# NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
# ORAL HISTORY TRANSCRIPT

BROCK R. "RANDY" STONE
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is November 14th, 2006. This is the third interview with Randy Stone and is being conducted in Houston, Texas, for the NASA Johnson Space Center Oral History Project. The interviewer is Sandra Johnson, assisted by Jennifer Ross-Nazzal.

I want to thank you again for joining us today. When we stopped the last time, we were discussing your early Flight Director assignments with the Shuttle Program. We had talked about the fact that you were the first Flight Director to have more than one woman on console. I'd like to pick up today around STS-8 and just go through some of these Shuttle flights and some of the other firsts that you were there for. STS-8 was the first night launch and landing, and it was also the first African American in space. So if you want to go there, and we'll talk about that mission.

STONE: Of course, STS-8, being the first night mission—I guess it was a landing, night landing that we did—was quite a challenge to work the preflight on that. The Flight Techniques on it involved the planning for landing at Edwards [Air Force Base, California] with the new lighting system that had been developed, so there had been lots of training flights with the Shuttle Training Aircraft [STA] at Edwards.

Actually, it was during that time frame that the Flight Directors had the opportunity to start flying on the STA to get a real perspective of what landing was like for the crew, so we had a better understanding of the workload that they were going through, and when it was okay to

communicate with them and when it wasn't. So we had several of our Flight Directors that actually got to fly on the STA for those first night training missions to see what it was going to be like.

So that was an interesting time for Flight Techniques, and it was an interesting time for the flight control team, with the first African American on the crew. That was a very—it was a nonissue with the flight control team. Very, very competent astronaut, and it was just a real pleasure to work with that whole STS-8 crew.

But I have to admit we were extremely relieved when we got to "wheels stop" on that flight, because landing at night at Edwards, it's like driving into a dark hole, because being in a high desert, there is almost no lights for many miles around the runway, and as you start the turn into the runway, it looks like you are driving into a dark hole until the lights of the runway start to appear and you get lined up. Then the runway is actually very, very well lit for that final phase down the approach path.

But I'm sure that crew—and I know they did after the flight, because we talked about it—it was very disconcerting until the vehicle turned far enough in that left turn for the commander to get his eye on the lights of the runway, because until that time, all they had was the instrumentation in the aircraft. Of course, we had become very, very confident that the navigation was working well by this point in time, but until the commander actually got a peek at the runway, I'm sure the heart rates were up. I know they were on the ground until we heard the call, "Runway in sight."

JOHNSON: Were you one of the ones that got to fly on the STA?

STONE: I didn't fly that early on the STA. I flew later, later in my Flight Director career. I flew with "Bo" [Karol J.] Bobko, who was the commander of the next flight I was doing as the Lead Flight Director, and I did get to fly, oh, eight or ten daylight landings into Northrup Strip in New Mexico, and then a number of night landings that same trip. We started out about an hour before dusk, got some daylight landings and some night landings in, and that was a really exciting experience for me, being a really low-time private pilot, to see what the workload that these guys had to go through to land the Shuttle, both at the daylight and the nighttime.

My impression of that—and talking to Bo, he agreed with me somewhat—for me, it was easier to follow what was going on in the cockpit in the night landing, because you were so focused on the instrumentation and you were not distracted by looking for landmarks, because you couldn't; there were very few landmarks to find in the high desert. You could see El Paso [Texas] over there, and Las Cruces [New Mexico], but it didn't really give you a perspective of where the runway was. So you were really concentrating on the instrumentation.

When you rolled out, the runway perspective at night was actually, to me, anyway, better than it was during the day, because you were completely focused on that lighted strip of land, and you could see the target that you actually aimed the Orbiter to. To me, it was easier to see at night than it was during the day. So that gave me a completely different perspective than what I thought was going on in the cockpit. But that was the first time I had ever done it. I'm not sure which Shuttle flight that was; they kind of run together. [STS] 41-D, I believe.

JOHNSON: During your time as a Flight Director, and there were lots of future announcements that were going to be made by the President and the administration, but that first—after, of course, the Apollo announcement with President [John F.] Kennedy—but the next big

announcement in January of [19]'84, President [Ronald W.] Reagan announced a decision to build the Space Station within a decade. What was the reaction?

STONE: Well, of course, all of us that were working in the space program that were really career space nuts, we were glad to have an anchor for the future in the Space Station, knowing we were going to build another piece of hardware that was going to fly in space. I believe some of us, or many of us, were disappointed that we were anchoring our future in low-Earth orbit as opposed to looking towards returning to the Moon and going beyond.

But in all practicality, the Space Station was the right thing to do, because it could involve more people and more university science-related organizations in the immediate future of the space program. So it was mixed emotions. We were excited there was another vehicle to build. We that worked in Ops [Operations] knew it was going to be a huge challenge and looked forward to that challenge, but were still a little disappointed it wasn't moving on to the planets.

JOHNSON: You also moved on and the [STS] 41-B mission came along, and again, another first. It was the first untethered space walk, Bruce McCandless [II]. Do you want to talk about that and what exactly you were doing during the flight and when you were on console?

STONE: All right. That particular flight for me was very interesting in the Flight Techniques, because we had to make the decision whether we were going to really let Bruce be untethered or actually tethered to the vehicle when he did these flights. After a lot of analysis the team decided that the smart thing to do was to fly untethered, and if we had a problem, then retrieve Bruce with the Shuttle. We were very, very confident in the maneuverability of the Orbiter to retrieve a

crewman, and we were actually concerned that if we were tethered and we had a failed-on jet or something of that nature, it would get to the end of the tether and start him tumbling, and then we would actually have an out-of-control crewman in this backpack that may just kind of roll himself up back down the tether into the Orbiter bay. As you can imagine, we did a lot of what-ifs on that, and together with Engineering and the Ops and the crew, made the decision that it was going to be an untethered flight.

I was not on console when Bruce did the EVA [extravehicular activity]. However, I was in the [Mission] Control Center observing it, because it was such a big first for the space program, watching a guy fly out of the bay and be completely unattached. The pictures from that were quite startling, because it was a first. We had pictures up close of the Orbiter from something that was not in the Orbiter. So the pictures from that were just incredible. Of course, now it's lost its first look and its excitement, because we see the Orbiter every time from the Space Station, lots of pictures with it up close. But that flight and then one of the unmanned satellites that had the ability to take pictures of the Orbiter gave us just a completely different perspective, and it was really neat from a first-time-view standpoint.

JOHNSON: I believe on that one you were Orbit One Team Flight Director. Before the flights and in between flights, if you can, just explain how those assignments are spread out, and how you determine who's going to be on what, and maybe talk about what some of those assignments mean.

STONE: Sure. The way the assignments were done in the Flight Director Office was oftentimes, or all the time, based on the type of experience and background that the Flight Director was

coming from. Some of the more difficult missions we teamed up more experienced Flight Directors on and didn't introduce a new Flight Director into the mix if it was a very complicated flight.

But the way the assignments went, a Lead Flight Director in that time frame was named about a year before the flight, and then part of their duties became to be the Chairman of the Flight Techniques meetings that were conducted to iron out all the new things that were going to happen on the flight. It was the Lead Flight Director's job to develop a rapport with the flight crew during their training, and this is long before we started integrated sims [simulations]. We hadn't even named, for instance, the other Flight Directors yet. But if a particular shift was going to have some complex operation like an EVA, like a satellite deployment, then we would name those Flight Directors early enough that they could participate in the Flight Techniques for the development of whatever was going to happen on that shift.

