

# NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

## ORAL HISTORY TRANSCRIPT

DAVID C. LEESTMA  
INTERVIEWED BY JENNIFER ROSS-NAZZAL  
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ROSS-NAZZAL: Today is November 26, 2002. This oral history with David C. Leestma is being conducted for the Johnson Space Center Oral History Project at the Johnson Space Center, Houston, Texas. Jennifer Ross-Nazzal is the interviewer, and she is assisted by Sandra Johnson and Rebecca Wright.

Thank you for joining us today.

LEESTMA: It's great to be here.

ROSS-NAZZAL: You became an astronaut in 1980. Why don't you tell us a little bit about the application process and the interview procedures.

LEESTMA: Okay. I was first getting ready to apply when the first class [of 1978] was picked. I think it was in 1976 that you, [NASA], sent out the applications, or NASA did, for new Shuttle astronauts. I'd seen something about it either in *Av Week* or something like that, but I was deployed in the Mediterranean onboard the [USS] *John F. Kennedy*. I was flying F-14s. My ops [operations] officer had sent in for an application and gotten it, and he brought it to me and gave it to me and said, "Dave, you must apply for this."

And I looked at it, and they wanted everything I've ever done in my life and every place I've lived since I was two, and all the justification that goes with it, and transcripts from every school since I'd been going to school. I mean, that kind of stuff. And here I am on a ship in the Mediterranean. So I went, "I just can't do this."

And so I just kind of put it away and forgot about it, and then when the class of '78 was selected, there were several people that I knew, that I'd worked with and that I'd been in squadrons with. And I went, "Wow. If they ever ask again, I will at least make the application," so that—it's better to have tried and failed than to never have tried at all.

And so it was shortly thereafter, in late '78, I think, that they asked for applications. And this time I was on shore duty, and so I had the opportunity to get all the stuff and put the whole package together and mail it in, and then you just kind of sit around and wait.

And then I got called for an interview by Greg [Gregory W.] Hayes. I said, "Oh, wow."

So, came down here for the interview and that was in—I guess it was in 1980. Maybe I applied in '79, but it was in February of 1980. I was in the first group that got interviewed for the class of 1980. After I left that interview, which was a very incredible week that you go through, lots of physical tests and the docs [doctors] spend about four days with you, but you have that interview. George [W. S.] Abbey was the chairman of the board at the time. Carolyn [L.] Huntoon and Joe [Joseph P.] Allen, John [W.] Young, [P.J. (Paul J.) Weitz], those are the ones I remember for sure that were on the board, and there were a few others.

And I went, "Wow. I know all these people's names or I've heard of them." And you're very nervous and you sit kind of in a corner of the table, and George is there and you don't know quite who to look at, and you're very nervous. I didn't know if the interview went well or not, but it was an enjoyable conversation with them.

And then after that week was over, I flew back to California and I remember that it was one of these, “Don’t call us, we’ll call you.” And you wait and you wait and you wait, and you know that different people that you know have been now called in for various later groups, and they’re interviewed. And you think back over the—there were twenty people in the group that I interviewed with, and every single one of them was, “Wow. How did I even get to be interviewed in this group?” I finally kind of gave up, that, if they hadn’t called me, nothing’s going to happen, but it was sure fun applying.

And then in late May of 1980, I got this call early in the morning. I was in California, so it was two hours earlier than here. As I found out later, they start calling around eight o’clock in the morning, and it was around six-thirty or something. And it was George Abbey on the phone. Now, I didn’t know that if George calls you, then you’re in, and if somebody else calls you on the board, then you’re not in. I found that out later that the chairman of the board makes the calls of the selectees, and some other member of the board calls all the people that weren’t selected. George asked me how I was, and I said I was fine, and he said, “Oh, and by the way, how would like to be an astronaut and come here to NASA?”

Whoa! What an exciting time. So I said, “I’d love to do that.”

And he said, “Fine. We’ll be in contact with you. Thank you.” And then he hung up.

So I told my wife, and she’s a California girl, or had lived in California a long time, and we had finally gotten stationed back in California. And she goes, “Does this mean we have to move to Texas?” [Laughter]

And I said, “Yes.”

And she says, “You didn’t say yes, did you?”

“Of course I did.”

She was just as excited as I was, but that was—so now we had to move, but we were getting ready to move anyway. I was coming to the end of my tour there at the X-4. So that was the process of applying and getting selected, and it was pretty exciting.

And then, later that day I got a phone call saying—and here it's May 20—I should know the date. It's May 27, I think it was, but it was 27, 28, something like that. And they say, "And by the way, we want you to report to the Johnson Space Center on July first," or July 7<sup>th</sup> or something like that.

And I'm going, "Wow. One month. I've got to sell my house and I've got to get orders."

And it didn't all work, because between selling the house and getting orders from the Navy and that, I ended up reporting a week late, just because I couldn't get it done. There were several others of us that had that same problem. I remember Ron [Ronald J.] Grabe and Guy [S.] Gardner, and I think one other reported late also. And so we were wandering around like we didn't know what we were doing when the rest of them knew what they were doing. [Laughs]

ROSS-NAZZAL: So you actually came a week late. Why don't you tell us about your training period.

LEESTMA: Okay. Right away you get—the first thing you do is all the admin [administrative] stuff; you get your badge and that. And then that Monday morning, I think it was July 14<sup>th</sup> or whatever that Monday was, the first meeting on every Monday morning is there's an Astronaut Office meeting. They called them an All Pilots Meeting, an APM. And that's when the whole office collects and they find out what people have been doing and what's going on.

And so, here we all walked out, trooped in, all nineteen of us. We became known as the “Needless Nineteen,” because there were thirty-five ahead of us, plus all the other astronauts that were there from the Apollo days that either hadn’t flown or were still there, and they were all waiting to fly the Shuttle, and we’re way down the line. And they go, “We don’t need you. We have plenty of us to fly the Shuttle missions.” So we were known as the Needless Nineteen. So we trundle in and we take seats. You’re sitting next to people like Al [Alan L.] Bean or Paul Weitz or John Young, people that you’ve read about or watched on TV, and you go, “I can’t believe I’m here.”

Pretty soon you get over that shock, because they start feeding you from a fire hose all the things that you have to do [to] get ready. But we didn’t really start training on the Shuttle or anything right away. The first year was an astronaut orientation period, where you visit the various different Centers. You get to know what NASA’s all about. You aren’t even given any technical assignments for about six months. You spend a lot of time learning NASA history, learning what the Johnson Space Center does. You get lots of lectures by engineering directorates, all the different directorates—what’s been done in the past, what they expect to be done. And so you learn an awful lot about the culture and what goes on at NASA.

I enjoyed it a lot, I have to admit. I was just fascinated by it, and as much as I could learn about it, it was pretty good. You visit various contractors, you go down to all the different NASA centers. We went down to the Cape [Canaveral, Florida], and I’d never been there before. Most of the other people had been there before. I went to the Cape, and they go, “This is the pad where Mercury was launched.” And you visit another site and this is where the Apollos were launched. And they go, “Some day, you may launch from here.”

And you go, “This is really hard to believe.”

And you realize how big KSC [Kennedy Space Center, Florida] is. I mean, all the buildings are big, and long distances you have to drive to get different places. So the Cape is a— it's a different kind of Center, and it's definitely a launch site. You know that you're dealing with rockets and spaceships there, as opposed to training and things that you do here.

So you just go through all that training, and it's fairly carefully mapped out. The folks that have put that together have done a very, very good job. I can remember, back in interviews, when I'd met Duane [L.] Ross, and he's still doing this. Talk about somebody that you need to talk to if you haven't already for your history, Duane probably knows it. He can remember names of people that have interviewed back in the sixties—maybe not the sixties, but certainly all the Shuttle folks they've ever interviewed. He's an amazing person. So, you know, meeting him.

Then our class sponsor was Al Bean, so Al went on all the trips with us. I can remember sitting in an airplane ride one time, and I was talking with Al Bean and he was relating his experiences when he went to the Moon on Apollo 12, and it just absolutely fascinated me. The stewardess came by and served us our Cokes or whatever, and after she left, I go, "She doesn't have a clue who she just talked to." I mean, having been fascinated by this. But this man next to me walked on the Moon. It's one of those experiences that you just remember, something that's kind of ingrained in your mind.

ROSS-NAZZAL: You've mentioned a couple of times how, when you arrived, you were in awe of these astronauts. Had you always wanted to be an astronaut?

LEESTMA: No, I hadn't. I never, ever thought I could be. I don't have 20-20 vision, so I figured that'll probably wash me out. And I wasn't a test pilot, and I'm not a Superman or anything like that. I don't leap tall buildings in a single bound. And, these other people, boy, just the things that they had done and were able to accomplish, not just in the Astronaut Office, but you read some of their stories and they had done a lot of things before they ever came here. So I knew the kind of people that generally got selected for these programs. So I was very humbled and very in awe to be here.

ROSS-NAZZAL: So you started out working with Al Bean, and he was your class sponsor, as you pointed out.

LEESTMA: Yes.

ROSS-NAZZAL: What were some of your first assignments, once you had gone through that initial training?

LEESTMA: My first technical assignment was to work on the pocket checklist for the APU procedures, the auxiliary power units that power the hydraulic system. I was under the mentorship of Ken [Thomas K.] Mattingly, and Ken had just been named recently to the STS-3 backup crew and STS-4 crew, so he was busy doing that, but he was also directing a lot of things in the office.

John, I think, was in full-time training for his STS-1 flight. He was the chief of the office and he was still trying to do that, but Ken was acting kind of as his deputy at the time. So we got

a lot of things. And I remember very clearly, Ken Mattingly always wrote his action items in green ink, and so every time you got a “green zinger,” as I used to call them, you knew that Ken had something that you had to do and get on. And I still have some of these green zingers. Ken kept incredible records and he would have lists of, “Action item number 108. Dave, that’s yours.” Or, “Dale [A.] Gardner, you were working on this one,” or, “Mike [Michael L.] Coats, you were working on this one.” Those were some of the other folks that were working on that at the time, and we used to laugh about them.

I still have some of them in some old records somewhere, some green zingers, some that I never did get complete, just because you never had time to do it all. But I remember drawing up the diagram on the APU system, the simplified diagram that goes in the front of the pocket checklist, and I think it’s the same diagram, pretty much, that’s still in there. So that was my first technical assignment.

I got assigned then shortly thereafter to working on the first release of the new software that was going to fly the Shuttle, called Release 19 at that time, that was going to be after the OFT [Orbital Flight Test] flights, starting with STS-5. And so I got involved with a lot of people in the Center that worked on the software control boards. It’s amazing how much you can learn about the Shuttle by just following the software around, because it touches just about every system and everything that you want to do.

So, working on that was really a learning experience and I was glad that I got assigned that when I finally got to fly, because I think it gave me a big heads-up on the vehicle as itself, because it’s all kind of supplied by wire. The software runs most of the systems, and by going through the operational flight software—Release 19 at that time, or whatever it was called at the time—we were able to learn a lot about the entire vehicle.

ROSS-NAZZAL: [Henry S. F.] Cooper says in his book that's one of the reasons you were actually selected for STS 41-G.

