human Resources first, and they screened people for qualifications, but he had a large number of folks to choose from. The selection year came about every two years, as I recall. They'd select the flight directors. The year that I was chosen he had elected that he wanted to select three, and I was fortunate enough to be among those. We had an intimidating interview.

JOHNSON: Do you recall anything about that interview?

HALE: Other than I was quivering in my boots? It's something that I really wanted and something that there was a big competition for, and how does one put one's case forward in an appropriate way? I remember—I'll tell you a little story. Ron [Ronald D.] Dittmore and I, of course, were very close because we started in the propulsion systems section together. He came a year before I did, and we worked for several years there, getting our certifications and working as propulsion system officers on the early flights.

He was, as I said, about a year ahead of me, and then he applied very quickly for one of the flight director jobs, and in that first round that he interviewed, Gene Kranz was the interviewer. I think that would have just petrified me, but Ron went and he did not get selected the first time. He applied, and we debriefed that. "Why do you think you didn't get selected?"

He said, "Well, I think I answered one question wrong."

"What was the question?"

"Which flight director that you've worked under do you think is a good flight director, and which flight director you worked under that you think is a bad flight director?" That's testing your powers of observation—also giving the boss some feedback into what the troops think about his direct reports—and we hadn't worked with very many flight directors. This is like after STS-2 or something, and we'd worked with just a couple of flight directors, who all had gone.

He said, "Well, Neil [B.] Hutchinson is absolutely great." Gene did not like Neil Hutchinson, so that was kind of the kiss of, "Well, young man, you need to go back and study some more," or words to that effect, I think, were the response to that question. As we got older and had more experience, we were able to answer that question better, so that was kind of an

interesting time. I was fortunate because by the time I started applying, we had much more experience and I had a much broader range.

As I recall, I was all ready for that question, and Tommy Holloway did not ask it. Shocks. Tommy Holloway, I think, is one of the most astute people I've ever worked with. He's very low-key, soft-spoken, got this "I'm just an old Arkansas country boy" kind of demeanor, but smart as a whip and did great things for the Agency. I was fortunate to get to be mentored by him in my early years as a flight director. I'd worked with him when he first got to be a flight director. I was the propulsion system officer, so we'd worked together for a number of years.

In the early part of 1988, Tommy selected Bob [Robert E.] Castle, Rob [Robert M.] Kelso, and myself as that class of flight directors. We were the first post-*Challenger* [accident, STS-51L] flight directors. Previous to *Challenger* by a little bit, I think late 1985, they had selected Ron [Ronald D.] Dittmore and Michele [A.] Brekke. Somewhere along the line, Michele—who could have been the first woman flight director—opted out of the office, and she never was certified and never sat on console as a flight director. She had a long and distinguished career in other areas, but that was not what she did.

There were only about two or three people that I know of in the Shuttle area that were selected to be flight directors and didn't actually complete the process and left the office before they were certified. Rick [Richard N.] Fitts, who was an early mentor of mine, he'd been my second or third first-level supervisor when I was young, Michele Brekke, and then Bill [William H.] Gerstenmaier, interestingly enough, was selected to be in the Flight Director Office. He spent about six weeks in the office and they decided he was more valuable doing something else. He went off to do a more programmatic kind of a job, and of course his career did not suffer from not being a flight director. Have I answered your question?

JOHNSON: Yes, I think that's a lot of good information. You were talking about the time to be certified and that certification process—maybe you can talk about that a little bit, just about what that entailed and how long it took for you, and the group that you were with, to go through that.

HALE: I was selected in unusual times because we were down, not flying, because of the loss of *Challenger* in early 1986. In those days training had several different components. The first thing was go to the training library. This is kind of pre-personal computer-based training, so there really wasn't any computer-based training. We'd go to the training library, and they had a whole catalogue of workbooks on every given subject—trajectory, propulsion, electrical systems—and in various levels. You'd have a first-level workbook, and then a second-level workbook, and so forth. They said, "Get one of everything and read them all, and when you're done, come see us." That was kind of the first part.

The first part of training really was take every workbook on every Shuttle thing—EMU [Extravehicular Mobility Units] spacesuits, RMS [Remote Manipulator System (robotic arm)], things that I had never really had an opportunity to work on—and take those to work with. Then there were classroom trainings that were offered by the training division. They said, "Sign up for all of them." Typically there would be a little bit of, "Class is full, we'll have to put you in the next class in another month," or something, but we got priority to take all those classes.

So we took *all* the classes, and then Tommy Holloway told us that we needed to go visit all the NASA human spaceflight centers. At that particular time we apparently had some travel money. I always thought that was one of the most valuable things we do because as flight director selectees, trainees, the doors kind of opened wide to us. So we went to Kennedy Space

Center [Florida], obviously, to Dryden [Flight Research Center, Edwards, California; renamed Armstrong Flight Research Center, 2014], we went to Stennis [Space Center, Mississippi], we went to Marshall [Space Flight Center, Huntsville, Alabama], we went to NASA Headquarters [Washington, DC]. We met with Mr. [George W. S.] Abbey when he was doing his role at NASA Headquarters. He was very happy to see us. Goddard [Space Flight Center, Greenbelt, Maryland], because Goddard is by there and they run the network.

We kind of made the world tour. He gave us a nickname of the Martin Short/Steve Martin movie—*The Three Amigos* had come out, so they called us the Three Amigos. It was kind of cute, so it was the Three Amigos World Tour. We went to all these places and just learned a lot. People were very open. On that tour I met the new NASA test director selectees that we would be working with for launches in the firing room, which were Al [Albert D.] Sofge and Mike [Michael D.] Leinbach, and I've known them ever since 1988. Who you met, who you got to know, was very important.

Then you see the facilities and the capabilities, what they can do. I made many, many trips as an ascent/entry flight director to Dryden, and knowing the geography and what they could do was extremely important. Same thing for the Kennedy Space Center because we're responsible for the landings. We went two or three times to White Sands Space Harbor [White Sands Test Facility, Las Cruces, New Mexico] on the northern strip, and that was all very important. Later on travel money got squeezed and we couldn't send people, and I always thought that that really lacked in the flight directors' training, if they couldn't go and see.

Some of the tours were really funny. I remember I went to Goddard, and they're strongest in all the network equipment. Tracking network equipment is not very compelling, visually, so we'd walk into a room and there'd be big racks of computer equipment. Here's

where we do this and so, here's where we do this and so, and so forth. Then, they took us down—it was one of the most memorable parts of this trip—to this big, empty room. They showed us, “This is where our mainframe computer used to be.” It's kind of like, “Oh, thank you for showing us this.” It was really cute.