Then as we got relatively close to the flight and started integrated sims, typically the Planning Shift Flight Director would then be named. They would not have one of the execution shifts. So we'd have the ascent-entry person, and sometimes they did an orbit shift, sometimes they didn't; the Lead Flight Director, who, because they had been working on it the longest, typically took the complex shift, unless it was something that was very, very specialized that one of the members of the office had been working on, and then we put that individual in there.

So Lead Flight Director is selected about a year before, and that was done by the Chief of the Flight Director Office, and looking at what people had on their plates over the next year, because it was very difficult to do a lead and then fly anything else in between, because as a Lead Flight Director, especially in those early flights, it was a forty-five, fifty-hour week just to

get everything done for your flight for that whole year while the crew was training and you were putting together the flight control team and working the procedures.

JOHNSON: You mentioned that one of the duties as Lead Flight Director was to establish a relationship early on with the crew. What type of things did you do to establish those relationships?

STONE: Well, you typically started out in the Flight Techniques. The crews, we always tried to include the crews in these Flight Techniques meetings to make sure we had their input, especially when we were doing something for the first time. My technique was to always, once the crew was named, I would hold a team meeting with the entire crew; make sure we at least knew each other and the backgrounds of each one of the team members. In many cases, based on my background and the time frame that I was a Flight Director, I knew most of the crewmen from over the last five or six years, so there were very few new crewmen on a team that I didn't know already.

So I tried to build a relationship with the commander, because between the Lead Flight Director and the commander, you really had full control of that mission and full responsibility for the execution of that flight. So you had to get to a point where each of trusted the other, because you didn't have time to argue once you got execution of a flight. You had to be on the same wavelength. So I concentrated on not only building a personal relationship, but a good technical trusting relationship with each crew member that we were going to be dealing with.

JOHNSON: If you would, just for a minute maybe talk about the integrated simulations and getting ready for flights, and maybe an overview of what that normally entailed and about how long you did that before the flight, and how many hours a day you spent in those simulations.

STONE: Okay. It changed gradually from STS-1, where we did many, many, many ascents, many entries, many orbit simulations, because it was the first time. But as we established what was really required for each flight, the number of integrated sims actually shrunk down. Typically, we did not start integrated sims full-up with all of the teams until three or four months before a flight. But that doesn't mean that some of these team members were not simulating, because we did what was called generic sims to qualify new flight controllers to be ready to support a mission, and that went on continually. They may not know which flight they were going to be assigned to, but they were being trained so they were ready to be assigned for a flight-specific set of simulations.

Ascents, we probably did, oh, ten days' worth of simulations for ascents and entries. That became very specialized, and typically the teams rotated as ascent and entry teams, so they got more and more proficient and took fewer integrated sims with a particular crew to be ready to fly. The unique things that happened on a specific flight then became—you would get more simulating time for the orbit events where the crew hadn't performed these before; the ground had not performed them before. So we did more simulations for those unique orbital ops. In the early days it was deploying satellites and learning how to do EVAs and that sort of thing.

Each one of these sims was very intense, very realistic, and very stressful. For me, sims were almost more stressful than flights, because every time somebody was trying—it was like a final exam every time you walked into the Control Center. At least that's the way most Flight

Directors look at it, and many of the flight controllers do. So it's pretty stressful, because you don't want to mess up. But it's better to mess up in a sim than in flight, but you still have this, "Oh, I don't want to look bad," attitude. So it was quite stressful. But people that become adept and stay in the flight control operations business thrive on that stressful environment. So looking back on it, even though I got nervous every time I walked in the Control Center, I think I really loved it. Actually, I know I really loved it.

JOHNSON: Did Flight Directors specialize? Did some Flight Directors normally work ascent and entry, or was that duty spread around for everyone to get a chance to work on all the different aspects?

STONE: We discovered pretty early in the Shuttle Program that it was better to specialize people in the ascent and entry world. After they became very proficient at ascent and entry, then we would allow them to break out and do a Lead Flight Director job as a change of pace. But we rotated people, because the ascent and the entry is a very, very high paced, high stress time for both the crew and the ground, and so you wanted people to do it to become proficient, but you didn't want them to do it so long that you actually burned them out. So over the years we've been very careful to have sufficient Flight Directors that they could fly two or three flights as an ascent-entry person and then miss one or two and kind of recharge their batteries, and in some cases, take a whole year off from ascent and entry and do a lead flight opportunity, because it's just completely different.

Some people, like me, I never was an ascent-entry Flight Director. My whole time in the office was spent in the orbit phase of the Shuttle. That doesn't mean I didn't become very

knowledgeable about the other two, because you're just around it. But I specialized in the new things we were going to do on orbit, and after a couple of years in the Flight Director Office, I was the assigned person to deal with the Defense Department and the missions that we did that were not public, some of them secret, some of them other than secret. So I had spent a lot of time in the world where you didn't tell anybody what you did for a living.

JOHNSON: What was it like trying to plan for missions with the DoD [Department of Defense]?

STONE: Well, it had a real up side, in that you didn't have any of the press looking over your shoulder, because they could not be included in dealing with the Defense Department on those missions that had things on it that were just not for public information. To me, it was just a very, very good experience, very professional, working with the military officers that were assigned to these programs. So it was kind of a high point in my Flight Director career for some of the missions that I got to participate in. But even today I can't tell you what we did. [Laughter]

Well, I will tell you one funny story on one of the flights I did as Lead Flight Director. It was STS-27. It was actually the last flight I did as an active Flight Director. From then on I was either the Chief of the Office or Director of MOD [Mission Operations Directorate], and was never really in the Flight Director seat again.

But STS-27 was a Defense Department mission that a number of years later they declassified not what it was, but the fact that it was a deployable. But at the time we couldn't even tell people it was a deployable payload, and so all of that was very—it was difficult in the sense that you couldn't even tell your wife or your family about this thing that you were working on.

After the mission—I've got to be real careful to remember what is legal and what isn't. But after the mission the flight crew and the Lead Flight Director—and that was what I was, was the Lead Flight Director on that—and the Program Manager met with the Air Force Program Manager for this program in a place still classified, and received an award, the National Intelligence Award for our contribution on STS-27.

The funny part about that was, it was a lot of very important people from Washington [D.C.] in the political world and in the intelligence world. We got these beautiful leather boxes with these beautiful pins and medals in it, and with a neat inscription in it, and we're all standing there looking at these things, saying, "Boy, these are really cool."

Then here came an armed Marine guard, taking them away from us and saying, "We're really sorry, but these are going to have to go into a safe."

So they went into a safe, and for seven years we couldn't—my wife said, "Well, why did you go to Washington?"

"Well, I went to Washington and got an award."

"Well, where is it?"

I said, "Well, it's locked up."

"Well, what was it for?"

"Well, that's locked up, too."

But seven years later we got a call, and part of the crew was still here. Part of them had left the agency and were on doing other things. But they got us all together at JSC and debriefed us, took the classification of this thing down. Couldn't tell what it did, but we could now talk about it; it was a deployable. We did some cool things, and they would let us tell about the cool

things that we did, at least some of them. So I don't talk about the cool things, because I never can remember which ones are okay, so I just don't do that.