LEESTMA: I wonder who he talked to. [Laughs]

ROSS-NAZZAL: What was your reaction when you finally found out that you were going to be flying?

LEESTMA: Oh, boy. For me, it was totally unexpected. I was in the class of 1980, and they had selected the crews through STS-9. I remember that clearly, when they announced STS-7, 8, and 9, I think, together, and Sally [K. Ride], being the first woman to be selected. And then my good friend Dale Gardner was on STS-8 and Brewster [H. Shaw], who had been my officemate, was on STS-9. They were starting to work into the thirty-five astronauts that had been selected in 1978, and they had a whole bunch of them to go yet. I mean, it was going to be a lot of flights before they got to us in 1980.

And so I was thinking, "Okay, I wasn't expecting anything." And then I got this call on a Saturday morning from George to come on up to his office, he wanted to talk to me. Well, to be called on a Saturday to go see the Director of Flight Operations, it's either really good or it's really bad. And knowing that I was not in line for a flight, I was pretty nervous, to say the least, wondering what this was all about.

As I got to the building and was going up, I remember Jim [James F.] Buchli was leaving the building and Loren [J.] Shriver and a couple of others, and they had these big smiles on their

faces. And they'd just been named the STS-10 crew. So, I wondered why—I don't know what this is all about.

So I went up there and I walked in, and waiting in George's office and waiting in the outer area were Sally Ride, Jon [A.] McBride, Kathy [Kathryn D.] Sullivan, and myself, and they're all '78 folks. So George invites us in and we come in, and there's Bob [Robert L.] Crippen. He was sitting in the office already. He was already assigned now to a flight, an earlier flight. Well, he was at the same time getting assigned. He got assigned to STS what was 13 at the time. That became 41-C. It was STS-17 at the time. And so we were selected to fly in STS-17, and when we first got assigned, it was an IUS [Inertial Upper Stage] mission on *Columbia*. We ended up flying a radar, the SIR-B [Shuttle Imaging Radar-B] radar mapping mission of the Earth on *Challenger* is what we ended up on.

They always told you, when you get selected for a space flight, don't fall in love with your orbiter or your payload, because they're liable to change, especially at that time. There had been some differences in what had happened. We finally ended up flying. But we became the thirteenth flight when we finally did fly, so we moved up quite a bit, a lot of flights, because they were having trouble with IUSs and some upper stages and various things. Those flights slipped behind us, but we stayed with our particular flight, which was very fortunate.

So I ended up flying quite a bit earlier than the other people in my class. I don't know if that's good, bad, or indifferent, but it was sure exciting to see our flight kind of hold its position while others slipped, because we figured, as they slipped, then we'd slip. But because of the requirements on our payload, we had to fly at a certain time of the year and a certain inclination and that, and so they held us in our place, which was real nice.

ROSS-NAZZAL: You had mentioned that you were originally going to fly in *Columbia*. It was being refurbished out in California.

LEESTMA: Yes, right.

ROSS-NAZZAL: And that was one of your first assignments that Bob Crippen gave you, was to act as the liaison with Rockwell International and let the crew know how the changes were going.

LEESTMA: Yes.

ROSS-NAZZAL: Can you tell us some about those?

LEESTMA: Boy, I don't remember all of them. I do remember traveling a fair amount, back and forth to California, to Palmdale, where it was, and the things that were going on. And it was progressing slowly, and there were a lot of tile modifications that had to be done to *Columbia*. There were a lot of upgrades to make it like the newer vehicles. They weren't going as fast. There's always money problems. And so, my reports coming back were probably a little bit more negative, only because *Columbia's* not going make our flight time. I just can't see it possibly happening.

It had flown in STS-9 and they just were not going to get it ready for a while. There [were] a lot of difficulties getting it ready. They were making some modifications. They were putting on a new nose cone called the—I think it was the SEADS [Shuttle Entry Air Data System

experiment]. It had some holes in it, I think, for air data-type things. They were putting a SILTS [Shuttle Infrared Leaside Temperature Sensing experiment] pod on the back, which is a leaside temperature infrared camera up on the top of the tail. They were doing a lot of different things and it wasn't going well, and it was hard to come back and be real upbeat when you know that your orbiter's not going to make your flight date, so you wonder what's going on.

And then they started to have that shuffle. The program realized that the orbiter wasn't going to make it and they shuffled orbiters around and we ended up on *Challenger* and with a new payload called SIR-B, and that's when it really got down to training and started getting really serious about it, which is good. And it was nice to know that we had a payload and an orbiter that we were probably going to fly. At that time I think that *Discovery* and *Challenger* were just kind of flip-flopping all the way along, so it was pretty much a two-orbiter fleet at the time.

ROSS-NAZZAL: Why don't you tell us a little bit about your training, in particular your training for the EVA [Extravehicular Activity] for this mission.

LEESTMA: When we got started, we had a meeting with "Crip," but "Crip" now was assigned to—it became 41-C. It started out as 13 and it was moved up; I think it became the eleventh flight. So now he was on the eleventh flight and the thirteenth flight of the Shuttle. Those are almost like back-to-back flights. We'd never done anything like that before, as the commander of both.

And the commander is generally the one that really sets up the training, sets the tone, and does that. And "Crip" told us he was going to spend as much time with us as he could, but until

he was back from his flight, he was pretty much committed to the 11 flight. And so we asked Sally to kind of be the training coordinator. She had flown before. The rest of us—Jon McBride, Kathy Sullivan, and I—were all new. This was our first flight.

And so she kind of became the de facto commander as such, at least for organizing our training and assignments and making sure that we were progressing and that, and it turned out very well. I think she did an excellent job of it.

And so we trained as a crew of four for a long, long time. A lot of our simulators were done. Jon would sit in the pilot seat. Sometimes we'd get a guest commander. We'd invite somebody in to sit in with us, or we'd just do it as the four of us. I think under those circumstances, there was a lot of pressure on us to know what we were doing and not screw up, and that includes in the simulators, because mission ops were looking at us very carefully to see if this is something that could be done or not. Can you train without one of the crew members who is doing another flight? Because they were looking at flying crew members more rapidly; that might be a better way to go.

And so we spent a lot of time training and prepping and making sure that we were on time and knew our material ahead of time. I think that helped us as a whole crew, to be ready to go fly. And then about halfway through our training, we got Henry Cooper assigned to us, because he was going to do an article for the *New Yorker* at the time on what it was like to train to be an astronaut. Henry's a different kind of character. I didn't have any objections to him being there. I think there were some folks here at the Center that were worried that it would interfere with our training. He did a very good job, I think, as being kind of as out of the way as he possibly could be.

He ended up publishing a book, and I enjoyed the book [*Before Lift-Off: The Making of a Space Shuttle Crew*]. It's not a real fast-paced read. It's pretty dry, because that's what training is. Training is, you go in the simulator, do this, you go to this class, you do this. It's not a real exciting detective novel or anything. But I thought he did a very good job of chronicling the activity that we did, from training through the final things, and getting ready for flight and going and actually flying.

ROSS-NAZZAL: I thought he did an excellent job when I went through it.

LEESTMA: I got to work with him quite a bit. I actually wrote the foreword, I think, to his book, and so that was kind of fun. I got to talk with him a lot about what he thought, really. I think he enjoyed the time a lot, watching how it really is happening.

ROSS-NAZZAL: Sounds like fun. Well, why don't you tell us a little bit about the flight itself. Actually, you had quite a few assignments on this flight.

LEESTMA: Yes.

ROSS-NAZZAL: You worked with the remote manipulator system.

LEESTMA: Yes. I worked with the remote manipulator system. I was Sally's backup on the RMS. I was the lead EVA. Kathy was going to become the first American woman to do an EVA. Actually, at the time we were assigned, she was going to be the first woman in the world

to do an EVA. When the Russians found out about that, they immediately sent a woman up and had her do an EVA, and so the Americans didn't get to be the first women to do—I mean, that's just how it operated. We weren't going to move up our flight or do anything to change any of that.

Let me see. I'm going to talk about the EVA first. One of the things that I was put in charge of was getting ready to do the spacewalk to prove that we could actually refuel satellites in orbit. Satellites all have these little standard refueling ports that they connect up when they're on the ground. One at a time, you very carefully have to handle the hypergolic fuels that go into it, because they're pretty dangerous— $N_2O_4$  and hydrazine. Hydrazine is very much like water, but it's got a lot of different properties, one of which is that it blows up if it's not handled right. "Crip" and the safety folks were very, very concerned that we shouldn't do this with hydrazine. We should just do it with water. The heat transfer properties of water and hydrazine are very, very similar, and that's what we really wanted to know. They were worried about what's known as adiabatic detonation, which is, there's no convection in space, so as fluids flow through ducts and into tanks and things, there's no real mixing of the temperature.

So as a tank is starting to fill up, if you're refueling a tank, as you remember, in a constrained volume, if you start filling a tank, there's less volume so the pressure goes up inside the tank. And as the pressure goes up, the temperature goes up. I mean, that's just one of the relations of—it's Boyle's Law or Charles' Law or one of those. So if the pressure's going up, the temperature's going up, and that's really no big deal on the Earth, because there's convection and this heat mixes around.

Well, in space there's no convection. It is possible that all that heat will go into one very minute area. Just a few molecules get heated up so that they could rapidly get very hot and reach

the detonation point of blowing the whole thing up. So you want to be very careful as you flow the fluid, in that you don't get to this adiabatic point and detonate this fuel.

And so I think "Crip" thought I was a little too cavalier, because I insisted that we should do it with hydrazine or what have we proved. Nobody's going to care whether—then nobody will know whether we can really do it or not. And he said, "Well, if you want to find out about hydrazine." He sent me to White Sands [Test Facility, Las Cruces, New Mexico], so I spent about, I think it was about ten days at White Sands, watching them do all kinds of adiabatic detonation tests, watching all kinds of things blow up. And I came back from there with a real appreciation for the capabilities of this kind of a deadly stuff. And not only does it blow up, but it's really nasty stuff. You can't breathe it. If you get it on your skin, you can get poisoned. So there were lots of concerns that if we do hydrazine, but if it sprung a leak and even got on our spacesuits, how are we going to get back in the airlock? We don't want to bring this stuff back in.

So we spent lots of time on how much bake-out time we'd have to do, how to get it off our suits. If you get in the sun, can you bake it out so that you don't bring it in the airlock? And then if we do come back in the airlock, how can you test whether you brought any in with you? How do you get rid of it?

So there were a lot of procedures that we had to work out, just dealing with hydrazine. Eventually we were allowed to do hydrazine. I had to go all the way to Aaron Cohen, I think, to give him a briefing on why we should use hydrazine and not water, and he bought off on it. "Crip" finally did. "Crip" probably had the final say-so on that, and he agreed to have us do it with hydrazine, because he had watched me several times in the neutral buoyancy facility to do the whole procedure, and how careful we were, and we had triple containment of the liquids at

all times. It's a very tedious task, using small tools and lots of arm and hand manipulation that you had to do to do this task. The tools were actually designed and built here at Johnson Space Center. The whole ORS, it was called, the orbiter refueling system, was built and designed here at the Center.