Whenever we came across something that was a little humorous, we would say, “Well, yes, we saw the room where the mainframe computer used to be,” and that became a watchword among us. But it was very good to see all the facilities. Really valuable, not just to be a flight director, but later in my career as well, having been all these places and seen all this stuff, and met the people. There's no substitute for face to face. You can talk in telecoms or email or what have you, but there's no substitute for face to face.

I remember Mr. Abbey, at the time, was very involved. We had an explosion—I think it was a Kerr-McGee AP plant, aluminum perchlorate plant—and there was a national shortage of aluminum perchlorate, which is the main constituent for the solid rocket booster fuel. He was in negotiations with the Department of Defense because they used that on their missiles, rockets. We weren't flying, but I remember that we talked with him at length about that particular subject. There was a shortage, and they had to bring on a new plant because they had a very bad accident, blew up the whole plant, Kerr-McGee. We were immersed in the issues of the day.

JOHNSON: You also were coming on in a time, because of the accident, because of the *Challenger*—there were some technical changes, but there was also a cultural change after the [Rogers Commission] Report came out. Can you talk about that, and moving into that position during that time?

HALE: It was a very interesting time because it really was a bigger cultural change than I realized at the time. So looking back on it, it was a huge watershed moment. When I came to work, whether NASA had put it out or whether the popular press had exaggerated or something, the basic belief was we're going to fly the Shuttle like an airliner, we were going to take teachers and journalists. We're going to fly Walter [L.] Cronkite [Jr., broadcast journalist] and John Denver [singer-songwriter], and everybody could go into space on the Space Shuttle.

We would be flying—I remember some of the early predictions were once every two weeks, which of course was not anywhere near we ever got to. But we were gearing up, and so there was this pressure, in the middle eighties, 1984 to 1985, that we've got to get the flight rate up. We're bringing new Orbiters into the fleet, we've got to train people faster, we've got to plan these flights faster. We've got to train the astronauts faster because we're going to move from two to three flights a year, to six to eight flights a year, to 10 to 12, and I think the plan for 1986 was maybe 15 flights that year? It was either 12 or 15, I can look that up.

It was a huge number of flights a year, and I think in the calendar year, in the 12-month period right before *Challenger*, we flew nine, which was just a huge workload. The discussion was, how are we going to support this flight rate? We were going to do multi-purpose support rooms. The Mission Control you see on TV is just the front room, and we would have a front room for every Space Shuttle mission because we'd have them going simultaneously. We'd have a countdown on one while we were flying the other, all these other things.

We would have a front room for every Space Shuttle mission, but in the back room, the staff support rooms, they would have to support more than one mission. How would we do that? How could somebody divide their time between watching *Atlantis* and *Discovery*, or whatever you might have? There were very serious questions about whether we could do that. That was

the challenge that was before us. That was the task that we'd been given to do. I was young enough not to do anything but salute, "We're going to go do this."

Then *Challenger* was lost, and that was a huge blow to everyone. It was a huge emotional event. The report that came out was widely misunderstood, if I can digress for a minute about that. We all watched the Rogers Commission hearings, we all read the report that was published, and the bottom line that I and most of my peers drew from that was we had one rogue manager out of Marshall who made a bad decision because there was schedule pressure, and therefore, we should all be vigilant not to let launch fever, schedule pressure, talk us into making bad decisions.

That's the entire lesson we learned out of *Challenger*, plus the fact that the president said we're not going to haul satellites, we're only going to do things that require people. We put pressure suits and parachutes and an escape hatch on the vehicle, and went back and examined every possible thing that could go wrong in the Shuttle so that we in Flight Control could do a better job.

We were all children of Apollo 13, because that was one of the great mythos value stories that they taught us. In Apollo 13, Mission Control saved the crew and saved the day. They would have died if we hadn't have been there, so that's what Mission Control is. Therefore, we need to be ready to save the crew in every possible circumstance that could happen. That's what we thought we could do, and of course in *Challenger* there was nothing Mission Control could have done.

That was a shock to the system. We now realized there was a class of problems that we were not going to be able to solve, so I think a little bit of the hubris went out of us at that point, and the realization that yes, we could, in fact, lose crews without being able to do anything about

it. Again, this lesson that don't let launch fever, schedule pressure drive you to do stupid things, was what we learned.

Much later I read Diane Vaughan's book on the *Challenger* launch decision [*The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*]. I know if you read that book, it's a powerful book. It talks about how she started out at the same place, having read the media, and then did her research and found out that that was not the case at all. That was not the case at all, and I'll leave that whole discussion for later because it's a different story that I wish I had learned at the time. I think all of us in the Agency took this one rogue manager thing, that we've got to be on the lookout—particularly those Marshall guys because, as you know, there is a huge inter-center rivalry between Johnson and Marshall. It's not good, but it is there.

We had this period in 1986 and '87, where we literally pulled everything up by the roots in Flight Control and looked at every possible thing that we could look at. All the failure modes and effects, all the critical item lists, all the crew procedures, all the ground procedures—what have we missed, what could we improve, how could we train to do better? We brought these new systems online, contingency aborts and bail out and all these things for launch. We did a huge amount of work, all to get ready to go fly again, and we were always chasing the flight date as it was before STS-1.

Everyone thought pre-flight would happen earlier than it actually happened, and there were delays, and we got put off. In the middle of this, I got selected to be a flight director. It was kind of a good thing for my training that we were in this down period because people had more time to help us, to train us. Then, for *Discovery's* return to flight in September of 1988 [STS-26], I drew the great assignment of being the color person, commentary person, for the AP

[Associated Press] Radio Network. I was sitting in a little trailer out behind Building 9 with the radio announcer, kind of giving color commentary on the launch, and I'm thinking, "What am I going to say if this goes bad," kind of a thing. Of course, everything went well and it was good, but we did get a lot of media training, I should say.

That's one of the things they recognized early. They put us through media training, which I really appreciate because I used that a lot. Flight directors were expected to do a change of shift press briefing. I went over and watched a number of those change of shift press briefings after we started flying again and before I actually drew a flight assignment, to learn how to do that because that's an art. They also had some videotapes of spectacular failures that flight directors had at press conferences. "Don't do this," kind of a thing. "Thank you. Yes sir, I won't."

That whole period, from January of 1986 to September of 1988, when I look back on it—on the one hand, we were not doing what we all came to do, but it was a really good time for me to get this new level of training. So a very busy time.