But we got the pretty little leather boxes with the pins and the medals in it, and every once in a while I wear the pin, and people look at that, because it's a little different than other NASA medals that people sometimes wear. But I can tell them it's the National Intelligence Award, and they look at me and say, "What do you get an intelligence award for?"

I say, "Well, I'm really not very intelligent, but it was just I lucked out and got one of these things."

But I do display it at home, and it's kind of a neat thing. But it was a very exciting time to be part of something that was very important to the nation, even if you couldn't talk about it.

JOHNSON: It could have been frustrating, I can imagine.

STONE: It was very frustrating.

JOHNSON: [STS] 41-C, you were actually the planning team Flight Director. What exactly are the duties of a planning team Flight Director? And we'll talk about that mission for a little bit.

STONE: Okay. Now, let's see, 41-C was SolarMax [Solar Maximum Mission satellite]. The Planning Shift Flight Director on every flight is typically the last person to get assigned to the flight, and they have a couple or three months to understand what the big picture of the mission is. But their job as the Planning Shift Flight Director is to take whatever happened in the previous execution day and make sure that what we're going to do tomorrow has been massaged

based on what we did yesterday and put together the daily plan for the flight crew on the next day.

It's actually one of the busier shifts, where you're really having to do analysis and trying to figure out how to put all the pieces back together, because typically things don't always go as planned, and you've got to reschedule things. So it was our job, or the planning shift's job, to put all these things into perspective, update the flight plan, get those plans ready to uplink to the crew before they woke up so they could have them the next morning to look at before they started their execution day. That's what a planning shift was about, and sitting and babysitting the vehicle and making sure everything is operating well.

JOHNSON: If you want to talk about that flight for a little bit, as far as the SolarMax, and it was the first satellite service call.

STONE: Yes, it was, and it was also the first time we realized that sometimes you don't know everything there is to know about a satellite you're going to go service. On that flight the plan was to fly out with the MMU [Manned Maneuvering Unit] and dock, essentially, with the aft end of SolarMax and then bring it into the bay with the arm, and the mating bar didn't fit. It took a number of tries before we got all of that sorted out and got the satellite retrieved to be able to do work on it and to get it retrieved. So that made the planning shift pretty exciting after that first day. We had to decide, one, do we have enough fuel to go back and re-rendezvous with it. As I remember, I think we rendezvoused with it two or three times—three times, I guess—before we were finally successful in retrieving it.

So that made the planning shifts on that particular flight really busy, and it was great to be a part of that. Bob [Robert L.] Crippen, I think, was the commander of that flight, and Bob's one of these guys that just could do everything well. He was fun to work with as a commander, because he was always one or two steps ahead of you and made the Flight Controllers look really good because he was so good.

JOHNSON: [STS] 41-D was your first assignment as a Lead Flight Director.

STONE: As a Lead Flight Director, yes, it was.

JOHNSON: It was also the first flight of the Space Shuttle *Discovery*, and there were some things that happened on that flight that we can talk about. But you mentioned that as a Lead Flight Director you established those relationships and started working about a year ahead, so if you want to just talk about when you got assigned to that and maybe walk us through some of the things you did in preparation for that flight.

STONE: Well, 41-D was a flight that got remanifested after one of the flights had an engine shutdown on the pad. Larry [Lawrence S.] Bourgeois was originally the Lead Flight Director for that flight, and because the schedule was getting shifted around and Larry had another pressing lead job that was going to take place shortly after 41-D, Larry and I actually swapped places, and I became the Lead Flight Director on that and started working immediately with Hank [Henry W.] Hartsfield [Jr.], who was the commander for that flight, and getting ready.

We had an experiment where we were going to raise this large structure in the bay. It was a boom that actually folded up into a canister that was actually smaller than this table, and it was going to be a hundred-and-something feet tall; just going to unwind out of this little can. So doing all of the analysis to assure that what we were getting ready to do with this things was, one, safe, and two, if it collapsed, how do you get untangled from it and get it overboard.

So Hank and I worked together very closely, and all of the commanders that I've worked with, I've remained friends with over the years, and Hank, I still see. We crossed paths many times professionally years after this flight, but a number of things made the flight interesting, getting ready for it. Let's see. Judy [Judith A.] Resnik was on that flight, and Judy had been a CapCom, Capsule Communicator, on one of my other flights with me, so I knew Judy well from previous contact in the Control Center. The flight was very successful from the standpoint that all of the things that we went to do worked very well. This mast extended out of the spacecraft, and it was a spectacular-looking thing, looking out in the bay.

But the flight will always be one that every time I see Hank, he gives me the evil eye. We're friends, and he has since forgiven me, but on that flight one of the nozzles where you put wastewater overboard froze up, and when it froze up, we couldn't dump the waste tanks. When we couldn't dump the waste tanks when they got full, you couldn't go to the potty in a normal fashion. So we reverted to what was called the Apollo bags, which was the methodology that we used for going to the bathroom in the Apollo Command Module. Unfortunately, they were really designed for men and not designed for women. Judy was a great sport, but as the days went on, Hank every morning would ask me if he could start putting wastewater in the potable water tanks, because we had tanks that we were emptying that had drinkable water in it, and there was

a methodology that we could change the configuration of the tanks and dump wastewater in the tanks.

Well, the guys at the Cape [Canaveral, Florida] didn't want us to do that, because it would make the turnaround of the vehicle much more complex, because the potable water tank would have to come out. All those lines would have to be changed to make it safe to be drinkable water again. So the program made the decision that we weren't going to do that, and so we made the crew suffer through the Apollo bags for a number of days. The vehicle, for several months after landing, was known as "Yellow Death" in the cabin. It was not a pleasant place to be. The crew was very, very good-natured about it, but Hank was really, really on me every morning to do something different.

We had done some things where we thought we were going to be able to clear that nozzle, and John [T.] Cox, Dr. John Cox, was the Flight Director on the shift where we thought we were going to do one more dump and see if it worked with the changes that we had made in the cycling of the heaters on this nozzle. We had the TV camera on the nozzle, and I came in early for my shift so I could watch this. As John started the dump, it was like an instantly growing ice tree. It started out of the side of the vehicle and then just went everywhere, and we had this huge icicle in about forty-five seconds.

We got the valve shut off, and we looked at each other and decided that that really wasn't very good. We weren't going to do this again. But we were two days from entry, and we certainly didn't want to start entry with this big hunk of ice. We did some analysis, and we knew it wasn't more than maybe a couple of pounds of water, so we were doing calculations. If we turned it towards the sun, would it melt it? Would it sublimate off and be gone? Well, it was

enough mass that we'd have had to stay in orbit for about two weeks more to get it to melt off. So we elected to knock it off with the arm.

The planning shift then that night worked all night, working the procedures to take the arm—and it was kind of a funny angle, because this nozzle was up fairly close to the leading edge of the wing, so you certainly didn't want to hit the wing—and take the arm and bump it and knock the ice off. So that was an exciting thing on the next day on my shift, knocking the John Cox icicle off the Orbiter. I tease John about his icicle pretty much every time I see him.

JOHNSON: It was also the first flight that had a commercially sponsored payload specialist, and Charlie [Charles D.] Walker was on the flight.