I remember that one of the young prop people from MOD [Mission Operations Directorate] that was working on the project at the time was a young guy by the name of Bill [William H.] Gerstenmaier, who is now the Space Station Program Manager. John [W.] Griffin was kind of the Project Manager, and his son is now a branch chief or something here. Joyce Seriale-Grush, she's now one of leads for the Shuttle Integration Office here in the Engineering Directorate.

So those people are still around, and it was a fascinating experiment to be involved in. When we finally did go out to do the—well, just before the task, I'd been talking to a lot of folks on the various flights, and little things go wrong on every flight, but we get the debriefs from the crew. And I'd ask them, "Well, why did this happen and why did [that] happen?"

And it usually is because some change was made, either an experiment or something, late in the flow, and they never got a chance to test it. This was really brought to light for me, because I remember, just before my last test with the actual flight tools, we were getting ready to use the flight tools with hydrazine out back in the back test area. You can't use hydrazine back there anymore, but we were using hydrazine to flow it in the system, to make sure that everything was working. And I was going to do the test, using the actual flight tools, so it was kind of a full-up check.

And I was talking with the guys that were back there, and we were looking at the tools and they were all bagged up nice. And they said, "Oh, by the way, we read in this magazine, we

got this new grease we put on. We've had a little trouble sliding the slide down the tools, and we put this new grease on there."

And I went, "New grease? What do you mean, new grease? What have you done to test this?"

And they go, "Well, the document says it's the same kind of stuff, it's just a little different."

I took those bags of those tools home with me that night, put them in my freezer, came back the next day, and they were frozen, and you couldn't move the slide. The grease froze. I didn't know it was going to do that. I showed it to John Griffin, and John then did the same thing, because they had thawed. Put it in the freezer, came back out, and he said—so they canceled that test that day. They went and cleaned the tools all off and we put the old grease back on, and then we went through the tests and the tests went well. But, boy, that is still on my mind, that if something changes, you'd better make sure that those people know that they've looked at all the different things that can go wrong. Because we could have gone on orbit and that would have been out in the vacuum of space, and we would have been unable to do the entire EVA because the tools wouldn't have worked.

ROSS-NAZZAL: That was smart thinking.

LEESTMA: I don't think it was so smart on my part. It was just the training that they put into you to kind of question everything. A lot of people don't like the astronauts because they're always asking those silly, dumb questions, but sometimes those silly, dumb questions are appropriate, and that one turned out to be okay.

So Kathy and I went out and did the EVA. I remember, as I first came out the hatch, I was coming out this way and Earth was down that way. [Leestma gestures.] I grabbed the handhold and pulled out and when I first—there was the Earth. It was right below me. And my heart rate went real high and the docs later confirmed that, because my EKG [Electrocardiogram] went real high, and they said, “This is when you came out of the hatch.”

I said, “Yeah, no kiddin’.”

And I had this tumbling sensation. Other people have had that same thing, and I remember in my debriefs, even to Joe Allen and some others, I said, “You may experience this. Just be ready for it.” And they’ve had it. You come out of the hatch and you get this experience that you’re going to fall. Some people have had that when they’re sleeping and they kind of go, “Whoa, I’m falling,” and then you aren’t. I wasn’t falling, but I got that tumbling sensation. So I think my handprints are still in those handholds right there, because I went, “Yow!” and just stopped for a short period of time and had to get my heart rate back down in a minute or two, and then continue on. That was a pretty exciting time, to leave the spacecraft itself and go out and EVA.

And followed shortly after by Kathy, and then we just went out and we did the ORS. We actually did it in little bit quicker time than they had predicted us to do it. And then we were asked to do a couple things. One, we had had trouble folding up the SIR-B antenna. The SIR-B was Kathy’s primary experiment, so she went out to check, and it looked like the insulation was just a little bit too thick in the fold areas. And so she could squeeze that down and she could tell that that was—it was just the insulation; there was nothing else binding.

And then we also had to do the Ku-antenna. It had failed. Its pointing mechanism had failed. If it doesn’t rotate correctly back, then we would have to jettison that before could close

the payload bay doors to enter. The Ku-band assembly, just the antenna itself, is like a million dollars, and the digital avionics. I mean, it would have been a very big loss to the program if we had to jettison it.

So the ground had come up with an in-flight maintenance for us to go out EVA and align the antenna by moving it manually, such that the stow pins would line up properly. And then inside the cabin, which we had prepared the day before, Sally and Jon would do the right electrical connections between some wires and pins and some connectors to put power into those pins, just drive those pins down.

So [Kathy] and I positioned the antenna and then we told them we were ready and then we watched these things come down. And so we locked it into place and we could visually confirm that it was locked in place, and then we didn't have to worry about it anymore. Now, that caused us problems orbiter-wise, because now to use the Ku, which the SIR-B antenna required for its high data rate, we had to point the orbiter so that the antenna was pointed at the right place, [toward the TDRS satellite], and make the orbiter rotate; [in these attitudes, the SIR-B antenna was not pointed in the proper direction.]

So we'd take data and then we'd do data dumps and we'd point the orbiter at the TDRS [Tracking and Data Relay Satellite], and then we'd go back and do data writes, rather than being able to take data the whole time and point the antenna and dump it. So they didn't get all the data that they wanted, but the mission was not a loss and we were able to do that for most of the time, and they got almost everything they wanted.

Let me think. What else? Oh, the arm. The very first day in orbit, we were supposed to deploy the ERBS satellite, Earth Radiation Budget Satellite, they called it. It was a Goddard [Space Flight Center, Greenbelt, Maryland] satellite and it was kind of measuring infrared

radiation coming in and infrared radiation leaving the Earth to see if things were in balance, or either heating up or cooling down or what the atmosphere was doing.

It was an RMS deployable, and Sally was primed for the deploy and I was the backup, so we trained a lot together, spent a lot of time in the simulators and going to Canada and doing those kind of things. It becomes a little bit of a contest of who can do this quicker, better, or, do it. All those competitive games were played in everything you do.

Sally was very, very good at the arm. She had been the arm operator also on STS-7, so I learned an awful lot from her, and just watching how she went through the training. When it came time to deploy the satellite, she had let me actually pull the arm out, do the checkout, and then grapple the satellite. And then she took over to pull the satellite out of the bay, set it up for deployment, deploy it, and then I stowed the arm.

Before we did the actual deploying of the satellite, we each got five, ten minutes to play with the arm and make sure that we were comfortable with it. So we deployed it; we got it out for deployment. The first thing we had to do, the solar arrays were folded up to the sides of the satellite, so we were getting ready to—before you deploy it, you put the solar arrays out and the ground checks it out and makes sure that it's getting current and everything's powered up and looking good.

So we sent the command for the first solar array to deploy, and it goes up. It's a beautiful satellite. It's got gold kind of foil insulation on it. The solar arrays are these dark purplish-blue things. I mean, it's a beautiful satellite, if you've seen pictures of it. So the first solar array went up and we go, "Okay, we're ready."

And the ground says, "Okay. Deploy the second one."

We hit the command and nothing happens. Uh-oh. So what do we do? So we wait, and the ground says, “Well, do the backup command.”

So we do the backup, or do it again, whatever it was, and nothing happens and it’s just locked in the side. And we’re going, “Oh, no. Now what do we do?”

And they thought about it and they go, “We don’t know what’s wrong. It looked like the current went out, so something either happened to the satellite or it’s stuck or frozen or we don’t know what it is.” So they said, “Point it at the sun for a while and see if that works.”

So we did, [to see] if that [thawed] it out a little bit. Nothing seemed to happen. We’d get it up there. We’re talking inside the cabin, of course, about what can we do to see if we can free this solar wing on this satellite. This was a flight back before we had all the TDRS coverage, so we went through long periods of time where we didn’t have to talk to the ground or they couldn’t see data. We were getting ready to come up over Australia and go through the Canberra site and talk to the ground, and then we would [have] about a fifteen, twenty-minute period before we’d talk to anybody, before we’d come up over the States. A big LOS [Loss of Signal] time.

Sally and I are looking at each other and wondering, okay, we both had the same idea. And so they said, “Well, we’ll talk to you over the States and see what else we can do.”

And we figured we’d given it the thermal thing, so what if we shake this thing with the arm? [Laughter] I looked at Sally and she looks at me, and I said, “We aren’t getting enough rates with what we’re doing.”

So we changed the payload ID [identification], which tells the arm what’s on the end of it, and we changed the payload in the software to zero, which means there’s nothing on the end

of the arm, so now you can go to the max rates on the arms and play with it. And we said, “‘Crip’, do you mind if we try to shake this thing loose?”

And he said, “Go for it. Just don’t break it.”

We go, “Okay. We’re not going to break it.”

So Sally took the arm and goes to the left as fast as she can and stops it and goes back the other way, which makes the satellite—the rates in the arm are really slow, but it’s putting some kind of force into it. She did this once and nothing happened. We did it, I think, twice, and the second time, I went, “Something’s moving.” So she puts it up to the deployment [position] and we’re watching it, and it slowly moved a little bit, stopped, moved a little bit, stopped, and then it went [whistles], and it deployed. I went, “Whew!”

So, she got it all right back in the deploy position, just like that, and we came up over the States, and the ground said, “Okay, we’re with you.”

And then we said, “Well, take a look at the satellite. See if we’re ready to go.”

I don’t remember the exact quote, but they came back up and they go, “What did you guys do?”

And we said, “We aren’t going to tell you, but just check it out, make sure that it’s ready to deploy.”

And they said, “Everything looks good.”

And so we made our deploy time and the satellite worked. It was supposed to work for a year; I think it worked for three or four years. I mean, it worked real great. And it’s one of those things that you just kind of go, “Whew!”

I don’t think we ever would have gotten permission to do what we did, except that we just decided to go do it.

ROSS-NAZZAL: That's a great story.

LEESTMA: It was fun. That was an exciting time. And both of us looked at each other and we got these kind of sneaky grins on our faces as we're looking, going, "They would never let us do this, but let's go try it." And "Crip" let us do it, so that was pretty neat, too. We had a neat crew. The crew was really a lot of fun, because we really melded and meshed well together.

ROSS-NAZZAL: Let me ask you a few more questions about the mission. This was the first mission in which a woman was supposed to go out on the first spacewalk.

LEESTMA: Yes.

ROSS-NAZZAL: And there were two women on the flight as well.

LEESTMA: Yes, right.

ROSS-NAZZAL: How did the media react to that?

LEESTMA: Oh, the media made obviously a very big deal about that. Sally, being the very first American woman to fly; Kathy, now, on this flight, is going to become the first American woman to do an EVA. Two women at one time, how is this going to work? They played it

down very well. Both of them were very, very good about it. It was just, “Hey, we’re just part of the crew.”

And Jon and I could easily just stand in the background and just be one of the crew. It actually took a lot of the spotlight off of us, which was fine. Since “Crip” wasn’t there most of the time, it was mostly Sally and Kathy being the spokespeople for the crew, which was perfectly okay.