JOHNSON: Between talking with the press for STS-26 and then the first flight that you worked as a flight director, which was STS-28, I believe—during that time period, during the flights, did you follow other flight directors and shadow them?

HALE: Absolutely, yes. That was one of the things that we had to do. We had what they called OJT [on the job], or shadow assignments. We would go sit with another flight director on integrated simulations, and certainly we sat with flight directors during flight. That was all very good training. You learned that what you do in integrated simulations is not necessarily how the

real world works. They try to make it as close as they can, but there are some differences, and certainly the level of tension is much higher.

Working in the middle of the night, I don't think people that tune in on NASA TV necessarily understand how difficult it is to work a midnight shift, and if that's when the crew's awake and activities are happening, staying on top of things, because that's something else we had to learn to do. We had a lot of discussions about how do you soundproof your bedroom so you can sleep during the day, so you can be chipper when you're on the night shift.

JOHNSON: You mentioned in another interview, the quote from that is: "Once you get to Mission Control as a flight director, you don't have time to do research." Following these other flight directors, I would think everyone had their own style in how they made decisions, and if they had to make a decision quickly. Then when you were doing it, how did you learn that? Was that something that's innate to you personally, and do you think most flight directors have that, or is that something that you learned in training, too?

HALE: Well, it's both. They selected flight directors with certain characteristics, and being a quick study and being able to assimilate a large number of facts and situational awareness and come to a conclusion is one of the hallmarks of being a flight director. Because the clock is always ticking.

I got a great lesson when I moved out of the flight director office. Aaron Cohen, who, of course, had been Orbiter project manager, director of engineering, and then center director for Johnson Space Center—I had a chance to talk with him one time and he said, "The really nice thing about being the program manager, project manager, is you can come back the next day and

say, “The decision I made yesterday wasn’t right, and I want to reverse it.” You’ve got a lot of latitude. You’ve got some time to go home and sleep on it and think about it and learn new things maybe, and come back a few days, a few weeks later, and turn things around. You may have wasted a little bit of resource, but better to make a good decision.

Whereas the flight director was always about, “I don’t care what the optimum decision is, I don’t care necessarily what the best decision might be if we knew all the facts, here’s what I know and here’s the time when I’ve got to make a decision,” and boom. I can work all the time that I want to gather more information, but when the clock says, “Time to decide,” you have to decide. You have to make the decision based on what you know, and not look back. Go forward.

A lot of flight directors failed in other management jobs because they kept that flight director style. It’s hard to change after you have been immersed in that. “I’m in charge. The program, the Agency, the nation, has delegated me the responsibility.” Flight rule number one in the book is “The flight director will make whatever decision necessary to ensure crew safety and mission success.” I used to be able to quote it exactly; I’m embarrassed I can’t right now. It was tattooed on our chests: you will do the best you can, learn the best you can, and make the right decision, and then you move on.

Very interesting management style, and people were looked for with that characteristic trait, then that was honed into us. Lee [Alan L.] Briscoe was very funny. He became chief of the office. He was a very good flight director, I thought. Later on, we had to all take these Myers-Briggs personality tests, and interestingly enough, all the flight directors came out on the side of making decisions with little information—I forget which one of the four letters that is—intuitive, I think. You’re comfortable making decisions with not a lot of information.

Lee Briscoe was on the other side. He was one of the guys that needed a lot of information, and so he would always pull us up short and make us ask more questions. We're like, "I know what I want to do, Lee. Here's what we're going to do." He'd be chief of the office. "We've got all the facts, and I need to decide." "Well, have you thought about this?"

Used to drive us nuts, and after we had the personality test it began to dawn on me that that was part of his basic personality, and he always wanted more. Not that he couldn't make a decision required—he was very good—but for those of us that are kind of out on the other end of that psychological spectrum, "I've got all the information I need, I'm ready to make a decision," you have to bring yourself back in a little bit and say, "Well, I've got another set of minutes, let's ask a couple more questions." Sometimes that's literally all you had. During the launch phase, that's what ascent/entry flight directors do.

During the launch phase, the whole thing takes 8.5 minutes, and you have sometimes seconds to make decisions in some of these cases that they would give us in training, which fortunately we never had. You train and train and train and train, and it really hones you to make those decisions quickly. As a matter of fact, as an ascent/entry flight director, I was always disappointed—relieved and disappointed—when the flight dynamics officer would sing out, "Nominal MECO [Main Engine Cut-Off], no OMS [Orbital Maneuvering System]-1 required, no action required." It was like, I trained for six months to be able to handle anything, and I didn't have to say a word, and there were no decisions to be made. Everything went fine, but what a waste of my time, to have done all that training. That's a good thing, too.

JOHNSON: You had to poll your systems experts in flight control, but did you often have to go above, like you mentioned?

HALE: Here's the analogy that I used: when you're working in the Shuttle Flight Director's Office, when you are the ascent/entry phase—it's a sports analogy—it's like full-court press basketball. It's run all the time, be on top of the game, never rest, never quit. It's full-court press basketball. Being an orbit flight director, where you're going to repair the Hubble [Space Telescope] or plug a new piece into the [International] Space Station, it's a little more like football. You huddle up, you talk about what the play ought to be, you go out, you execute the play, it went good, it went bad, you come back and huddle up and think about the next play. That gets as close as I can get. Then Space Station is like baseball, to carry that to that extreme.

When I was an orbit flight director—and of course, you start out as being an orbit flight director, that's the first rung of the certification ladder—you get told in no uncertain terms that there are certain decisions that you need to call the program about. I can remember very distinctly having the Shuttle program manager's phone number on our phone list, and on a Sunday afternoon or something, having to call the program manager and say, "Well, we've had this situation happen. We could do this or we could do that. The flight rules say do this, but if you're willing to take a little more risk with your Orbiter and the refurbishment, we could do that, which would be better for the payload." You're very cognizant of the fact that you have upper-level management.

Every day the Mission Management Team would meet—almost every day, anyway—and they would come back. The flight director stays on console, the missions operations director, who is the chief of the Flight Director's Office—I got to do that a couple of times—would go to the Mission Management Team Room and they'd talk about the strategy for the day. Then they'd come back and the MOD [Mission Operations Directorate]—I can remember several

times, the mission operations director would come back and tell the lead flight director on console, “Here’s what the MMT [Mission Management Team] wants you to do.”