STONE: That's right. We had Charlie from McDonnell Douglas. It was the CFES [Continual Flow Electrophoresis] experiment. We had high hopes for CFES, and he did just a wonderful job of training and integrating into the flight crew. We really believed that that had commercial value, and it probably did and probably could have been made into a commercial product. But because of the cost of flying something like that in space on Orbiters, because you weren't there long enough, it became prohibitive.

But it was a good experience to work with the commercial side, though it was kind of cumbersome from the standpoint that we couldn't do all the things as rapidly as the commercial people would like you to do them. It was more procedures than they wanted to deal with in many cases. But it was the first step in learning how to do that sort of thing in space with a commercial entity, and the government has gotten better at it, but we haven't had a lot of opportunity to exercise that. But from a crewman standpoint, he integrated in very, very well,

and the training was, at least from the flight control team, was almost transparent that he was not a professional astronaut.

JOHNSON: In general, I know some of the astronauts had various reactions to having payload specialists on their flights, but as far as the mission control teams and the people on console, how was that relationship with these payload specialists?

STONE: It was generally pretty good. Some of them were better than others, but all of them were capable people. The flight control team probably had some of the same misgivings as the astronauts did. How can they be trained in a short period of time to be safe on the Orbiter? Some of them had to be looked after more carefully than others. But in general we proved that with that amount of training, you could keep them from getting in trouble in the Orbiter, and they could be a productive member of the crew.

Now, some of them were better than others. Charlie was actually very good. Some of them were just better than others. I didn't have a lot of experience with many other payload specialists. The crews kind of felt like, "Hey, it took me five years to get to fly. Why should they get to be assigned nine months or a year before a flight and not have to do everything I did to go fly?" So that was kind of the rub, I think, with the professional astronauts, but it didn't matter that much to the flight control team. We just wanted them to be safe and do what we told them when we told them to do it.

JOHNSON: One of your next missions was [STS] 51-A. It was Joe [Joseph P.] Allen [IV] and Dale [A.] Gardner used the MMUs to dock with two different malfunctioning satellites. Do you have any memories of that, and what shift were you on for that flight?

STONE: Well, Larry Bourgeois, I believe was the Lead Flight Director on that flight. I did the second recovery. Let's see. We did PALAPA [B-2 satellite] first and then WESTAR [VI] second. I believe that's correct. I did the second one, whichever one it was. They both looked exactly alike. But my memory of that flight was how hard it was to do the rendezvous planning and the planning and the analysis that said that once we got these things on board, the first one on board, and then we went to rendezvous with the second one, because of the attitudes that the Orbiter had to fly at to get to the next place, are we going to expose the satellite we just put in the bay to temperature extremes that would freeze the hydrazine that was left in the propellant system, cause a leak, and then have a problem when we got back on the ground.

So that was an interesting analysis time, getting ready to go fly that. It was an exciting flight to be a part of, because there were so many things to do. But the flight out to both of these satellites was relatively uneventful and the recovery of them was uneventful. But the planning for it was just a nightmare of details to make sure that it was going to be a safe mission. But Larry Bourgeois was one of these guys that was famous for his attention to detail, so he was probably the right guy to lead that flight, and it was fun to be a part of it as one of the other Flight Directors.

JOHNSON: You were Lead Flight Director again in February of '85. You were actually named for the [STS] 51-E mission, which became [STS] 51-D because of some shifts because of the

Orbiter having some damage to it. But it was also kind of an interesting flight, though, for a lot of reasons. First of all, we had a U.S. Senator. "Jake" [Edwin Jacob] Garn flew on that mission. How did that affect the planning for the mission itself once he joined the flight crew, and the outside attention?

STONE: Well, let's see how to put this graciously. Most of the flight control team and most of NASA felt like it was a political stunt and a dumb thing to do. Working with Jake Garn, though, was a pleasure. When you had him alone, he was very dedicated. He was serious about what he was going to go do. But it was still almost a political stunt, but he was a very capable individual and getting him ready to go fly was not terribly difficult.

Of course, once we got him in space, it was not very pleasant for Jake. He never adapted well to space, and so he spent a number of days pretty sick, kind of rolled up in a ball over in the corner. But he was a very capable person, and even when he was feeling bad, he did the things that he was supposed to go do.

So from a personal standpoint we got along very well. From a political standpoint I kind of thought it was dumb, and the attention that we got from the press made flight preparation a little bit more difficult, because they were more interested in what Senator Garn was going to do as opposed to what we were really going to do on the flight. But from that standpoint, it wasn't really all that bad.

JOHNSON: Were there any considerations or accommodations that had to be made in Mission Control because of the public interest or the interest from the press?

STONE: No, there really wasn't. In our shift briefings that the Flight Directors give, at least in that time frame, after every shift we went over and gave a postshift briefing to the press. On that flight, of course, they were there in force, because they wanted to know how Jake was doing, and so that was kind of interesting the first two or three days. "Well, he's been a little green." But we didn't have to do anything special in the Control Center to accommodate that. We just dealt with the press in the postshift briefings.

JOHNSON: Speaking of that, as a Flight Director and dealing with the press, how did you learn to deal with the press?

STONE: One of the best training things that all Flight Directors got in the early days, and still do, was a training class in how to deal with the press, how to do interviews, how to take control of the situation when it becomes hostile, how to deal with those ambush-type interviews where they catch you going from building to building. My class spent two days, two eight- or nine-hour days, with a professional group of people that we just did interview after interview, and they taught us the techniques for how to take control; how to take control back when you lose control in an interview. It was extremely helpful to me in dealing with the press.

In the early days, in the first twenty or so flights, there was so much interest with the press that you always had somebody asking questions that were maybe in your opinion, "Boy that was a dumb question," but you had to remember that there's no such thing as a dumb question when you're dealing with the press, because it just goes from bad to worse if you say, "You're really dumb."

But it got to be actually fun for me. I disliked it the first two or three times, but once I mastered the technique of dealing with the press and got to know many of them individually, it was not a terrifying experience. It was actually kind of a fun thing. I could call my mom and say, "Hey, watch on TV. I'm going to be on TV." Or my wife. My wife didn't seem to care as much about it as my mother did. She was the space nut in the family.

But I did have a few interesting debates with the newspeople. Jules Bergman, who was the Science Editor for ABC, I believe, Jules always had his own slant on things, and he was always trying to catch you in something, a technical error. So when I knew he was going to be there and we had done something during that day that I suspected he would be asking me about, I did a little extra homework so I could always be ready to deal with Jules. But all in all, dealing with the press is not an unpleasant thing unless something really unpleasant happens, and then it's never pleasant to talk about a failure.

JOHNSON: How often did you have to deal with them? When you were Lead Flight Director, was it your responsibility to always talk to them?

STONE: Well, actually, in the early days we went and talked to the press after every shift. Typically, the Lead Flight Director probably got to do it more, because they typically had the complex execution shift and got to go talk to the press.

I guess the worst time I ever had talking with the press, I did the press conference right after we deployed the first of the two satellites, WESTAR and PALAPA, and the PAM [Payload Assist Module] motor did not operate, and I'm telling them that, "Hey, we're looking at this, but

we think that this is a random thing and the chances of it happening a second time is one in thousands, and the community was all ready to go launch the next one."