And they just fit right in. They were just part of the crew. Sally did a great job of keeping us all together and keeping morale up and letting us know, “Now is the kind of time where, start paying attention to this kind of stuff,” and, “Hey, guys, we’re about three months from flight. This is where the training really starts to peak and you’re going to be spending a lot of hours here, working eighty-, ninety-hour weeks, and just be ready for that. Let your families know.” And, sure enough. So it really helped prepare us and get us ready to go through that.

Through the simulations, all of just worked together as a crew. After “Crip” flew, he came back and joined us, and so then through the summer of ’84, then he was there with us. And so we went off and did that.

In fact, “Crip” and I and Sally were on the—I can’t remember where we were. I think we were on the roof of the VAB [Vehicle Assembly Building], at the Center, to watch the launch of what was supposed to be about two flights ahead of us at the time, 41-D, when they had their pad abort. And that’s when we kind of held our spot, but the people that were in between us, they moved out into later in the flow.

And watching that pad abort, whoa. [Laughs] Not sure that this is something, because you could tell something was wrong, but you weren’t sure what. The main engine started, and then they shut down. The vehicle hadn’t gone anywhere, and since you’re up on the roof there,

you don't have any data or anything. And then all of a sudden you see all the water gushing out. So that was pretty interesting. We went back and talked with the crew after that. That was Hank [Henry W.] Hartsfield's crew—Hank and Mike Coats, Steve [Steven A.] Hawley. Those guys were on that flight.

And then I flew back. I couldn't stay for much longer after that. We flew back, and that's when the manifest juggled a little bit, but we held our spot, which was real nice. We knew that our training was going to be hot and heavy that summer. Some of the other crews got—they were pretty disappointed, but they all ended up flying.

ROSS-NAZZAL: For this mission you actually designed a tool for your EVA. Can you tell us about the tool that you designed?

LEESTMA: I'm trying to remember which one that was. There were several tools that were all part of this ORS package, and you had to maintain triple containment. And so the question was, how can you undo this valve that you had to take this cap off. Once you take the cap off, you're kind of open to this valve, and if there was a leak inside, there was hydrazine to spit off. So how can you do that without being seen, and how do you get that cap off?

The main tools to take the cap off and all that, and the triple containment, were designed in EP [Propulsion and Power] Division. But one of the problems that we had in the early parts of developing this EVA was there's this cap that goes on the valve, and it's a cap that, in a real satellite, would have been tightened very tightly by the mechanic and it's very tightly safety-wired so that it never comes off. I mean, you don't want it to ever come off.

That's the first thing I had to do in the EVA was take that cap off, and the first thing that I had to do before that was to take the wire out, the safety wire. In most satellites it's in about a twelve-inch by eighteen-inch little recessed area. Actually, it's a little smaller than that, but there's a recessed area and then this valve compartment's inside that. And when you have gloves and an EVA suit, it's very cumbersome to get in there. We didn't have anything to get that safety wire out, and you couldn't really see the safety wire.

So, I had seen this tool. I think it was at one of the places that somebody was working on my car one time. It had a flashlight and it had a little mirror on the end of it that stuck out, and so you could shine the flashlight into the mirror and reflect in and get light to see what you were doing, and then you could look in the mirror and see what it was that you were doing. And I went, "Oh, man, that'd be perfect for what we're doing."

And so we actually flew—I mean, we took—this is a bought-off-the-shelf black little flashlight with this little extension with a mirror on the end of it, and we adapted it to get it right so it would be space-qualified and work in space, and I actually used that tool to get it. Also, along with that was a little kind of knitting hook, and we put a cutting blade inside the hook so that I could—it was easier to grab a hook around the safety wire and then tug, to cut the wire, rather than to try to get some snips in there. You couldn't get any kind of snips in there.

So by looking with the flashlight in the mirror, and then the hook, I could get the safety wire off. And then we took a pair of pliers that one of the EVA folks, I think, had suggested, and we just bent the end of it. So we had right-angle pliers, and so I could reach in with those right-angle pliers and pull the safety wire out.

There's a picture of me in the EVA that [Kathy] took [while in the payload bay during the EVA with] this big smile on my face after I've [completed the first step of the experiment].

And I'm holding up these pliers with the last little piece of safety wire in it, going, "We got it all, so now we can actually go do what we came here to do." But that was the hardest part of the whole thing, was getting the safety wire out and getting the cap off.

ROSS-NAZZAL: So your EVA actually proved that you could refuel that way.

LEESTMA: Yes. I feel like I could go back up if I had to, and refuel. Now, of course, there's always the problem of rendezvousing with the satellite and grappling it and getting positioned and all that, and then carrying the fuel up with you. I think they decided that by the time you cost the training and the Shuttle flight itself, it would be cheaper or as cheap to launch another satellite. But it can be done. If we ever decide to do it, it can be done.

ROSS-NAZZAL: Let's talk about your next flight. Your next flight was very different from this first flight.

LEESTMA: Yes, it was.

ROSS-NAZZAL: It was actually a classified mission with the Department of Defense.

LEESTMA: Right.

ROSS-NAZZAL: Why don't you tell us how it was different, or compare and contrast to the—

LEESTMA: Let me see. There's a little interim in there, though, because between this time I was assigned to another flight, which was called the ASTRO-1 mission. It was scheduled to be the twenty-sixth flight of the Space Shuttle, and it was going to be on *Columbia*. I think the reason I got assigned to it is because it was going to be the first flight of *Columbia* after this period of time when it had been down. It still had been down for an extended period of time, that we never did get to fly the first time.

We were getting ready to fly that, and it was going to be the flight right after the *Challenger* mission, 51-L. And it was called 41-E, or 51-E, I think is what we were called, because we had slipped a little bit because *Columbia* hadn't gotten ready. And so I was down at the Cape. Well, actually we were in the simulator when 51-L was going to be launched, and we didn't think it was going to launch. We had started watching and we saw all the ice and the cold weather, and so we got in the simulator. Jon McBride was the commander assigned at that time of that flight. Dick [Richard N.] Richards was the pilot. Jeff [Jeffrey A.] Hoffmann and Bob [Robert A. R.] Parker and myself were the mission specialists.

It was the ASTRO-1 flight. It was an astronomy mission. And so we got in the simulator and they said, "Hey, they gave the 'go' for launch. Do you want to come down and watch it?"

So we got out of the simulator and watched it and watched what happened. We realized, since we were the next flight, we go, "Well, there goes our flight. Who knows what's going to happen."

And so we immediately reported back to the Astronaut Office and just waited for what kind of assignments we'd get after that. So there was this down period, and during that down period, that crew, and then this DOD [Department of Defense] crew that I was assigned to, and the crew that eventually flew the next flight, 26, Fred [Frederick H.] Hauck's crew, were the

three crews that basically stayed in training. Everybody else was kind of relieved of all their duties, and we stayed in training.

Because I was on two crews, I was spending a lot of time in the simulator and I was getting real tired of it. Then they realized that out of the first several flights that were going to fly, they would not fly the ASTRO-1 mission, and it was slipped to STS-35 or something. But Dick Richards and I were reassigned to the—well, I had already been on the DOD mission with Brewster. Dick was reassigned to that flight. And so then we ended up training for this Department of Defense flight and getting ready for that, which was going to be the first flight on *Columbia* once we started flying again.

So they were getting *Atlantis* ready and *Discovery* ready and *Columbia* ready to go fly. At that time they were going to be 26, 27, and 28. *Discovery* was going to fly first, then *Atlantis*, and then *Columbia*. Again, here I am assigned to *Columbia* and it's not going to be ready. They were having a hard time. This was in its big down period to make it just like the other orbiters that had been built, and since *Columbia* had been built earlier, there were a lot of differences. So it was still in that process of being modified and put back together, so it didn't make the 28 flight. It slipped, too, when they flew *Discovery* and *Atlantis* one more time each before we finally flew in the summer of 1989.

Training on a DOD crew was different, because everything was done in a classified mode. Our flight data file was classified. You couldn't bring it home. You had to check it out. You couldn't talk about your mission. It's a whole different experience than being out there every day, and people can talk to you about it and what's going on. You just say, "Hey, we're going to go fly."

"What are you going to do?"

“Well, we can’t tell you.”

So it’s a different experience in that regard, but you get to do some pretty exciting stuff. Every space flight is just as exciting as another, and this one certainly was one of those.

Waiting on *Columbia* was hard, because it almost seemed like *Columbia* was never going to get ready, but it finally did. And so we were able to launch and go on that mission in the summer of 1989, in August. I remember, we launched on the eighth of August. It was the day before my dad’s birthday, but he was there at the Cape again. I remember, I was able to get him on the—I had some friends that got him to where he could at least listen to what was going on in the air-to-ground. I told them, “After one rev [revolution], when we come back, make sure that he’s in that area in the Cape where he can hear the air-to-ground.”

So I wished him happy birthday and said, “We lit some pretty big birthday candles for you.” So he thought that was pretty neat, and that was fun.

ROSS-NAZZAL: What can you tell us about the mission itself? I know that the mission was classified.

LEESTMA: The mission was classified. Shoot, I don’t know if they’ve ever told us if it’s unclassified or not. But we had a payload for the Department of Defense, and then lots of in-cabin-type things that we did. Because it was a DOD mission, you did what you went up there to do and then you came back, so it was a five-day mission. They really only wanted us to be gone for four days, but we talked them into one additional day, simply because if you’re going to go to all that effort to get up there, give us some more things to do and we’ll do them.

The primary part of our mission was over in a couple days, and so we just finished up with the in-cabin-type experiments and did those, and then we landed. We ended up having to go to Edwards [Air Force Base, California] to land, at the end of that. Actually, we hadn't even tried to land at the Kennedy Space Center, because the first flight of each of the vehicles after the big down period was always at that lakebed. So we flew *Columbia* and landed at Edwards.

I did get to land at the Cape on my first flight. We were the second flight to land at the Kennedy Space Center. We had a lot of trouble getting flights to land there at first. In fact, just about all the flights ended up going out to Edwards, but a little later in the program we found that that's, [KSC], probably the best runway in the world to land on, and as long as the weather cooperated, we went in there a lot of times. So my last flight, too, we also landed at Kennedy.

ROSS-NAZZAL: Can you talk to us about NASA and DOD in these missions, if there were any conflicts, for instance, regarding a classified flight versus NASA's public affairs interest?

LEESTMA: NASA's mission is always very open in the pursuit of space, and it's very open. The DOD missions at that time were conducted in quite a bit of secrecy, because the Shuttle, though, was such a great space truck. I mean, it could carry heavy payloads to orbit and it would have the attention of people deploying them, if necessary, or operating them, or whatever you were going to do.

That was a very big plus to the DOD, because they had probably had some failures before that, that they might have been able to fix if people had been there or they had been able to spend some attention to it. They also were able to get pictures of everything that's going on, and see that it was configured just right before it was let go or whatever it had to do.

The DOD liked it. They did not like dealing with NASA. I don't think NASA liked dealing with the DOD. It was kind of a constrained arrangement, but it worked very well during the times. I mean, the results that we got of the—I don't know how many DOD missions we did, but we did about five or six, STS-27, ours in 28, and there [were] some others after that. I don't remember what they all were.