There’d be this big, “They want me to do what! What are you talking about? This is not what we agreed to do.” We had some interesting times that way, but everybody’s aware that they work for the program. Other senior managers, like the center director, Mr. Abbey, I think I told you, was notorious for coming in just a little after 2:00 in the morning, and come and sit in the console next to the flight director. Just to check the pulse of things, I think. You were always aware senior management was watching you.

We’re all talking on headsets. We’re all trained that you speak on the loop. You don’t talk to somebody with the mic [microphone] not keyed, even though they might be as close as you and I are. You are on their comm [communications] loop, the flight director loop or whatever, and you key your microphone, and you talk. “What do you think we ought to do, Payloads? What do you think we ought to do, FAO [Flight Activities Officer]? What’s the plan?” Then, you have this conversation.

It’s because those comm loops get routed all over, and you know that there’s a squawk box sitting in the chief of the Flight Director’s Office, sitting in the Mission Operations Directorate’s office, sitting at the Center Director’s Office, and at NASA Headquarters. Everybody is listening to the flight loop, saying, “What are those nutty guys down in Mission Control getting ready to do?”

I don’t think it necessarily inhibited you because you get accustomed to that thing, but always in the back of your mind you know that people are listening. Many times you would have a little rehearsed speech. You hoped they were listening so you could say, “Okay, here’s what we’re going to do, and here’s why we’re going to do it. Everybody listen up.” Sometimes

you found out nobody was listening. That's okay too, but you had it and it was recorded. They kept those tapes.

After *Challenger*, I was told as a section head for the prop [propulsion] section, that I should go listen to the comm loop tapes for my propulsion team and report if there was anything that would be untoward if we released those to the press. Apparently there was a thought that all these comm loops would be released to the press. I don't know that they ever were. I had to sit down and listen to five or six hours of audiotapes of what my guys said to each other on their comm loops in the countdown and after the accident. You know that that could very well be you on those comm loop tapes, and I think that was always in the back of your mind.

JOHNSON: Let's talk about that first flight, as much as you can. Since it was a DOD [Department of Defense]-classified mission, if you can just give us what details you can of that first experience?

HALE: I can't say anything about the payload or the operations because that, as far as I know, is still classified, but we can talk about the process. The first certification you get is as an orbit flight director, which it's means it's not launch, it's not landing, it's the on-orbit phase. Typically we'd have a flight director that did launch and landing, and in the middle of the flight, what I did for many years, we'd come in and check on things, go to the MMT meeting, bother people on some other flight director shift, as operators, talking about what are we going to do for the landing or whatnot.

Then you had three other flights directors, three or four. For very long missions we'd rotate a team off, but three 8-hour shifts—ostensibly 8-hour shifts, give or take. There would be

an Orbit-1, 2, 3—or an Orbit-1, 2, and planning flight director. Planning being the guy who's there during crew sleep. Everybody, of course, had their own team. When you were first certified, you got your orbit certification. Your first job typically was to be the planning team flight director.

So I was planning team flight director for STS-28. What that entails, of course, is every night the crew's going to sleep. You come in and you see what had happened during the execute periods of the day—what had gone right, what had gone wrong, maybe there's some new requests. I'm speaking in general terms now, not specifically about STS-28. Maybe there would be some requests from some of the principal investigators on the little science experiments we'd carry, or maybe the primary payload had some stuff they needed done. You would work with your flight activities officer and the whole team to build a new plan for the next day, or modify the existing plan the next day, as required, while you're monitoring the Shuttle.

There were really only two rules for the planning team flight director. Number one rule is always have the plan ready when the Orbit-1 flight director shows up. I saw that happen a couple of times, when the planning team got behind for one reason or another on some flight, and the Orbit-1 flight director, typically the lead flight director, he's overall in charge, on the Orbit-1 shift would stroll into the Control Center, and, "The plan's not ready. The crew wakes up in three minutes and we haven't finished reviewing the plan, and we're going to have to teleprinter it up to them." Oh, my goodness, it was bad. That's rule number one, get your plan done.

Rule number two is don't wake the crew up. You'd always be watching some little thermostat or some silly parameter that's one degree above the alarm that's going to set off the system alert tone, to tell the crew to switch from the A-heater to the B-heater—there's always

something. You're sitting kind of on the edge of your seat, that, "Is this going to wake the crew up?" Some of those limits you could change from the ground. Some of them you couldn't. The ones that you could change from the ground you wanted to stay on top of.

The really funny alert was, particularly in the early days before we had a whole TDRS [Tracking and Data Relay Satellite] network constellation up there, you worried about losing comm with the crew. In the dead middle of crew sleep, your sleep typically being eight hours, give or take—at four hours into crew sleep, there would be a time tone that would go off. If that time tone went off, that would tell the crew that somehow communication had been lost with the ground, and they needed to go switch their radios around and regain comm. If you lost track of things and didn't have your comm officers turn that alarm off, it would wake the crew up in the middle of the night. They would not be happy if they really had comm.

The other thing we also knew is the crew didn't sleep a lot of times. You could see the toilet flush, you could see lights come on, and they're up. We know they're up, but we're not going to say anything to them because they're big boys and girls. Particularly the first night—crews were notorious for not sleeping the first night because they're so excited, the adrenaline's high, or they were suffering from space adaptation syndrome [space sickness], and they were not having a good night.

For whatever reason, the first night or two a lot of crews did not sleep very much. Some crew members I don't think ever slept at all, but it's a personal thing. We're supposed to tell them to sleep, and then you'd write a little note to the flight surgeon, "When you have your private medical conference, remind them that they're supposed to be asleep because they need their rest," kind of like mother hen stuff. You didn't want to say that on the open radio because,

again, it gets broadcast to the world, but the surgeons got a private medical conference and could say things to them that won't go out to the whole crew.

I drew the planning team on STS-28, classified flight. I personally hated working classified flights. The overhead that comes with security is painful, and it is against the culture of NASA, being a very open civilian organization. It was just a real pain to do all this security stuff, overhead. At the end of all those flights they gave us a debriefing, and we didn't do a very good job, apparently, because things leaked out that shouldn't have. Again, I don't know the particulars, but I remember being deathly afraid of Brewster [H.] Shaw. He was the commander of the flight.

Brewster is a very intimidating individual, and he looks at you with those icy blue eyes that he's got and says, "Oh, really?" Then you just go, "Oh," like back in third grade, I did my long division wrong. We really wanted to do a good job with Brewster and his crew. The big thing that happened on that flight was the space radiation guys. I've written about this—as far as I know, it's got zero to do with any classification thing. There was a solar flare and STS-28 was a high-inclination flight, which takes you into areas where the Shuttle crew may get a little bit higher dose of radiation than it would on the more equatorial flight.