Then I had to go back and talk to them about the second failure, and so that made not only NASA look dumb, but the manufacturer of the PAM motors looked dumb, and nothing is better for a newsman than to have something dumb happen and they can stick you in the eye with it. So that was not a fun thing. So after the second failure, Glynn [S.] Lunney, who was the Shuttle Program Manager, he went with me to field the hard questions.

JOHNSON: It's good to have him watching your back.

STONE: Absolutely.

JOHNSON: Back to 51-D, you did have an incident on that flight, too, where they had to manufacture a flyswatter.

STONE: Oh, the flyswatter to go out and flip a switch. That was a very interesting, interesting scenario as we looked at what was on board that we could do this. The satellite that we deployed was a Navy satellite, a Navy communications satellite. The way it deployed out of the bay—some of the early satellites were on a platform that spun, and then they went out vertically. This particular satellite that we did on 51-D was almost the diameter of the inside of the payload bay. It was about a fourteen-feet-diameter disk sitting in the bay, and it actually rolled out of its cradle and started its spin stabilization after it got out of the payload bay. What was supposed to

happen when this thing came out of the bay, a set of microswitches were to be tripped by it clearing the bay, and it turned on the satellite.

Well, thirty seconds later after it deployed, it was dead; a minute, two minutes, it was just dead. It had no life to it. So our thought was that, "Hey, this set of microswitches, for some reason, failed." There was a little trip arm on the side of the spacecraft that was spring-loaded, and it sprung out when it cleared the cradle, and that was what tripped the microswitches. So we said, "Well, we don't know whether it will work," but talking to the manufacturer, there was some belief that if we took this arm and tripped it back up and then let it release again, we might unstick these microswitches and have the satellite come alive.

So we were not planning to do an EVA that flight, but we had two crewmen that had trained for contingency EVAs, Dave [S. David] Griggs and the other crewman was—help me. Have you got it on there, the other EVA crewman?

JOHNSON: Jeffrey [A.] Hoffman.

STONE: Jeff Hoffman. We talked to Dave and Jeff and told them what we thought we wanted them to do, and then we started looking on board to see what we had to give them something that looked like a flyswatter that would give an extension to their arm, because we didn't want them touching the spacecraft. We wanted to have something that they could reach out with and flip this switch.

Well, we ended up making the flyswatter out of some hard plastic cover of one of the flight data files that was on board, and there was some wire from something. Anyway, we made this device that was, I guess it was five feet long, very, very flexible. In fact, after the flight the

ground team presented me with the flyswatter, so I had that flyswatter at home forever, and I just donated it back to the flight data file people. I gave them their hardware back, because it had a flight data file cover on it, at a reunion for the FAOs [Flight Activity Officers] here about a year ago, and it's now—the flyswatter, I guess, is on display in their office area.

But anyway, we planned to do this and got the crew suited up the next day and did the EVA and swatted the spacecraft and flipped the switch three or four times, and absolutely nothing. It remained dead.

One of the things that happened on that EVA that was not—it didn't make the news too much, probably because we were LOS [loss of signal] and the TV couldn't see it, but Dave Griggs was pushing off from one side of the payload bay and sailing himself across to the other side of the payload bay, probably just enjoying life out on his—probably going to be the only EVA of his career. Well, he pushed off of one side and disappeared over the edge. He missed the edge of the bay.

We had com [communication] with them, and you could hear the commander kind of sucking wind and saying, "Dave, are you all right?" Because he disappeared over the side. Now, he's on a tether; he's going to come back. But you never like to be out over the side where the tiles are and the leading edge of the wing.

And Dave, in a very, very professional voice, said, "Boss, the underside of the vehicle looks really, really good." Then he comes floating back up over the thing as this automatic tether reel reels him in. But we were all much relieved that he didn't ram into something on the bottom side of the spacecraft.

JOHNSON: Yes, that could have been a different story altogether. The next flight that I have that you were assigned as a Flight Director was the [Space Shuttle] *Challenger* [STS 51-L] accident.

STONE: Probably the preparation of that flight was kind of a highlight for me, of my career. The crew was such a wonderful group of people. I became very close to the crew, friends with all of them. Christa McAuliffe was just one of those wonderful people that you grew to like instantly. It was one of those flights, it just felt right. I mean, everything went well in the training.

I had been associated with the TDRS [tracking and data relay satellite] spacecraft before on STS-6, and so I knew a lot about the spacecraft. I knew a lot about the IUS [Inertial Upper Stage]. So from a preparation standpoint, for me, personally, it was fairly easy, fairly straightforward. From a complexity standpoint, the two, the teacher and the payload specialist, didn't add much complexity to the flight. So it all just felt like a real easy thing. We were looking forward to getting another TDRS spacecraft up there and kind of ending the congestion we had with the vehicle that we had launched on STS-6.

Really, no ill feelings. Nothing felt abnormal until we started counting the vehicle down. Then, as you may remember, we counted it down several times and couldn't go for one reason or another. For this flight the Planning Shift Flight Director was Chuck [Charles R.] Knarr. He was the guy that did the shift before the ascent team came on. Chuck, on the third time, the third attempt, on the time we did launch, Chuck called me early, early in the morning before the ascent team came in and says, "Hey, I just wanted you to know where we were in the count, and I'm waking you up because it's freezing down at the Cape. I don't think we're going to go. There's ice on the pad. But I'm nervous when they come to poll to find out if I'm go to launch."

And I said, "Is the Control Center ready to go?"

"Yes."

"Is the vehicle, from the parts that we can see and are responsible for, is it ready to go?"

He said, "Yes."

I said, "Well, then, from an operations standpoint, we are go for launch." You've got to depend on the tactical on-site commander at the Cape to make the call on the temperature and the ice on the pad. So that was the first time in the process that I'm nervous, because this is out of the ordinary. Of course, we weren't in the discussions at all about the temperature effects on the SRB [solid rocket boosters]. It was all taking place behind the scenes.

But anyway, I came in to the Control Center about two hours before launch; talked to Jay [H.] Greene, who was the ascent Flight Director, because I was going to take over for Jay right after payload bay doors opened, because we deployed the TDRS satellite on the first day. So I was in the Control Center with Jay. As the sun came up, yes, there was a little bit of ice on the pad, but people were getting comfortable with the scenario. We had trouble with closing the hatch, and so that kind of delayed stuff, and it got it later in the morning, and it was going to be a little bit warmer. So by that time our kind of uncomfortableness was going away.

Just before T-minus-nine minutes the Flight Director in charge of the room, the ascent Flight Director, always clears the room. Protocol says that the Lead Flight Director doesn't stay in the room, because you don't want two people that think they're in charge in the same place. So I went back into the viewing room, and I was actually sitting with Dr. [Christopher C.] Kraft.

The launch occurred, and when the vehicle came apart, Dr. Kraft and I both knew that we were not looking for a vehicle to come out the other side. It was obvious to anybody who knew anything at all about the Orbiter that it was in pieces. The flight control team, though, did not have a TV that we typically allowed them to watch. INCO [Integrated Communications Officer]

had one up, and the picture that always sticks in my mind is Jay Greene and Lee [Alan L.] Briscoe. They turned their heads and looked at the INCO TV and realized that we were dealing with a disaster.