But the DOD missions actually went very well, and I think the DOD was very, very happy with the product that they got in the end. As far as I know, there were no failures or problems with any of those missions. The crews performed very well. I was pleased to be a part of that. I came as a military astronaut. I was glad to be a part of one of those, and was glad to be selected for that and to be able to do that. So I got to do both sides of it.

One is more open. It's a lot easier to talk about it, say what you've done. I mean, everybody wants to come back—especially when you come back from a space mission, you want to tell everybody what you did, and when you can't do that, it's a little bit more subdued. You don't get asked to do many public appearances and things like that. So you end up basically going back to the office and training and getting ready for the next mission.

ROSS-NAZZAL: Were there any specific challenges for the crew in terms of training or the payloads?

LEESTMA: No. It's just more the secrecy. Sometimes you had to disguise where you were going. You'd file a flight plan in a T-38 from one place, and you'd go somewhere else, just to try to not leave a trail for where you were going or what you were doing, or who was the sponsor of this payload, or what its capabilities were or what it was going to do. You just had to be

careful all the time of what you were saying. But as you get closer to a flight, you start getting real excited about it, because you're going to do some really neat, exciting things. So it was kind of a half-and-half-type thing.

ROSS-NAZZAL: I would like to actually go back to *Challenger*. For some reason, in my mind I skipped ahead. You actually served as a member of a committee which investigated the history of the SRBs [Solid Rocket Boosters] at the Marshall Space [Flight] Center [Huntsville, Alabama]. Can you tell us about this committee, and what was the name of the committee?

LEESTMA: I don't even remember what the name of the committee was, but about a day—it was about a day after the accident, maybe two days, I was asked to go to the Marshall Space Flight Center. George called me up and said, “You're going to be on the Marshall team that's going to investigate the solid rocket boosters.”

Nobody knew for sure yet what had happened, and they were assembling teams all over the place. “Crip” was in charge of the recovery team down at the Cape. So, Mark [N.] Brown was assigned with me to Marshall. We went up to that team and introduced ourselves, and immediately got involved with the film reviews and everything that we could possibly do to either—and looking at all the data to either exonerate the solid rocket boosters or find out if something had gone wrong with them. That was this team's intent. And then if something had gone wrong, obviously then we went on to that, which we did find out.

The team was led by Neil [A.] Armstrong, and his deputy was [Major] General [Donald J.] Kutyna from the Air Force, who had been in charge, I think, of the Titan program at the time, so he knew about solid rocket boosters also. He actually had been at one time a fairly strong

critic of the Space Shuttle and NASA. He was from the Air Force side. I'd known him from some of the stuff that I'd done with the Air Force before that. Neil and General Kutyna complemented each other. Neil is a very laid-back-type personality and General Kutyna's a real hard-driving type. So they're the ones that [ran] the team. And we had lots of different groups, mostly Marshall personnel that are assigned to these, but we were there from JSC to see what was going on and to add any expertise or help that we could to these teams.

After reviewing, oh, man, hours and hours and hours of film, we started to see little things that you wouldn't notice normally, little puffs of smoke and stuff from the sides of the boosters, and we started to really focus on the O-rings and the joints, the field joints of the SRBs. And it wasn't long before we could pinpoint, in some of the films that we got back from the Cape, that, in fact, one of the field joints had failed in the SRBs, and that was the cause of the accident. And so then it's—oh my goodness, so you go through all that, and there was obviously a big SRB flap even before the flight, and whether they should launch or not and whether they did. And the coldness may have contributed to this, because the O-rings get very hard and the joint tends to flex a little bit differently in cold weather.

I do remember, since I was on the next flight of the Shuttle, I remember on our launch date, which had been scheduled three weeks after the 51-L, I called down to Cape weather to find out what the temperature was at our launch time, and it was below the certified range also of the SRBs. Not as cold as it was on 51-L, but it was still colder than what they had been certified to. So there was a lot of consternation and recrimination going on at Marshall, but, really, the NASA people bucked right up to that and said, "Okay, what do we have to do to fix these things? We've got to get ready to go fly again."

So we started looking at lots of different possibilities of what to do. And I remember that Guy Gardner and Dale Gardner, two astronauts that were assigned to the mission that was going to be after our 51-E mission, they were going to be the first flight out of Vandenberg [Air Force Base, California], but they were going to use filament-wound boosters at the time.

And I remember some of the briefs that we had gotten on filament-wound boosters, and they had a different clevis arrangement, hanging clevis arrangement than the boosters that we were flying. And so I talked to Bob [Robert] Schwinghamer, who was one of the senior engineering guys at Marshall, and he said, "Yeah, and that's to prevent this gap opening." And so then we talked a lot about that, and they went off and that was one of the things that they put into the redesigned solid rocket boosters, was this, a device to keep the joint from flexing or opening when the pressure gets into the case. They did a lot of other changes, too.

I think that right now, as far as a solid rocket booster goes, they're about as safe as you can possibly make a solid rocket booster. We've sure learned a lot. Wish we had listened to some folks before on the solid rocket boosters, because that was a great tragedy, that 51-L mission.

ROSS-NAZZAL: What suggestions did your committee come up with to improve the SRBs?

LEESTMA: Change the material of the O-ring; add an additional ring. Instead of having just one, put two in. Put this tang and clevis arrangement in. Certify it to the entire temperature range at which you might launch, rather than just at warmer temperatures. We put heaters into the round, the joints, so that the joints are always at 70 degrees, no matter how cold it is [outside].

Then there were lots and lots and lots of process improvements of how they assemble them. They test them and check them out. I don't know how many came out of the whole committee's report, but there were lots and lots of changes to be made, lots of attention paid to solid rocket boosters. Not just the hardware changes, but a lot of it was process changes, right from how you attach the propellant inside each of them, and the burn rates, and the materials that are used, the separators and dividers and the O-rings. They have a little flap mechanism now so that when the pressure ignites, this flap goes down and it seals the joint from getting hot gas even in the first place, in addition to having two O-rings—or actually three; two on the inside and one on the outside—and a tang and clevis arrangement. So the joints, in my opinion, are never going to fail. So if it does fail, it won't be the joint.

ROSS-NAZZAL: So you're pretty satisfied with the solution that NASA came up with?

LEESTMA: I was very satisfied with the changes that they made, and the fact that they had actually put those into production, and test and qualification and certification, and whatever else they had to do, and be ready to fly in two and a half years was quite an incredible accomplishment. Two and a half years, people go, "My goodness." But two and a half years to basically build—they called them the refurbished or redesigned SRBs, RSRBs, but they were basically a brand-new SRB. To go through all the quals [qualifications] and certification that they had to do, and build them and test them, I think it was a phenomenal accomplishment. Of course, everybody held their breath when Rick Hauck's—the STS-26 went up, but that was probably the safest flight we've ever flown on the Shuttle. [Laughter] That had more attention

paid to it than any one that we had ever flown, except maybe STS-1. But STS-1, there was a lot we didn't know that we had to find out first.

ROSS-NAZZAL: Let's talk about your third and final flight, STS-45. This was also a different flight for you. This was actually a Spacelab.

LEESTMA: This was a science flight, so now I've been on kind of an operational-type flight, just to operate this radar and take pictures of the Earth, and then a DOD flight, and now this was a science flight, with a pallet full of atmospheric-related experiments. Kathy was one of the first payload commanders we ever had. I flew again with Kathy Sullivan on that flight. Being an Earth-type scientist, she was a very good pick to be on that flight. And then [C.] Mike [Michael] Foale was on that flight; that was his first flight. And myself. And then Charlie [Charles F.] Bolden was on the flight; he was the commander. And Brian Duffy's first flight, who was the pilot. Another really good crew. We had two payload specialists.

Actually that brings up a point from my very first flight. Very, very late in the flow, they decided that, in STS 41-G, that we would fly two payload specialists. So we became again—we had a lot of firsts on that flight—the first flight to fly two payload specialists, and the first crew of seven at one time.

The Astronaut Office viewed this as kind of, “Why are these people on board the flight? That's our prerogative to fly. They're taking seats that should really belong to members of the astronaut corps.”

And so there was lots of controversy about payload specialists. One was an Australian, Paul [D.] Scully-Power, to study the Earth's oceans and stuff, an oceanographer. He was the

first oceanographer to fly in space, I think the only one to fly in space. And a Canadian, Marc Garneau, who later was selected into the Astronaut Office and has flown a couple of times since, I think.

So they became—they were kind of international flavor. It was the start of the series of time through late '84 and 1985 where we flew a whole bunch of payload specialists, a lot of them from foreign countries. The Russians had done this on Soyuz, and [NASA] Headquarters [Washington, D.C.], I think, thought it was a good idea to do it. I think even presidents at the time thought, “This is cool. As part of foreign affairs, I can promise this country they send somebody over and we’ll fly them on the Space Shuttle.”

Eighty-five was kind of a hoo-ha year. “Let’s go fly,” and we flew nine or ten missions, and most of them had payload specialists, many of them international type. But we were the first ones to do that, and we had already designed our patch. Each crew gets to design their own patch. It was a nice round patch with our names on it, and we didn’t know quite what to do. We really didn’t want to redesign the patch. So we came up with the idea of putting the payload specialists’ names on a little sew-on flap that goes on the bottom of the patch, and if you see our patch, you can see that. And that’s been kind of the convention ever since, for payload specialists, that their names go on that flap, at least until a period of time after that. And now I think, because the crews are named so far in advance, they’re able to get everybody’s name on. We don’t add people late. They were adding payload specialists fairly late at the time.

Some folks didn’t particularly like the payload specialists on board. I thought, if that’s what the country and NASA want to do, then fine, let them fly. This is great. So we had them on board. We had a crew of seven. Seven makes the Shuttle a little bit more crowded than it

would be with five. You have to share your space and share your time at the windows and that kind of stuff, but you learn to get along and I think it went very fine.

And so on ATLAS [Atmospheric Laboratory for Applications and Science], again, this next flight, there were seven crew members and we had two payload specialists. They were both scientists that had been selected by Marshall at the time, because they were the ones. Dirk [D.] Frimout from the Netherlands; he was our international. And we had Byron [K.] Lichtenberg, who was the American that was going to be on board.

So that kind of finished out our crew. We were operating at that time on twenty-four hours, so we were operating around the clock. That gave me an opportunity to do something that I never thought I'd get, but I got to be, for twelve hours of each time on orbit, I was the commander. That was really kind of fun. Charlie and Brian were on the other shift, and so for twelve hours a day they were in charge of the orbiter on orbit, and the other twelve hours, I was.

Mike Foale and I and Byron Lichtenberg were on our shift, and Kathy Sullivan and Brian Duffy and Charlie and Dirk were on the other shift. So, twelve hours on, twelve hours off, back and forth. I got to do a lot of things that, as a mission specialist, wouldn't normally get to do. I got to fly the orbiter, do the maneuvers. I got to manually fly it a couple of times, because the payload desired a manual slough through things by the orbiter, so I got to do a lot of neat things that I wouldn't have been able to do normally.