In the middle of the night I get this call, this disembodied voice, "Flight, this is SRAG," the Space Radiation Assessment Group, "and we've had a solar event and we should talk." There's a flight rule—it's in the book, you can see to this day—that says if you get a prediction of a certain amount of radiation, you're supposed to terminate the flight. You're supposed to do an emergency de-orbit. A little less, you might wait till the next planned landing opportunity, but you terminate the flight early. So this is a serious thing.

I spent some really quality time with the guys, and I was really worried that this flare, I was going to have to wake the crew up and say, “Start emergency de-orbit prep [preparation],” and all this stuff. We finally got some more data and they said, “Well, it’ll be a little bit less, it’s down to the land the next day level.” Here I am, it’s 2:00, 3:00 in the morning, and I’m thinking, “Oh, do I need to start making phone calls? Tell the program manager, call the director of mission operations, start waking everybody up?” They said, “Well, wait a minute, flight, we’ve got some more info.”

We piddled with this for two or three hours, and the story got a little better and a little better and a little better, but it’s still going to be terminate the mission early. The lead flight director comes in, Chuck [Charles W.] Shaw, and of course he comes in early because when you’re a lead flight director you come in ahead of everybody, you want to get everything. Comes in early, and I give him, “Chuck, this is what’s going on.”

He immediately goes racing down the hall to where their room is, beats on the door. It’s a locked door because they do things back there that had some implications, and he goes in the room and he comes back and says, “We’re not de-orbiting early, we’re going to stay on orbit.” “It’s your call, Mr. Lead Flight Director.” I had the flight rulebook out and opened to the page, we’re talking about all this, and it was really interesting. Then, to finish up on the story, we stayed on orbit and did the mission, and landed.

The flight docs [doctors] who meet the crew at landing—I think we landed at Edwards, pretty sure we landed at Edwards—take them in a little trailer there, they give them the medical exam. The flight docs said, “Well, we think you boys have been exposed to some significant radiation, and here’s what might or might not happen to you,” and really kind of scared the crew, I think. Then a few days later they got the dosimeters, because we carried individual dosimeters

on the crew, as normal. They got nothing. It was all a normal background. The crew was furious because, A, we didn't tell them during the flight—which looking back on it, maybe we should have—and B, they were furious with the flight docs for scaring the bejeezus out of them when they landed, and then C, they were furious when it came back and it was a non-issue.

That was really baptism by fire. Now, that's got nothing to do with what we did on the flight. It's just there, that's my story from STS-28. I learned a whole heck of a lot, and I had to go to no press conferences, which was a good thing, because we didn't do press conferences for those classified [missions]. That's the only silver lining on working a classified flight, is no press conferences. Do I rattle on too much? I'm doing okay?

JOHNSON: No, you're doing great. You had 40 Space Shuttle flights as flight director, so I believe you still hold the record for that.

HALE: In terms of number of flights supported, that's true. I think the Space Station guys probably had more hours. They can't count it the same way because it's one big mission, but yes, I still hold the record. Paul [F.] Dye was really chasing me—he was really hoping we'd get one more Shuttle flight. I think if they had authorized just one more Shuttle flight and he got assigned, he might have paced me out, but yes, there it stands.

JOHNSON: If you don't mind, maybe talk about some of those missions that stand out in your mind, or anything that you'd like to talk about? Maybe close calls or things that you had to make decisions on?

HALE: There's so many stories. And to be frank, after this time a lot of the details run together and I couldn't tell you which flight did which. You remember the first couple and the last one, and then the funny incidents in between, or really interesting incidents. I remember STS-33. Fred [Frederick D.] Gregory was the commander, and Story [F.] Musgrave was on the flight. It's another DOD-classified flight, and it had just fallen out that we were in orbit over Thanksgiving. I've told this story before and you may have heard it from other people, but I had the Orbit-2 shift. I wasn't the lead flight director, I was the other orbit flight director.

I remember we celebrated Thanksgiving at my house early because I had to be on console at noon or one o'clock. So we had family, and we had turkey and dressing and the whole stuff at about 10:30 in the morning, which is tough, because I had to go to work. I went into work, I came into work, and the toilet was broken. The Shuttle potty was broken. I spent all Thanksgiving Day trying to get people to come in because they were all off. The engineering staff, the support people—it's Thanksgiving Day, we had the potty broken. There's a long story about that, but it was very interesting.

Finally, some guys figured out how to make the thing work by taking the front panel off and using some vice-grips to move a valve inside of it that had stuck. But that's an important thing. They only had one toilet on the Space Shuttle, and the alternative was to use the Apollo bags, which nobody wanted to do. That's very unpleasant. We had a lot of problems with the toilet over the years.

I had a couple of learning experiences. My first assignment as an entry flight director was on STS-31, which was the Hubble [launch] mission. Again, as you go through, you get certified as orbit, then you get certified as entry, then you get certified as ascent, kind of the top of the heap there. Somebody else—I can't remember now who launched, was it Linda [J.]

Ham?—was the ascent flight director, and then I sat with Bill [William D.] Reeves, who was the lead orbit flight director, many of his shifts.

Particularly during Hubble deploy, which was just vastly interesting. This was before we knew Hubble had its mirror problem, of course. It was a very important mission to the Agency. We didn't understand how important at the time, but we knew it was important. Watched him through the deploy, working with the Goddard guys to get the telescope out and activated, and then I did the entry.

The entry day was really dynamic. The weather in Florida was out of limits, not even close. The weather at White Sands was out of limits, not even close. The weather at Edwards was on the limit of being acceptable. Loren [J.] Shriver, who's the commander, a really great guy, good stick-and-rudder guy—the entry flight director is very interested in how good a pilot the commander is, as you might expect. We had the wind blowing and it was really strong, and we had a flight rule that said it's a big glider and they do this energy analysis. We launch a [weather] balloon and we get the wind profile and we run the simulation of what the Orbiter's going to do as it glides back in.

One of the key parameters is given a perfectly flown landing pattern, how far down the runway will you touch down? The guidance and the crew training all said the nominal touchdown point is 2,500 feet from the threshold of the runway, which is quite a good margin. Then, we knew that there were uncertainties and the wind would change and how the pilot flew it, but we felt that covered us for everything.