It became the darkest day of my life, but at that point, training kicks in, and I could see Jay shake it off and start doing all of the things that he's supposed to be doing. He's locking up the Control Center, securing all the data lines and all the data links, and having the flight control team do the right things from a recovery standpoint. We alerted all the DoD recovery forces. He's talking to the Flight Dynamics Officer [FIDO], who can see all the radar stuff. It was clear to the FIDO that the vehicle was in pieces, because he was tracking a whole bunch of different targets. So we in the room knew that we were not looking for recovery of the vehicle or the crew, but getting ready for a long-haul recovery from a disaster.

I was on the Ops team, the team that looked at all of the videos and started trying to figure out what had happened. It became clear within about twenty-four hours what had caused it. Why, nobody knew at that time, but we knew we had a breach in the SRB, and we knew that it probably burned through—we didn't know whether it burned through the tank or burned through the support in the vehicle and broke the vehicle. And that's what really happened. It didn't blow up from the tank blowing up. It blew up because it got turned sideways into the aerodynamic stream. It came apart due to aerodynamics.

Then the next number of months those of us who were on the flight control team worked on what could we have done different, looking at all of the things that happened. It was clear to us that before we flew again, we had to have a better methodology for determining if we were ready to go fly. Not that anything that we did wasn't sufficient, because it probably was, but overall the program needed a better way to decide if it was safe to fly. We used the downtime to

go from what I call R&D [research and development] preparation to operations preparations, and we formalized all of the flight readiness process and formalized being face-to-face to decide to go fly.

Tommy [Thomas W.] Holloway is one of those rare people that has just tremendous insight into other people and what's making them tick. Tommy decided, after we finished our Ops investigation, that he needed to have his Flight Directors out doing something constructive, and he needed to have me in a place where I wasn't reminded every day of my part in the *Challenger*. He sent me to go run a branch in the Mission Control Center.

As it turns out, it was one of the best things that ever happened to me from a managerial standpoint, because I learned a lot of skills. Tommy then asked me to be the Deputy Division Chief for Flight Dynamics Division, and so I was out of the Flight Director Office for a period of time. I did come back to the Flight Director Office and flew STS-27, the second flight after return to flight. Larry Bourgeois did the first flight, the first return to flight, and then I did the second one.

My emotional desire was to fly that first flight coming back. Tommy made the judgment that that was not the best thing, not in my best interest, and looking back on it now, I agree with him. Then I was pretty aggravated, because I really, really did want to do the next one. It's like falling off a horse; you want to get right back on. But I did participate in STS-26. I was the Mission Director for the TDRS out at what became Onizuka Air Force Station [Sunnyvale, California], the [Air Force] Satellite Control Facility out in California, and then did STS-27 as my last flight.

Because of my experience in the downtime, being a Branch Chief and a Deputy Division Chief, after Larry Bourgeois moved on—Larry became the Chief of the Flight Director Office

after STS-27. Tommy became the Associate Director of MOD and ran the operations for Space Shuttle. When Larry moved on, Tommy asked me to come back and be the head of the Flight Director Office, and I worked directly for Tommy until he became the Program Manager of Shuttle, and in leaving, then I became the Associate Director of MOD, replacing Tommy.

I don't believe I would have been prepared for that job had I not had the opportunity to go do these other things during the downtime, which I didn't want to go do. I wanted to stay in the thick of things in the Flight Director Office, but it was the best thing for me.

JOHNSON: Well, do you want to take a break, and we can change out our tape?

[pause]

JOHNSON: As you mentioned, you had a chance to move into some other areas, but during that time after the return to flight, President [George H. W.] Bush, the first President Bush, announced the Space Exploration Initiative [SEI], the plan to go to the Moon and Mars, and as you mentioned before when you were talking about Space Station, that people were a little disappointed that you weren't going on to the Moon. What was the reaction to this first Moon-Mars announcement?

STONE: Well, I guess people were really excited until they started really looking at what kind of support the initiative had in Congress, and that could be described as little or none. So therefore nobody believed it was going to happen, and the enthusiasm of Mr. [Daniel S.] Goldin waned very quickly as the Station became more and more over budget, more and more complex to get

off the ground. Those of us that had been part of new starts could see that none of the right things were happening to have a new start to go back to the Moon and Mars, and so it was just clear that we'd better put our efforts in making Space Station a success, or we weren't going to have a human space flight program.

So even though it was exciting for a very short period of time, the reality that it was not going to happen under that administration—the NASA administration or the Presidential administration wasn't going to have the clout to make it happen financially. It just became kind of a disappointment. It didn't make much of a splash, because it became clear very quickly that it was—the President may have been very, very sincere, and I know he was very, very sincere. But none of the other political things that had to happen to make it a reality happened, and so he was kind of left holding the sack.

Even though a large part of the failure to move forward was in the political side, probably some of it was in the NASA side in not making some of those hard choices that our current Administrator for NASA is doing. We just didn't make those choices back when the first President Bush made the commitment.

JOHNSON: As you mentioned, you were named Chief of Flight Director Office. If you can talk to us for a minute, exactly what your duties were and what that job entailed as being Chief of the office.

STONE: Well, being Chief of an office like the Flight Director's is kind of like being Chief of an Office of the Astronauts. You had more than your share of large egos, more than your share of very, very capable people full of self-confidence. So being the head Flight Director brought with

it a challenge to not butt heads with all these people, but to kind of get them lined up in some semblance of iron filings all marching in the same direction. So it was a very interesting time for me, learning how to "manage" all these people that really required very, very little management. You give them a framework to operate in, and every one of them was just an incredible independent operator to do it.

But as Lead Flight Director you were accountable for assuring that everybody was running the procedures to bring a flight from when it was conceived to being ready for the Flight Readiness Review. So the chief of the office became kind of a minichairman of a Flight Readiness Review for all of operations. We did our Flight Readiness Review of all of the products that Mission Operations Directorate had to deliver for a flight, which included the training, all of the procedures, all the documentation had to be reviewed. So the Chief of the Flight Director Office became the chair of that flight readiness process at the next lower level below the program, and typically was the person with the Lead Flight Director that went to the program Flight Readiness Review and said, "Mission Operations is ready to go fly this flight."

As the head of that office, you were typically the interface to the Center Director for questions involving flight operations. You were the person that the Director of Mission Operations came to to assure themselves that we were really ready to go fly. But managing these people, that's probably a misnomer. I don't know that I ever managed the Flight Directors. I just kind of kept them all herded up and pointed in the right direction.

But it was a great experience. I have never worked with a group of more talented, dedicated people in my life, and one of the biggest sources of pride in my professional life, that I accidentally lucked in to get to be a Flight Director. I told you earlier in this process that I felt like that I almost got to be a Flight Director by accident because of my involvement in STS-1

and making the no-go decision to fly on that first day. So it's really a source of pride for me and it's a source of pride for every person that has been selected to the Flight Director Office.

It's a difficult, demanding job, and it takes its toll. There's only a limited length of time you ought to do it. Being the Chief of the Flight Director Office was actually an easier job than being a Lead Flight Director, from a technical standpoint and from an emotional expenditure standpoint. You still felt very, very responsible, but you also knew that very, very talented people had that deep commitment of responsibility for keeping the crew safe, so you felt good about it.

JOHNSON: Were you also responsible for bringing up new Flight Directors in that position?

STONE: Yes, I brought on four new Flight Directors during my tenure. The second woman Flight Director, Linda Ham, but she was the first one that went all the way through the program and became an active Flight Director. Linda was selected. I selected Linda as a Flight Director in 1991, I think.