So it was a really exciting flight for me. It was a very, very fun flight. I got to do a lot of things that I had never done before on the orbiter. It was exciting because the payload was neat. One of the things in the payload bay was a plasma generator that would shoot these little bolts of plasma down from space back into the atmosphere, and then we'd measure the conductivity

through the ion that was created. They tend to spiral down to the atmosphere; they don't just go straight when we'd shoot these things.

So the first time we were firing it, I was down in the mid-deck and I heard Kathy go, "Wow!" So seven heads are now looking down at this thing as we fire—it was in the dark, and we'd fire this little bolt of plasma out of this plasma generator thing that we had. It would fire down, and you could see it leave the payload bay. It looked kind of like a phaser, like a gun out of *Star Wars* or something. And it'd shoot these little bolts of thing and you'd see them kind of disappear. And then you'd watch, and then it'd hit the atmosphere and it'd glow again, and you'd see this spot glowing down into the atmosphere when it went in, and you'd go, "Wow, that is one of the most neatest things I've ever seen."

And then unfortunately, about the second or third time we tried to fire it, it arced and shorted out and we couldn't fire it again. But I sure remember those first ones pretty well. I remember Kathy's first—she was in charge of that experiment, so she was doing it. We were down eating dinner, I think, before we went to bed, my crew, when we heard her yell, "Wow! Look at that!" And, man, it takes about three seconds and everybody's up there with all their faces pressed against the windows, wondering what's going on.

That always goes down to the law, though. I remember we had that—on my first flight, when we had seven people, there's three people that launch in the mid-deck area. And there's no windows down there and you can't really see. The rule always was, for the three people downstairs, that they told the four folks on the flight deck, you never get to say anything that ends in a question mark, like, "What was that?" or, "Did you see that?" Because now they're, [the mid-deck crew], going, "Uh-oh." [Laughter] "What is that? What are they talking about?" So we were told you were not allowed to say anything like that at all [from the flight deck].

ROSS-NAZZAL: You mentioned a couple things that I'd like to go back to and hit upon. First of all, you mentioned that you were operating twenty-four hours a day. Was there any sort of competitiveness between the red team or blue team?

LEESTMA: There probably is a little bit in the training time frame, because you're going to end up training as a team, and maybe one day the red team has their sim [simulation] and the blue team has it the next day. When you're done, you ask you training team, "Well, how did we do compared to those guys?"

There's always that natural competitiveness, but nothing that ever gets kind of vicious or anything, and you've all got the same mission, to make your mission as successful as you possibly can. That's the one thing you want to do. And so we were all working toward that purpose. So that worked out very, very well. I think a lot of attention has to be made into crew selections and how they're made, and we'll probably get into that later. Because I think that's very, very important for the success of the mission as it goes on.

ROSS-NAZZAL: You also mentioned that you got to serve as commander, essentially, when you were in charge.

LEESTMA: Yes. On orbit, anyway. Didn't get to land it.

ROSS-NAZZAL: Well, you at least got to maneuver it.

LEESTMA: You bet.

ROSS-NAZZAL: Because of this, were you in charge of any experiments on board the orbiter?

LEESTMA: I was backup on most of the experiments, on a lot of them. I did some mid-deck-type experiments, some eye experiments. For Helen [W.] Lane, in Space and Life Sciences, I drew blood samples, and Henry did some nutritional-type studies and things like that. But as far as the payload bay experiments, no, those were the payload specialists' and Mike Foale's and Kathy's responsibility, and I was responsible for the orbiter.

So I had to spend a lot of my time in training learning about the orbiter and the orbiter systems and how to operate them, and emergency procedures and all the stuff that goes with that. Because when I was on board, I was probably the only orbiter person on my shift, so I had to be ready for that. Of course, I mean, five feet away is Charlie and Brian, if I ever need them for anything, so it's no problem.

ROSS-NAZZAL: Well, you actually did spend a good deal of time working on the SAREX experiment. Can you tell us about the experiment?

LEESTMA: SAREX is the Shuttle Amateur Radio Experiment. It requires that you have a ham radio operator's license, and then you get this radio and a special antenna to put in the window. So during your free time, if you want, you can talk on the radio and talk to other ham operators on the ground. Little did I know—and so the Amateur Radio Club here at the JSC trained us and

got us ready for our test. Brian and I and Kathy all took the ham radio test, and we all became ham radio operators so that we could operate the SAREX legally while we were on orbit.

That was kind of fun, and since I knew Morse code anyway from my old Navy days, I had no trouble with the test. So we went and did that, and on orbit it started to get fun, because about the second day, I was able to use it. I had some off time, and put the antenna in and was able to talk, and found out how much fun and how much excitement there was of people on the ground to talk to an actual Shuttle coming over. There might be fifty or 100 people calling at one time, and it's just [makes static noise] in your headset. You can't understand it. But then somebody would come through that either had a very high-powered radio or a very tuned antenna or something that would come in very clear, and you could talk very, very clearly to them. So you'd exchange your call signs and then you'd give your call sign, and everybody who's listening can now hear that call sign, so they can say they had a radio contact with you on the orbiter.

And ham radio operators always exchange cards with people that they have what they call a QSO with. When I got back from orbit, I was inundated with thousands and thousands of these cards of people that had listened to me talk or had actually had a two-way conversation with me. And since we'd recorded them all, we had to verify that we had actually gotten these people's call signs so that we could send them a card back. That actually took months to review the tapes and get call signs or parts of letters. If we get a card in, you could say, "Yeah, that was them," because they'd give the dates and stuff. And you'd go, "Yeah, it all correlates." So we sent out, I don't know, I probably sent out 1,500 cards back of QSOs that we had with folks on the orbit.

I claim, and I don't know what the claim is worth, to be the first person on two-meter radio, which is just line-of-sight radio, to have talked ham radio to people on all seven continents. During one of our passes down over Tierra del Fuego on that flight, I was able to talk to an Antarctic station that was down there that had ham radio operators who were actually in Antarctica. So I got to talk to Antarctica, too, including all the other continents, so I've talked to people on all seven continents during that flight. That was neat.

ROSS-NAZZAL: What was the goal of this experiment? What did NASA hope to learn?

LEESTMA: The goal was as much to show maybe a human relational thing that NASA can do. It's an experiment, can you talk from space via ham radio to the ground and back? Could it possibly be used as backup communications? And the answer is yes, it could. And then, I think it got people all around the globe excited. Every time we'd come over land and we'd put the antenna in and listen, there were people calling us constantly. It didn't matter where you were. I mean, you could be over China, you could be over southern Chile, you could be over the ocean and somebody would call you and you'd go—they're on some island somewhere, but they knew you were coming over and they were a ham radio operator. Because NASA had published the frequency that we'd be on and that kind of stuff.

To me, it was a public relations thing as much as anything else, and I think it worked out very, very well. Maybe it appeals more to a niche, people, the ham radio operators, but it had very worldwide appeal. I remember over Africa one time and it was two or three in the morning, their time, down on the ground, as we were coming over. I put it over because I didn't know if anybody would be there, and I hadn't gotten Africa yet, hadn't gotten anybody from Africa. And

there was this, “Hey, matey,” with some very British accent, and he was out in the outback, as he called it. I mean, it’s like an Australian term, but he was out in the middle of the desert, somewhere in South Africa or Namibia or something like that. He had been up and he said, “I’m up here in the middle of the night and I knew you were coming over, didn’t think anybody would be up and aware.”

I remember one time coming over New Zealand. We were getting ready to come over New Zealand and the sun was still up. We could see the sun, but it was getting ready to set over us. And talking, and this guy came up real loud and clear. He was a big ham radio operator, probably had a big antenna or something. He said he was in Auckland, and I said, “Oh, we’re coming right over the top of you. As a matter of fact, would you run outside and see if you can see us? We’re in the sun, you’re in the dark, and we’re going to be right over the top of Auckland.”

And about thirty seconds later he came back on, “I saw you! I saw you!” because he could see us going across the sky. It was pretty neat.

I said, “Go run outside and take a look. We’re right overhead.”

ROSS-NAZZAL: What did you most commonly talk about with the ham operators?

LEESTMA: Oh, mostly it was to exchange call signs. And then there would be a question like, “How did you get interested in ham radio?” or, “What’s it like?” or, “What are you doing right now?” You couldn’t talk very long, because you’d go out of sight with them very quickly or you’d lose signal or somebody else would break in. But what I would do sometimes is just do a running dialogue for thirty seconds, forty-five seconds, knowing that people are listening, and

just saying, “We’re coming up over the coast of California. It’s a very clear day. The Pacific looks beautiful. It’s looks like a smog-free day in the Los Angeles valleys. Oh, we’re up over Monterey now.” I mean, it just, it goes so rapidly, and they would—just to give them a little what’s going on and what we’re looking at.

ROSS-NAZZAL: Great. I think this would be a good time for us to stop the tape.

LEESTMA: Okay.

[Tape change.]

ROSS-NAZZAL: What I’d like to do now is shift gears, and talk more about your management duties at NASA. One of the first positions you served in was as Mission Development Branch Chief. Can you tell us a little bit about that branch and your duties?

LEESTMA: Mission Development had mainly to do with the missions—the on-orbit operations, the payloads that the astronauts would fly. I don’t even remember the whole organization of the Astronaut Office, but we had several branches. One of those was Mission Development. Another one had to do with the flight data file, and there [were] a lot of different ones to it. But it was pretty much the astronauts that were supporting the other flights and looking at future flights for the payloads, and to make sure that they were compatible with the missions, and to find out as much about them as we could ahead of time to see what issues may be there as far as operating them or deploying them or doing whatever you had to do. If there were issues with

upper stages, what kind of safety requirements had to be placed on them, and working a lot with MOD on those kind of things.

So that was kind of a fun job, because you got involved with a lot of different payloads that you weren't going to fly, but that other people were going to. But when you saw them fly, you knew that you had a part in doing that. So it was an important part for the Astronaut Office to get involved in, to get their presence out into the field so that these customers or these people would know that people were involved in helping with their procedures early on, so that when it finally got turned over to a crew, it wasn't like either starting all over again or starting from scratch. So most of us in that group had some either space flight experience or knew the kind of stuff that had to be done to get these things ready to turn them over to a crew so that there was the least perturbation to their training and stuff.

Many times in the early flights, and I remember this was very true in my first flight, when you got the payload, nobody had really looked at it, from NASA, from an operational and a procedures viewpoint. And many times the procedures that the customer had written up were just not workable, or were so inefficient that it just didn't work well at all. And so the crews would have to spend a lot of time rewriting the procedures and getting them set in a format so that they could fit it into flight plan. MOD would help out a lot with that. I mean, that's kind of what we did. This branch was formed to try to do some of that ahead of the crew, to take a little bit of that workload off the crew. Crews tend to make changes anyway, and perfect them and make them the way that they just want to, but if it's a small delta rather than a total rewrite of the whole thing, it sure helps. And that was the main purpose of that branch.

ROSS-NAZZAL: Did you work with any of the corporations while you were chief of this branch?