They said under certain circumstances, if it's really important to land, if that landing analysis says you land as close as 1,000 feet from the threshold of the runway, that is okay, you can still proceed and land. Then, if the circumstances are even more severe, you can land at a

reduced speed. In other words, you use more energy, so when you come across the threshold of the runway, you're going slower. If you land 10 knots under the normal planned landing speed, 185 knots versus 195, and you're only 1,000 feet down the runway, that's the limit. And that should only be used judiciously. I don't remember exactly how the flight rules say it, but that's a go day, but it's at the limit.

We had a go day at the limit. I think that the landing, the touchdown prediction was something like 1,100 feet at 185 knots, which is really right on the ragged edge of being go, but I was the newly minted entry flight director. We'd been through all this training, I knew the flight rules—how can we not land? We need to land. “Go for landing.” Well the wind picked up, and so Loren actually wound up landing at, like, 750 feet from the threshold at, like, 170-something knots. It was not a good day to land.

In other words, the flight director, me, set the crew up in a bad situation. That was one of the first lessons I learned, is rookie flight directors are dangerous because they tend to follow the rules and don't really understand all the implications. After that landing, I was scared silly because they could have come up short. They didn't—Loren was very good—and other than getting a good finger-wagging from the chief of the Flight Director Office, we kind of went on.

It came to my next flight as entry flight director, STS-37, and a similar kind of situation set up. Clobbered at KSC, clobbered at White Sands, Edwards is kind of on the margin. We launched these balloons and the analysis came back that it was okay but right at the margin, and Steven [R.] Nagel was the commander. The second time, this is my second entry flight, and I'm getting a reputation, see? I said, “Okay, we're going to go.” This was a lakebed runway, so I know we've got a lot of margin. The wind shifted, the energy state came down, and the crew

landed 750 feet short of the threshold, on the lakebed. On a lakebed runway, it's just a stripe on the sand.

We did a lot of things different after that. I had a lot of explaining to do. And again, I'd followed the rules, for the second time, and made a poor decision. My first two landing set-ups, the goal of the entry flight director is give the commander a good day to land. I learned a lot from that. And after that I became a lot more amenable to waving off for a day, saying, "This just really isn't a very good day. We ought to just give the crew an extra day and let them think about it."

Which flight was it, was it 113—I think we set the record for the number of wave-off days because I just didn't like any of those days. We finally, after three or four wave-offs, got to a situation where it was acceptable, it was good enough, made me feel good. We gave Jim [James D.] Wetherbee, I believe that was STS-113—we set the record, you can check, for the most number of wave-offs.

Crews wave off for one day, they kind of liked it. You got practice, you got to put on the suits, you got to do the checklist, you do the drill, come down, and then you don't burn, and then you get the afternoon off, and you can sit and look out the window. They generally had a very busy flight and it's off-time, and they can do what they want to do. They liked that, the first day. More than one day—it's a little like going to a baseball game. One extra inning is okay, but not more. There are dozens of stories like that.

JOHNSON: You mentioned learning those lessons from those two experiences, and after the flights, you had debriefings, of course, with the press, but you also had internal debriefings. The

lessons that were learned after every flight—how were those put into the flight rules? How was that information disseminated to everybody else that might not have been part of the debriefing?

HALE: Good question. Of course, we had all kinds of debriefings. The crew would have three or four weeks of debriefing—how was the food, how was the primary payload, how was this, that, or the other, how did the landing go? We had different folks who would debrief them on everything, and then the flight directors would go. We had a series of meetings called Flight Techniques. Back in Apollo, they called them Mission Techniques.

Those meetings would occur monthly, or maybe more frequently if you needed them. You would come back and you would say, “Here is something that came out of the crew. Here are the items that came out of the crew debrief on topic X.” Then you would assign, as chair of Flight Techniques—which rotated among the flight directors—action items to the various people. “We need to change this checklist, we need to improve this flight rule,” and you would assign action items which then all got tracked. They had a due date, they had an assignee. Sometimes it involved a study, sometimes it was just write a change request for a checklist or something, and they would get fed back in.

You would always discuss—in this big forum that had lots of people that maybe worked the flight, maybe didn’t—but they were all in Mission Operations, the Flight Crew Office—and you would talk about how it went. What went well and what didn’t go well. That was, I think, how you tracked all this stuff.

To change a flight rule, a little bit of bureaucracy involved there. You had a Flight Rules Control Board. So flight techniques would say, “We need to examine how far down the runway should we land.” You might have some studies, talk to the weathermen about how the winds can

change, how the balloons may not measure things exactly right. To the guys who did the simulation, “How accurate is the simulation?” To the pilots, “How well do you think you’re going to fly, what are you comfortable with?”

You’d have a series of meetings and you’d talk about all these subjects, and you’d come to a conclusion. “We need to change the limit from this to that.” Write a formal change request, send it to the Flight Rules Control Board, who would look at that, typically have to give a presentation, “Here’s why we’re changing it, here’s what we talked about, all the experts agree.” After the Flight Rules Control Board approves it, it goes to the program manager. The program manager gets a package, typically before every flight, of his board, the Program Requirements Control Board. A lot of rules are kind of trivial. “We need to change thermostat set point from this to that,” kind of thing. Some of the rules were significant. “We want to change the way we do a launch abort.”

The Flight Director’s Office would send two or three flight directors to this big board. It’s got the program manager, safety, engineering, the whole gamut of folks in this board meeting, and say, “We want to change these rules. We’ve got presentations on these five because they’re significant. We have these other 12 that are not so significant that we can talk about if you’re interested, but they’re pretty straightforward.” And then you go through a presentation and explain why you’re proposing this change. Sometimes the program manager would argue with you, particularly if he’s a former flight director, and sometimes it was just, “Okay, thank you very much,” sign it off, “Next,” kind of a thing.

Could we take a five-minute break here?

JOHNSON: Sure, not a problem. You were talking about some of the landing things, and that made me think too about the Shuttle auto-land, and some of the issues and how that had to be improved over time. I was reading on your blog about STS-53, and that was an interesting story. I was wondering if you could share that with us.

HALE: Yes, that is a very interesting story. There had been this capability built in the Shuttle autopilot to auto-land. The pilot or commander does not fly the Shuttle until it goes subsonic. That's about the time the commander takes over. It's all flown automatically down to that point, which is a very short amount of time to fly. We're talking two to three minutes from the time the Shuttle goes subsonic until you're actually wheels on the ground. It's not a very long time to fly, but that's what they live for. It's a big deal.