JOHNSON: Was that a selection that you felt strongly about?

STONE: I was given absolutely no help. The way we select Flight Directors is that the Flight Director Office kind of puts together a list of people that we believe are capable, and then at that time we went through a very regimented selection process with an interview, and typically a couple of us, the Chief and the Deputy interviewed them, and then sometimes even the Director of MOD interviewed them. But I was given no direction to go out and find a woman. My

direction was to find the best candidates for the job, and at that time Linda Ham was one of the best candidates for the job. And she proved herself very, very well as a Flight Director. She was one of the best ascent-entry Flight Directors we've ever had. But there was no political pressure to select a woman.

JOHNSON: You mentioned that some of the processes changed after Shuttle as far as flight readiness and that sort of thing. Are there other processes that changed while you were in that position?

STONE: I think the process that changed the most within MOD, and not so much as a result of me being the Chief of the Flight Director Office, but just the evolution of the directorate to make things repeatable, make them production line. If you did the job the same way every time, you got the same-quality answer every time, and it was during my tenure there that we really honed that into processes that went across the Mission Operations Directorate on getting the Control Center ready, on getting the flight data file ready, on getting the flight design ready. We worked very hard to put production processes in place so you'd put in the inputs, and yea, verily, you'd get out a reliable answer every time.

We really streamlined the readiness process. We had great confidence that if we had run the process, all the products that MOD was going to deliver were good products. So I guess that's kind of the big change that took place while I was there, but it was something that the whole directorate did. We were just a part of the integration and overseeing of making that come together into the flight readiness process.

JOHNSON: In that position, you had a chance to meet some interesting people, one of which was the Queen Elizabeth, the Queen of England. Do you have any memories of that meeting?

STONE: Oh, I certainly do, because I made a terrible faux pas that day. You are never supposed to be higher than the Queen, and when they brought the Queen into the Control Center, I was standing behind the Flight Director console. I came out, and she put out her hand to shake my hand, but I am eighteen inches taller than she is, and so I am looking down. There's a picture in the NASA archives that several people who follow queenly things have told me it could be the only picture like it in the world where a commoner is higher than the Queen of England. But she was actually a very charming lady, and it was a pleasure to have her come through the Control Center.

As a Flight Director I got to meet President Reagan in the Control Center. He came through the Control Center while I was there, and a number of other celebrities over the years that we got to show through the Control Center. It was always great fun to do that.

JOHNSON: Any others that you can remember?

STONE: Let's see. My memory of names is less than sterling. Oh, the country-western singer that was killed in the airplane crash, flying his own airplane.

ROSS-NAZZAL: John Denver?

STONE: John Denver. I got to meet John Denver a couple of times. It turns out he and Jay Greene became friends in that time frame. Of course, John Denver was really pushing to be the first entertainer in space when we had thoughts like that running rampant within the agency. So that was an interesting time.

Shelley Winters. I took Shelley Winters through the Control Center, which was a real experience, because she was in the twilight of her career at that time, but she was very interested in what we did. So that was one of the other ones that I remember. I'm sure there were probably more, and I'll think of ten more tonight.

JOHNSON: I just never would have imagined Shelley Winters coming.

STONE: Yes, she came with several other people, and none of them were names that I even recognized then, much less remember now. [Laughter]

JOHNSON: Well, we won't push your memory anymore. In [19]'93 you were appointed Assistant Director for the Space Shuttle Program. How did that come about, and if you can, just share some of the details of that time period.

STONE: Well, that was one of the bigger surprises of my life. I was Chief of the Flight Director Office. Tommy Holloway was the Assistant Director for Shuttle Operations. The way the MOD was organized at the time, we had an Assistant Director for Shuttle, and an Assistant Director for Space Station, and an Assistant Director for Facilities. Tommy was Shuttle; Larry Bourgeois was Station; and Steve [Stephen G.] Bales was head of Facilities.

Tommy asked me to help him with the budget process in '93, and so I was doing that, and Tommy had a staff meeting there just before the time to submit the MOD budget. I'm sitting in the staff meeting completely unawares that in ten seconds my life was going to change completely as Tommy named me as the new Assistant Director for MOD. I truly did not know that, and Tommy had a knack for doing it, because when I became the Chief of the Flight Director Office, I found out because I got invited to Larry Bourgeois' staff meeting, who was then the Chief, to find out Larry was leaving, and Tommy was there and named me as the Chief of the office. So I had been surprised a number of times.

But at that point the involvement in the technical became less and less and the involvement in the managing of the resources of the directorate became more of a priority in what you were doing. And we were going through a very dynamic time. One, we had a new Control Center that needed to be built to support Space Station. We had to get ready to fly Space Station. We didn't have any of the in-depth organizational structure to run Space Station yet, and that was Larry Bourgeois' job, to put that infrastructure together so we had a Station Flight Control Division and a Station Training Division and an Operations Division. It was just kind of a mirror image of what we had done in Shuttle. But the directorate now has kind of got three pieces to it, with the three of us leading it, and Gene [Eugene F. Kranz] kind of being the architect on top making all of this happen.

It was during that time frame that we were trying to decide—there was a lot of budget pressure to reduce the cost of doing business, and it was clear that if we were going to survive as an organization, we could not have two mirror organizations flying two different spacecraft. We could not have two different Control Centers flying two different spacecraft. We made a tactical

decision, or a strategic decision, that the next Control Center that we built would have the flexibility that it didn't care what spacecraft it was going to fly.

So when we built what is known as the new Control Center in Building 30, we built it so that you could log on to the console as a Shuttle person or as a Station person, and the right software would load up from the servers to operate that particular spacecraft. So it gave us, for the first time, the opportunity to go from one room to another room; fly Shuttle over here and Station over here. And if you didn't like that combination, you could fly vice versa. You could do it in any part of the building.

Once we made that commitment in infrastructure, then Mission Operations looked at making the same kind of decisions to drive their organization back together to have one Operations Division, one Flight Dynamics Division, one Systems Division to service both spacecraft and be able to move people back and forth across the spacecraft membrane to lower your overall costs of doing business. When we made that strategic decision with the Control Center, it drove us to a new organization in MOD, and we made the decision to combine the Shuttle and the Station organizations.

At that point I took over both of those organizations, and Larry Bourgeois was selected to run one of the program offices in Building 1. I think it was called the Projects Office. It had EVA; it had a bunch of different things in it. So the directorate shrunk down from a three-headed dog running the organization to two, and then a couple of years just to one. We shrunk back into the original organization where the Director of MOD had the accountability for all of that, the three elements, again.

So that took place while I was the Assistant Director. Gene Krantz retired. John [W.] O'Neill became the Director of MOD. At that point in time John had been tasked to establish a

coalition between all of the Centers to try to pull together a single operating entity for Control Centers and networks. That was going to be a contract called the Consolidated Space Operations Contract, or CSOC. John was named to lead that, and it became clear that it was going to be an organization, a fairly large organization, where he could not do both, being the Director of Mission Operations and run this new organization.

At that time I was selected to be the Director of MOD, and Jim [James D.] Shannon was the Deputy of the organization, which made for a real interesting situation for me, because Jim Shannon had hired me thirty-three years before, and he was my very first Branch Chief at NASA. We had a great relationship. In fact, he was one of the principals—he and John O'Neill were the two principals that convinced the Center Director that I was the right guy to be the Director of Mission Operations. So I shall always be indebted to Jim Shannon for one, hiring me, and two, being gracious enough to recommend me over him for the Director of MOD.