LEESTMA: Yes. We worked with Hughes Aircraft, I remember one. Worked a lot with Lockheed-Martin. Ball Aerospace. Those are the three kind of that I remember, but there were a lot of other little ones. University of Florida [Gainesville, Florida]. A lot of university ones. They needed the most help, because they were going to build a little experiment, but they didn't know what kind of, I mean, even what format to put their procedures in, and you could help them and get that going.

ROSS-NAZZAL: Did you do any work in the simulators, then, with these companies or groups?

LEESTMA: Not a whole lot, but occasionally you would. Mostly you'd desktop it, just have them bring it and you'd operate it in just a room like this, rather than taking it into the simulator itself.

ROSS-NAZZAL: After 45, you actually became the Deputy Chief and then the Acting Chief of the Astronaut Office.

LEESTMA: That was actually after 28.

ROSS-NAZZAL: Okay.

LEESTMA: Well, the chief of the office was after 45, but after STS-28 I was asked by Don [Donald R.] Puddy, who was the Director of Flight Crew Operations at the time—he had just assigned Brian [D.] O'Connor up to a flight and he asked me to come up and be his Deputy

Director of Flight Crew Operations. So that was really my first foray into, other than the branch area, to be involved in the management of the Center.

During this time, as the Deputy of Flight Crew Operations, Don Puddy broke his leg, so he was out for a lot of things, so I had to fill in for him a lot. And then he spent six months at an advanced executive training thing, so, again, for another six months I was kind of like the Acting Director of Flight Crew Operations. This was in between my flight and STS-45.

And so I got an introduction. I got to meet most of the managers at the Center, involved in a lot of meetings, and a lot better understanding of how a directorate operates. The Astronaut Office is kind of a different kind of an operation at this Center than the way that the rest of the Center operates. So, I mean, I was involved in POPS, budget planning, and going to safety meetings, and doing all the stuff that you do as part of the regular institutional support that goes on. It gives you a different appreciation of what it takes to fly a space flight and operate a Center. It was a really good experience for me.

And then I'd been assigned to 45 and I'd been starting to train for that, and finally it was time for me to leave up here and go back to my crew. So after I flew STS-45, then when I came back, they were in transition between chiefs of the office and what was going on, so Don Puddy asked me to be the Deputy Chief of the Astronaut Office, which was what I was doing.

And very shortly thereafter is when Dan [Daniel C.] Brandenstein left the office and we had no chief of the office for a while, so I was just kind of the acting chief in the interim. Did that in the interim, and then Aaron Cohen asked me to apply, and selected me as the Director of Flight Crew Operations. They had put out a notice that they would like people to apply. I didn't even see that notice. Aaron called me and asked me to fill out my application. When I looked at what you had to do, I went, "This is like going through being an astronaut again."

So I went to P. J. Weitz, who was the Deputy Director of the center at the time. I said, “P. J., should I really do this or is this just window-dressing? Should I pay attention to what I’m doing or is this just because they want a wide selection-type thing?”

I mean, I didn’t know the real purpose of it was. And he said, “No, you are a legitimate candidate.”

“I am?” That kind of thing.

He said, “So pay attention and be serious about it, if you really want the job. If you don’t, then don’t apply.”

“Oh, okay.” So I thought about that for a long time, and then spent some time filling out that application and applying. It was to my great surprise that Aaron called me in one day and said I was selected for that job. So I took over from Don Puddy in November of 1992, a little over six months after I landed from STS-45, and served in that position for quite a while.

ROSS-NAZZAL: Did you actually retire from the astronaut corps at that time?

LEESTMA: I had to at that time. I kind of left the astronaut corps with the thinking that, “Well, this is temporary and I’ll go back.” So I didn’t really retire from the astronaut corps as such, but I had to retire from the Navy. To take that position, I could not remain on active duty, because the Navy said they didn’t have a billet for that, and that was at this time. And so within six months I had to retire from the Navy, which I was eligible for. So I did that, and then was selected into being the director up here.

ROSS-NAZZAL: Why don't you tell us about some of your major duties. You've hit on some of the institutional bureaucratic duties.

LEESTMA: The major duties as the Director of Flight Crew Operations is you're responsible for the Astronaut Office and all the functions that go on within that, including selection of crews for flights—at least the recommendation to the Center Director or the Administrator of who should fly those flights. And the selection of new astronauts, and at that time, when I was there, every two years we were selecting astronauts. So I was involved in the selection of three different astronaut classes, and making those recommendations up to the Administrator, and also for all the aircraft operations out at Ellington [Field, Houston, Texas].

At that time we were flying thirty-two T-38s, four SDAs, the zero-G airplane, and all the mission management airplanes and those kind of things. So there's a pretty big, broad scope of things that you have to do, plus you're involved with the programs quite a bit. At the time that I was the director, the ISS [International Space Station] was just getting started. They didn't have any hardware any orbit and the Shuttle was the program that we were involved with, but, you see, you spend a lot of time with those program managers, because they're pretty much paying for your directorate. And the crews that you select support the missions that they feel very responsible for, so doing that was really the exciting work.

Shortly after I took over as the Director of Flight Crew Operations, we entered into negotiations with Russia, and the Mir Program came up. And at the time when it first came up, it was going to be just one flight. We already had somebody. We knew that this was kind of coming, and Don Puddy had already kind of picked and then I ended up formally selecting Norm [Norman E.] Thagard to be our astronaut to fly on Mir for an extended period of time.

The Russians, they agreed to that and that was great, except they wanted a backup, because they didn't do anything without backups. They do things a little bit different. After the first four Space Shuttle flights, we didn't use backups anymore. We always figured there was another crew in training downstream a little bit, that if we had to, we could always move somebody up. In fact, we did do that a couple of times.

That worked out very well. The Russians operate strictly as crews, and if one person on a crew can't make the flight, that whole crew is taken off and the backup crew moves in. So they had their two backup crew members, but they needed the third. We did not have a backup crew member. Norm had been at—we had sent him to the Defense Language Institute at Monterey [California]. He was progressing very well in Russian. We had nobody else, and they were insisting that we assign a backup to his flight.

This got to be very tense, because not many people at that time wanted to go to Russia. I mean, I'll be frank with you. Not many astronauts wanted to go to Russia to go spend several months on board Mir. Nobody knew what the conditions were going to be like. There was very, very little U.S. support in Russia at that time.

I made a trip over to Russia, my first one of several at that time, just to see what it was. And just getting to Star City was very, very difficult. The Russians didn't want to let you out there, a very secretive place. Things hadn't thawed out a whole lot after the Berlin Wall. So it was going to be a very difficult, arduous tour for anybody that was going to do this. Norm was up for it; he was ready for it. We didn't have anybody else, so we started asking around, who would like to do this and that. I went and asked Bonnie [J.] Dunbar if she would be willing to do that. She kind of gulped, and then she said, "Yes, I would be willing to do it."

So then I had to go to Carolyn Huntoon, who was the director of the Center at the time, and say, “Bonnie has volunteered, but I need your advice and opinion on sending a woman into this. This is not going to be easy. It helps us in sending a little bit of a signal to the Russians that we do things differently. You’re forcing us to do a backup. Now, we’re going to send you, as a backup crew member, somebody that we think is perfectly legitimate to be the prime crew member, a woman. This is not a stunt or anything. This is very legitimate.” She had flown three or four times in the past, and she’s one of our ace astronauts.

The Russians didn’t want us to send a woman. They didn’t like that. They said, “Nah, she won’t be able to make it through the training.”

That just probably made Bonnie more determined, but she was going in there not knowing the language and 99 percent of the people don’t speak English where she was going. And, whew, what a difficult—I mean, I have nothing but the highest admiration for what she did. She went into one of the most difficult situations anybody could ever do professionally, and she did a very, very good job.

The Russian instructors, for the most part, respected her. There were some there that didn’t care for her a whole lot, because they didn’t like women being in that position. And so I had to go over again one other time to try to calm some things down and settle some things, but it worked out very, very well. But it was a very, very, I think, grueling time for Bonnie, and she did it remarkably well. I think she did a wonderful job.

Norm came through that. He did a great job. In fact, by the time he was ready to fly, he was more Russian than U.S. He just dug right into it and immersed himself in the whole training and became a cosmonaut rather than an astronaut, and did a very, very good job on that first flight.

Shortly before they launched, before Norm launched, it was decided that we would fly six more times on Mir. I'm going, "Man, after this first time, where am I going to [find] twelve more people to do this?"

So we're sitting in the office and I was working with "Hoot" [Robert L.] Gibson, that I had picked as my chief of the Astronaut Office when I was selected as Flight Crew Ops, and saying, "Now, how do we pick these people? Let's pick the really good ones and let's pick people who are going to do a very, very good job, and let's work this out to see how we're going to make this happen. And then we've got to get them into Russian language training now, and we aren't going to be allowed to formally announce this for a while, so everybody's going to know kind of who these people are, but we've got to get a head start."

The Russian language is very difficult to learn, and, as we found out from Norm, if you don't know the Russian language—and for Bonnie—you're starting out in a hole, a big hole. And we had people that had to be able to relate to all the things that were going on.

So we picked a group of folks, kind of "onesies" at a time, and started moving them into Russian language training. We decided that, first, it was too expensive, and it was very difficult to send people to Monterey for a long time to do this. So we asked them, "Is there a way that we can do this here at JSC?"

And they said, "Well, why don't you just hire a couple of our instructors and bring them to JSC."

So we did that. So we started Russian language training here, and by this time the Station is starting to get a little bit more of an organization going. George Abbey had the idea that we should send somebody to Russia permanently, to be kind of the station resident at Star City, to deal with all the things that Bonnie and Norm had to deal with kind of on their own, to be kind of

the person that, “I’ve got a problem in my apartment. The electricity doesn’t work,” or, “There’s no water” or, “I can’t talk home. The phones don’t work,” or, “At training, this happened,” and to deal with the people in charge at Star City.

So we started sending people over as the residents. Ken [Kenneth D.] Cameron was our first one that we sent over there. He did a great job. I mean, these people, I basically promised them, “If you go over and do this, when you come back I’m going to assign you to a Shuttle flight and it’s going to be a good one, like, fly to Mir, okay?”

So, the people that did that, the people that looked, you watch, that commanded those flights or were the pilots or the lead mission specialists were the ones that had spent that time in Russia, because they now knew the language and they were of great benefit at flying the flights to Mir, because they knew the Russians, they knew the ones [that would fly], so we kind of tried to make this all work.

Then we, “Hoot” and I, worked out a plan in how the backup would become the prime of the flights that we’d go [to the Mir later], so we didn’t have to train twelve people; we could do it with maybe six or seven. So, with that said, we got that going, and Norm is now in space. I got to go to Baikonur and watch him be launched out of there. That was a really neat experience, too, to go there to Baikonur, and they tour you through Yuri Gagarin’s house where he had lived, and where [Sergei] Korolev had done all the things that he did out there. Boy, what a barren, bleak spot in the world, where that is. Their launch site is really in the middle of nowhere.

Norm’s launch went great, and he came back and then we had this period of time before we had to send other people. But now we had to have people in training, and we sent Shannon [W.] Lucid and John [E.] Blaha over. We sent Wendy [B.] Lawrence and Scott [E.] Parazynski

over there, and that's when we started to have our first problems again. Scott's too tall and Wendy was too short. We called it T-squared and TS, too tall and too short.