There were certain deficiencies or concerns with the autopilot early on, flying that last part of the landing all the way to the ground. The crews traditionally fly it, and they've done a good job. There were some instances that were interesting, and STS-53 is one of those, but we never certified auto-land. We were worried that under certain circumstances—after we commit to landing, you basically are coming in. You do the de-orbit burn, you don't have a lot of options. You could switch ends of the runway, and that's about it. There's not a lot of other places to go land the Shuttle.

We practiced these emergency landings all the time. We were to land the Shuttle at Orlando International [Airport], or something like that. But there's not a lot of options, and clearly, if you go to a runway that isn't set up for the Shuttle, then you don't have a lot of the navigation aids the crew are used to, and all this kind of thing. We got worried about we might

need auto-land, and particularly when we're facing the very long Shuttle flights, the extended duration Orbiter flights, if the commander had problems.

There was a case on one of the early flights where the crew didn't hydrate properly and they didn't pump their g-suits [anti-gravity suits] up, and the commander almost passed out, which was scary. That was a very early flight, and we all knew about that. We made very sure that the crew drank all the water they were supposed to and had their g-suits pressurized and all this kind of thing.

There was always a concern, particularly as we got these longer and longer flights, there's some vestibular things that happen, some vision changes that happen with people, and we were concerned about them landing. We wanted to make sure we had a viable auto-land system, and the program manager gave us direction to test that out. For STS-53, we worked very, very hard to dot all the i's and cross all the t's so we could do an auto-land test. An auto-land test—you're using a real Orbiter with the live crew. They've got to, no kidding, be right on the mark, or it could be really bad.

Dave [David M.] Walker was the commander. We worked very hard with him to train on how to monitor this automatic system, this landing, and if it's not doing the right thing, how to manually take control back without getting into a worse situation. We did a huge amount of training, and just a couple of weeks before the flight, we were set to do this auto-land test, practiced, practiced, practiced. Had written all the rules and all the procedures and briefed everybody on what we were going to do. Had the blessing of the program manager and the center director and the chief of the Astronaut Office and everybody else.

Jed [Jeremiah W.] Pearson, who was the associate administrator for human spaceflight, former Marine Corps general, as I recall, reviewed it and said, "We're not going to be flying any

more of these long-duration flights. We don't need to do this. We're going to knock this off." Devastating. The team was all set to do this. We were all ready to do this, we were so excited about doing it, thought it would be a good capability.

The general, for whatever reason—I never talked to him about it; he was briefed at a higher level than the flight director—said, "No, we're not going to do any more of those so we don't need to demonstrate this auto-land thing. It's risky." He made that call. His prerogative. That's why we have senior-level managers to assess the risk. But we were devastated. We went off and did the flight, another one of those classified flights, can't talk about what we did on the flight.

Got ready to do the landing—it's one of those classic days. You look back on it and you say, "If some novelist were to write this, I wouldn't believe that it could happen." We were watching low clouds at the Kennedy Space Center. The weather was good, but the clouds were coming in at about 3,000 feet, and our limit was you had to have a broken ceiling no lower than 8,000 feet. That's to give the commander enough time to get the visual landing as you're flying on instruments and as you're diving down for that final approach.

You want to break out of the clouds in enough time to see the visual landing aids and the visual picture, in case those electronic instruments are off. They were never off, but we worried about it. The rule was 8,000 feet minimum ceiling, and we had this line of clouds approaching. They were down around 3,000 foot on the bottom, and so, if they got to the Shuttle Landing Facility before landing, it was going to be a no-go. We're working with the weathermen, "What's the wind? How fast are the clouds breaking?"

Finally, we came to the conclusion that it was going to be an unacceptable landing time, so I waved off and sent them to Edwards, where conditions were beautiful. Clear sky, unlimited

visibility, though it typically is out there. A little bit of wind, but not bad. Lo and behold, in the time that we waved off and got ready to go around again, those clouds stopped. It was like Mother Nature was playing with us. Too late to go to KSC, turns out that the conditions at landing time were beautiful. It would have been great to land at the Kennedy Space Center that day. But it's in the rearview mirror, you can't do anything about it.

We go to Edwards, and Dick [Richard N.] Richards was flying the Shuttle Training Aircraft, and one of the things you want is the report from the Shuttle Training Aircraft pilot giving you, "I've just flown this same approach in the STA, and here's what I saw, and I think it's a good day or not." We had this one cloud, and the wind is blowing moderately. We had this one cloud that comes over and obscures, just plops right over the visual landing, its 3,000-foot bottom. Dick Richards flies the approach, "Oh, it's a great day to fly except this one cloud is right over the visual. You should not come here today because it's right over the visual landing aids." We said, "It's an hour and a half till we land, that cloud's not going to be there, and it's the only cloud in the whole sky."

Well, guess what? It stayed there. All the way down to de-orbit burn, Dick Richards is yelling at us over the radio, "No-go! We've got a cloud over the landing edge. You can't land here, no-go!" I'm thinking, "Eh? The wind is blowing, we know what the winds are, how could that cloud not be being blown by the wind away?" The weathermen, "Oh yes, it's going to move flight, it's not going to be there." I gave them a go for the de-orbit burn, thought Dick Richards was going to reach through the radio and strangle me. We said, "No, we believe the cloud's not going to be there, so we're going to give the go." Guess what? It didn't go anywhere.

There were some other very interesting things that happened on that landing, and Dave Walker made a wonderful landing, but he didn't break out of the cloud. He didn't see the visual

landing aids until 3,000 feet, exactly what I'd been worried about at the Kennedy Space Center that didn't happen, happened to us at the Edwards flight complex where it shouldn't happen. You don't think Mother Nature laughs at us?

As I say, the physics of the situation are a mystery to me. Meteorological science tells you that those things shouldn't happen, and yet, they did. I bear witness to it, and we made the best decision we could at the time that we had to make the decision, and it was a bad decision. Should have landed at KSC, should not have landed at Edwards. It was really funny—and we were all practiced to do the auto-land thing and didn't do it.

Then, we had a little incident with the tape recorder, which is really funny. It's very important, as the Shuttle's approaching the runway, you fly this Heading Alignment Cone, HAC, cylinder cone. You're not aimed at the runway; you're doing the crosswind leg and then you circle around and you go on the final leg. Because of the way the Orbiter flies, it's very important to fly that precisely, because you could put too much g [gravity] on the vehicle. Or you could violate the venting. The air is rushing back into this big old payload bay as you're coming down, and if you don't allow the air to re-press it properly because you're descending too fast, you could crush the Orbiter. Bad things could happen.