JOHNSON: During that time period also the Shuttle-Mir Program came about.

STONE: The Shuttle-Mir Program was pretty complex. Tommy Holloway actually left to go run that program. It was the precursor to developing the relationships to operate the International Space Station jointly with the Russians. Very, very difficult to establish those working relationships with the Russians. For Mir, it was their spacecraft, and we were kind of a guest, but being very strong personalities in the operations world, we worked very hard to have more and more control. The Russians worked very hard to keep us from having more control. So it was a difficult time.

Tommy was an incredible statesman and built a very, very good relationship with the Russian management team that really laid the groundwork for us when we started working the International Space Station relationships. Tommy made it much easier for me when I started establishing the relationships with some of the same people, but some different people, to establish a Control Center presence in Moscow [Russia] for the Space Station, and having a Russian Control Center presence in our Control Center, when we finally got to where we had both American and Russian hardware flying. So Tommy did just an incredible job of laying the groundwork for us.

But the Mir Program, from an Ops standpoint we had some people in Moscow, but we were kind of observers looking over the Russians' shoulders. We provided an Ops Lead that was able to talk to the American crewmen daily to provide some technical input for what they were doing on Mir, but really to be an English-speaking voice that they got to talk to every day to reduce the isolation they felt when they were flying on Mir. But we provided that, those Ops Leads, out of Mission Operations in Moscow, and those people started building the relationships that we were going to need to have a real flight control team and a real infrastructure capability in the Moscow Control Center. So it was just the first baby steps to Space Station.

JOHNSON: As far as the operations—and as you mentioned, there was this budget issue to reduce the cost, when you were talking about the way it was organized—and then running Shuttle-Mir and having people in Russia and everything, how did that affect the processes and the cost, too, and the manpower to have people continuing to fly the Shuttle.

STONE: Well, Shuttle-Mir was not a huge manpower sink for Mission Operations. We had actually very, very few people in Moscow. We would have three at a time or four at a time so they could cover all of the shifts when we had an American crewman on board. The agency had an office in Moscow—but it was not run by JSC; it was run out of Headquarters—that gave us some infrastructure support in Moscow and helped us politically with the Russian Space Agency and the Russian contractor workforce over there. But MOD didn't have a huge investment in people.

Now, it's very expensive to have people full-time in Moscow, so we're running up hundreds of thousands of dollars' worth of travel during that. But for MOD, we were just a small piece of that. They were more program-level expenses in having to buy services from the Russians that we didn't do in our organization. But it was clear that doing business in Russia—the Shuttle-Mir Program was an eye-opener for the program to see the cost of doing business in Russia.

It was way more expensive than was envisioned, because it was so difficult to get information and so difficult to build contractual relationships with the Russians. It was envisioned originally in Station that we wouldn't have anybody in the Moscow Control Center. We'd do it all from over here and just talk to them on the loops. Well, if you ever work with a Russian, just talking to them on the loops, having never looked them in the eye and never having dinner with them and never drinking a vodka with them, you're just flat out of luck. You are not going to get anything done unless you have a personal relationship with that Russian on the other end of the com loop.

So Mr. [George W. S.] Abbey was a pretty wise guy, and he said, "Okay, we're going to have people over there. We're going to have Ops Leads that are going to be in the Russian

Control Center. We are going to build those relationships. We're going to send Flight Directors over there and Flight Controllers over there, and get to know the Russians." That philosophy was way more expensive than the program was happy about paying, but it was the only way to break into the Russian system and be successful.

So that was an interesting learning experience as we went through and got the first pieces of Space Station on board. It took very special personalities to be successful in Russia, and some of the people that were very successful over here were not very successful in negotiating with the Russians. So we watched who was successful, and then we kind of leaned on them to move us forward with the Russians.

JOHNSON: You mentioned when we talked about Apollo-Soyuz that you didn't have a chance to go to Russia at that time, but then you were on console during the docking. Were some of the same people involved, that were involved with Apollo-Soyuz, now with the Shuttle-Mir Program on both sides?

STONE: Yes. Yes, some of the Russian Flight Directors were the same. All of the Russian structural engineers were the same. The structural guys were not people that I knew, but some of the American structures guys who were now in their late fifties and sixties, it was like an old home week to get to meet their Russian counterparts from Apollo-Soyuz, and it was really, really fun to watch. I did not have a direct counterpart with the Russians on Apollo-Soyuz, so I didn't have that, but I watched other people do that. Glynn Lunney, who was the Flight Director and Program Office person that kind of put Apollo-Soyuz together, I saw him in action with the

Russians when they came at the beginning of the Station Program, and it was like old home week. So it was many of the same people.

The Russians, the way they do business, they don't change jobs very often in the course of a career. They can't understand it. There have been three Directors of Mission Operations since we started Space Station, and their Director of Mission Operations is the same guy, so they don't understand our moving around.

JOHNSON: Did you get a chance to go to Russia this time?

STONE: I did. I spent a lot of time in Moscow when we were establishing the Control Center and developing the operational protocols to run two Control Centers simultaneously, and establishing who was in charge. That was an interesting and tricky set of negotiations, because we said that since we've got the principal dollars involved in this, we are in charge, the Americans were in charge. Made it very uncomfortable for the Russians, since for the first two years of Space Station, most of the stuff that was up there was Russian hardware. So, you could say you were in charge, but clearly you may not have been completely in charge.

Working those relationships out and being able to negotiate with the Russians on understanding what they wanted to do with the hardware and making sure the Americans felt comfortable that what they were going to do was safe, was a day-in and day-out negotiation, and it was very difficult. Fortunately, the Lead Flight Director for the Russians, Victor [D.] Blagov, who has just recently retired, was a very, very reasonable man, and even though he was blustery and typical Russian, he could understand both sides of the argument, and we generally did the right thing with the negotiations, even though it was very difficult.

Russians are much better negotiators than Americans. Every American that deals with the Russians in the space program should go through a very intense negotiation school, because they are way better than we are at negotiating. We got better at it as we went along, but man, we were sheep getting eaten by the wolves early on in the Ops world. But we did get better.

JOHNSON: Was there any hesitancy? I think I've read that, because of the Apollo-Soyuz; the actual docking was a little rough from the Russian perspective. [Laughter] Then here we are talking to them again about docking again, now with their Space Station.

STONE: Well, it was, and they were very, very uptight the first time the Shuttle arrived, but the Shuttle was a much, much more precision vehicle than the Apollo vehicle was, and there was never an issue after we docked the first time. Now, we had to do a lot of analysis work to make sure that where the jets on the Orbiter were firing weren't causing oscillations in the solar arrays and weren't going to do this or that. It doesn't say we didn't do a lot of work with them to make them comfortable, but after we did it one time, they recognized the precision flying abilities of the Shuttle, and it became a much easier task in the future.

JOHNSON: Were you in the Control Room for the first docking?

STONE: I was. I was. It was a fun thing to be there for the first Shuttle docking.

JOHNSON: Well, it's almost four o'clock, if you want to stop for today and continue on the next time.

STONE: That's fine. That will work for me.

[End of interview]