There was a whole series of constraints on how you fly this Heading Alignment Cone and come down. They had, in the cockpit, a tape recorder velcroed up behind the commander to capture their conversation. I think that's a pretty typical thing to do. Just as they got on to be ready to turn on to the HAC, the tape recorder came un-velcroed and fell on the floor and distracted the commander. All of a sudden, we're watching the plots on mission control, and instead of the little tick marks where the Orbiter's flying, going right over the circle which is what we've always seen before, they're going out. I thought, "They're going to crash."

There's nothing we could say, and by the time we could say anything, David got back in control and he cut the corner on the HAC—which you're not supposed to do because of the g and venting concern. And then they're on final [approach] and don't see the ground until 3,000 feet, so there was a lot more excitement in Mission Control in that landing than there should have been. There's a story like that—maybe not that dramatic—but there's a story for every flight. Operation was very exciting.

JOHNSON: We're getting close to the hour and a half mark, but I was thinking, if we can just start talking about some of the Shuttle-Mir flights, and that first experience working with the Russians and the first one, STS-60, taking a cosmonaut on the Shuttle. Did you work that flight?

HALE: I worked one of the early flights, and I don't remember. I need to go back and check my records. We all went through the experience of working with the Russians for the first time in Shuttle-Mir. We were all children of the Cold War, and the Soviet Union was the enemy. In space we'd been competitors for years.

We did have some of the veterans that had worked Apollo-Soyuz [Test Project], ASTP, back in the day. They told stories of going to Moscow in the bad old days, where they stayed in pretty crummy hotels and were followed everywhere by men in trench coats and fedoras if they went out to try to find a restaurant, all this kind of stuff. We were not in those days. It was much more open, and we learned pretty quickly that the Russians were pretty good guys. I think one of the most valuable things they did was they sent many of us at JSC to a Russian-American cross-cultural class.

We had a guy that came and talked about the differences in American and Russian culture, and there were many valuable things we learned. The most valuable, I think, is that the Russians are very interested in the pecking order of things. Where do people fall in the social hierarchy? They're interested in personally moving higher in the social hierarchy, and therefore they can be very contentious.

Their culture and history say that they have to really be contentious to try to move up this ladder—regardless of the official organization chart. Not so important to them as it is to us. We tend to think so-and-so's in this position, therefore they're responsible and I need to give them good advice, and they'll pick the direction, and then will execute that. Russians are more about this informal, who's where in the informal pecking order, so they like to pick quarrels because that's how they juggle around for this social pecking order. They like to be confrontational. And they like to drink a lot too, but that's a different story.

I remember this very distinctly—the first couple of meetings I sat in with some of these Russian guys, it was like, “You Americans don't know anything, you're foolish. We know how to run—” It was very confrontational. Then after it was over and we decided what we're going to do, this all, “Hail fellow well met, we're all colleagues, we're all going to have a great experience together.” It's just that the dichotomy struck me, and I was really glad I got to go through that class.

I have to tell you, about the same time they gave us the Japanese-American cross-cultural class. The thing I remember most from that class, and there were a lot of things, is that the Japanese want to avoid confrontation at all costs. When they say, “*hai*,” it doesn't necessarily mean “yes,” which is standard translation. It can mean, “I heard what you were saying.”

Doesn't necessarily mean "yes," but "we just want to avoid confrontation and we'll do this non-confrontationally."

It became the standing joke around the Flight Director Office that when we had these multinational meetings later on for [International] Space Station [ISS], we put the Japanese guy next to the Russian guy and watched the fun. Because the Russian guy would want to be confrontational and the Japanese guy would be trying to avoid at all costs. We had minor entertainment that way. Those are all generalizations—everybody's got their own peculiarities. We learned very quickly that they were very smart.

I worked as lead flight director on STS-96. Not Shuttle-Mir, but ISS flight. Second ISS flight. We just put the [Unity] node and the FGB [Functional Cargo Block] together on STS-88, and STS-96 was put in the schedule to carry some logistics and outfitting equipment. It was going to be the first flight to the Space Station, but it worked very closely with the Khrunichev [State Research and Production Space Center, Moscow] flight directors for the FGB. They're really good folks. I enjoyed meeting with them.

I was the lead flight director, and we had this sim [simulation] case where we tried to dock, and the docking mechanism failed, and we bounced off. They were in for a drift, we were in for a drift, everybody started to tumble and move apart and we had to figure out what to do. Hadn't thought about that as a possibility—the sim guys were great at finding things that you hadn't thought about. As lead flight director, I went back and I wrote this, I think, 12 pages of every conceivable situation we could be in for this case. I wrote 12 pages. We had it translated and sent to the Russians, and the Russian flight director wound up putting his version of my 12 pages on a three-by-five [inch] card. That's when I really believed that I learned that they were

very smart guys. He got it right too, by the way. I started using his card instead of my 12 pages. They're really good guys, and we learned a lot.

Sergei [K.] Krikalev, who was the first Russian to fly, was just—I would call him a superior human being. He is just wonderful to work with, and I think on my flight we carried Yelena [V.] Kondakova, who's the first Russian woman to fly on the Shuttle. She was outstanding as well. We had just very good relationships with those early cosmonauts, at least the ones that I worked with we did.

JOHNSON: Did you ever get to travel to Russia, or their Mission Control?

HALE: We had people in Mission Operations that were in Moscow continuously for months and years and made dozens of trips, and I wound up making three. I was in Moscow three times out at the TsUP [Russian Federal Space Agency Mission] Control Center. Once was for pre-flight prep, and then twice as I supported—we would always send a Shuttle flight director to the TsUP to represent the Houston team. We had a Houston support group, which were flight controllers that lived over there basically. I went for two times to support Shuttle missions. It was really good, I'm really glad I got to meet them and work with them and meet in the cafeteria with them.

The Americans, we had this big ex-pat [expatriate] group of NASA Americans staying at this apartment house that we rented called the Volga. We had a bunch of rooms in the Volga, and that was kind of like being back in the dorm, you know. We'd all get together and make dinner together or something. It was a good experience, very multicultural. Across the street from the Volga there was a bar, and you did not go over there because it was the mafia's

hangout. They said, “Don’t go directly across the street, don’t stand out in front of that bar. If you want to catch a taxi or something, go down the street.”

It’s all those little things, back in the early ’90s, mid ’90s. I think it’s changed dramatically since then. That was all a good experience. Maybe we ought to come back and talk about that another time.

JOHNSON: We can stop there, sure. No problem.

[End of interview]