And so we're fighting with the Russians, going, "What do you mean they're too tall or they're too short?"

"Well, they don't fit in the seats in the Soyuz and we can't fit the seats right."

So eventually we determined that too tall was really probably a more serious problem, so we brought Scott back. And, gosh, I can't remember all the names of the people we replaced them with. I should know every one of these. Might have been Dave [David A.] Wolf or Mike Foale. Mike Foale went over there. Or Jerry [M.] Linenger.

We had these folks going over there and going back and forth, learning the Russian language. Scott was back; Wendy was still there. Eventually, later on, it was determined that Wendy was really too short and we had to replace her, too. So then we had to use Jim [James S.] Voss as a backup, and then to go there as a backup and not fly, which is where he was going to end up, wow, that was hard. So he stayed there twice as a backup. He backed up—gosh, who was our second to last to fly? I can't think. And then David Wolf. And then he came back, but then I put him immediately on our expedition crew so that he was going to fly on Space Station.

Just all the dealings with the Russians were difficult, okay, and I had to be involved in that a lot, because most of the dealings were with their crew in Star City. Eventually the whole program worked out very, very well. I think we learned an awful lot. I think the Russians learned a lot, too.

Flying on Mir was not the greatest thing anybody ever had to do, I don't think, because it's a different spaceship. It was old, and what you had to go through to get trained to do that was very difficult. I think every single one of those seven folks that flew on there is a hero. And

Shannon, who was on there, and delayed and delayed, and she ended up seven months on there. Wow, what a trooper.

John Blaha took over. Jerry Linenger. And then Mike Foale was on board when they had the—Jerry was there when they had the fire, and Mike was there when they had the collision. And then Mike actually did an EVA with them. Dave Wolf later did that. We did a lot of things with them, and they finally gradually became more to accept us as partners, and this was all kind of a lead-in to being part of Space Station. It was something we probably really had to do. Nobody here, I don't think, was real excited or agreeable to doing it. Doing it one time with Norm, and we thought that was good enough. Doing it six more times, a lot of people said, "What are we really going to gain?"

But what we did, we gained a little bit of the trust and respect of the Russians, and we needed to do that. We sometimes, I think, can be a little arrogant that they need to gain our trust and respect, but it's a combination. They were a space-faring nation also, and had done this a lot of times. So I think it was very, very valuable to do that.

And in the meantime, sending our other people to and from Russia to work with them, they got to know them. A lot of those people ended up on our International Space Station crews. Peggy [A.] Whitson, who just came back, or is just coming back, was one of the folks that we'd sent over there to work with their payload folks. I told you Jim Voss had been over there for a while. We'd sent a lot of folks there and back. And Mike Foale was there, and Mike's going to fly again.

So we had a lot of people that ended up learning the Russian language, or as much as you probably can learn. Some become more fluent than others, Charlie [Charles J.] Precourt being one. I mean, he's fluent in Russian—it's incredible—which made him a nice selection to be the

Chief of the Astronaut Office when I needed to replace Bob [Robert D.] Cabana. Because he could really work with the Russians well, and he had flown twice up to Mir, once as a pilot and once as the commander.

So anyway, that's a separate era from just the Shuttle flights, but it was actually a tense era. I remember one meeting that I had to fly to Russia to meet with them, and that was over the issue of who was going to command the first flight of the International Space Station. It had been agreed that two Russians were going to fly and one American was going to fly. I insisted that the American had to be the commander of the flight. That was also agreed, not just by me. I mean, the Administrator agreed on that. Congress had kind of said, "Why are we funding a Space Station if we don't even command it?" I mean, we were by far the majority owners, and if the first crew that goes up there were not the commander, that's not good.

So I got the enviable commission of going over there and laying out the roles and responsibilities of the crews, of each crew member, who was going to do what. And it ended up, who's going to be the crew commander? Sitting there, negotiating with Peter Klimuk of Star City and his folks that were up there that were responsible for the crews, he still had the hammer and sickle flag over his office, so you knew where he stood. [Laughs]

So we sat around the table, and we didn't get very far the first day. We were there for about twelve hours, and doing things through interpreters, I find, is very difficult. I don't speak very much Russian. Klimuk spoke probably more English than he let on, but they only respond in Russian. So we're going back and forth through interpreters. We broke up not on a real friendly term after the first day, agreeing to come back and talk again the second day, going through the roles and responsibilities, and we would lay out our proposal and they'd take a while

and they'd come back with their proposal. And their proposal always had the commander being the Russian, and ours always came back with the commander being Bill [William M.] Shepherd.

We finally said, "We're at a stalemate here, but I can tell you that the American government—not me; I'm just representing this whole thing—insists that Bill Shepherd be the commander."

And then they went, "Oh, well." They got real upset, and then Klimuk just spoke for a long time. The interpreter is taking all these notes, trying to get it all right. And then he stopped, and the interpreter told me, he said, "So, what you're asking for is that your Bill Shepherd be the king, and he sits on his throne and he tells his two serfs (or whatever the Russians use for this word) what to do, and he just sits there and doesn't do anything."

And that finally broke the ice, because I started to laugh. I said, "You don't understand how we operate space flights. Just because you're the commander doesn't mean you don't do anything. One of the hardest-working crew members on this flight is going to be Bill Shepherd. For goodness sake, it's not that he doesn't do anything. He's just the one responsible and the one who has the authority that if anything's going wrong, he's the one that's going to direct it, or if things come up, he's the one to assign who's going to do what. Other than that, you're all three, the crew members, responsible for the operation of the Station. He isn't going to sit there and do nothing while the two Russians do everything."

That was what they had in their brain. Until that finally came out, [they] didn't understand [his role as commander—a problem] between cultures. So they just pictured him as a czar, the king, and that he didn't do anything. He was just the royalty, and the two peons would do all the work. I went, "No, that is not at all like it."

So once we get through that, in a couple more days we laid out roles and responsibilities and hammered out that, and they had agreed at that time then that they would accept Bill Shepherd as the commander. Now, I'm not sure they had much of a choice, because the Congress would never accept it any other way; NASA had already said it was going to be that way. But, boy, I remember the negotiations getting tense, and you have to be ready to walk away from the table, which we did one time, saying, "Well, that's unacceptable."

And they came back and said that—and, first, they would propose one of their guys as being the commander, and then they'd go away. And then the next time, the other would be. So it would be [Sergei K.] Krikalev and then it would be—gosh, what was the other guy's name? I can't think of it now. I always have trouble with names. But the other crew member. And so they went back and forth, back and forth. And we just, "It's going to be Bill Shepherd."

It shouldn't have been that hard, but it was kind of a dealings on give and take and how you have to give some. And what we had to give, which they didn't understand, is that the crew commander is actually a member of the crew and does as much work or more than anybody else. Once that finally broke through, that went fine.

So that was very interesting. I was glad to get out of Russia after that, too. Especially when they assigned—then you write this all up and you document it, and then you sign the protocol and you drink vodka. And when we did this it was like eleven in the morning and we were supposed to get on the flight at two that afternoon, and it was a long flight home, let me tell you. [Laughs]

But then, everybody's a good buddy, and it was as if you hadn't had any disagreements or anything. It was a very different way of doing business. But that was one of those experiences, too, that was pretty neat.

ROSS-NAZZAL: Sounds like you did a lot of negotiations during these programs.

LEESTMA: Oh, you had to do some with the Russians, yes. A lot more negotiations were done with the Space Station folks, which I wasn't a part, and everybody had the same—you can talk to any of them, and they all had the same kind of experiences. You've got to make sure that you do this with Tommy [Thomas W.] Holloway and get his story, too.

ROSS-NAZZAL: Can we take a step back and talk about some of the things that you brought up, some of your duties as Director of Flight Crew Ops. Can you tell us about the selection of the astronaut crews? How did you put crews together?

LEESTMA: Okay. It's based on a lot of different things. We would get verbal reports, sometimes written, on how people are progressing, whether they're real fast learners or they're slower learners, how well they're doing in their simulators. You look at that. You meet with the chief of the office and you find out what this mission is going to be, what the payload is, what kind of expertise you really have, and then where you can fill in just your general folks.

Are there any political whims that have to be satisfied in this particular flight? The payload, it may be bought by, I don't know, for sake of another one, by Italy. But is this going to be a 28-degree mission where you never see Italy, or is it a high one that's going to fly over there and you can get pictures? There's all kinds of different things.

Is the payload going to come from California and is there an astronaut from California? I mean, there's lots of different things. So you kind of lay out all the different players, and then

you have to look at who is really compatible. And you work with some of the flight docs and you get an idea from them on which ones they think are compatible. If you have a very strong commander, you might be able to put a little weaker pilot with them. If the commander is one that you're a little bit iffy with, you put a really strong pilot with. Same with the mission specialists. You mix and match, and you finally come up with this mix and you get one flight. And then you go, "Oh my gosh, but this person has really got to fly this flight and they can't fly both." And so then you go, "Okay, we'll put that one there. Now who else?"

And so you really have to do it in groups. You can't do it flight by flight by flight. I think for a while NASA did it flight by flight by flight, and then they realized that you can't really do that, because there are some astronauts that have a certain expertise that really is important for one flight and may be not as important in another. So you look at it kind of over a year to eighteen-month time frame, ahead of the flights that you've already assigned, and you start spreading it out and looking. And then as the missions change, you may have to change them before you officially announce them.

And so that's why there's a lot of secrecy involved in who you're picking. It's not so much that it's got to be any big secret, but the fact that you might change it. It's really the business of the Director of Flight Crew Ops, the Chief of the Astronaut Office, and probably the Center Director, of why you may have made some of those swaps, and for all different kinds of reasons.

And so you carefully lay this—you have to carefully orchestrate this. And then if that eighteen months out here you want this person to fly, then maybe the best thing you can do is become the Branch Chief of Mission Development. Or you need them to go work as a payload-type person. So, their last job before they go into full-time training, you try to manipulate—you

do manipulate that and you make sure they get assigned into those that lead them best into those flights.

The Astronaut Office [has] no dummies, and they catch on to that and they go, “Why did I get assigned this particular job?” And they start looking out at the flights and they go, “Oh, maybe so.” They never know for sure, but they hold out the hope that, “Oh, maybe that’s one that I’m here for. Why do they want me to worry about tether dynamics in space on this thing? Oh, but there’s a tether mission out over here.”

So it’s not the sorcerer’s apprentice, or you throw darts at the wall. It really is carefully thought out, and it’s not just mission by mission by mission. It’s thought out over a period of time. And then when we select crews, at least when I was doing it, I would generally try to announce three at a time, rather than just one by one by one. That way, you encompass that and then you can now think about this next group and work your way forward in time.

And it’s amazing how you select those three, and before you know it, there’s another three you’ve got to do, when you’re flying fairly regularly, which we were doing in the early nineties. Wow, it goes very swiftly, and pretty soon you’re turning around people, and people are coming off flights and you’ve got to put them on another one. And then you’re in the midst of selecting an astronaut class. The question that’s always asked is, “How many astronauts do you need?” You have to go through all this analysis, and we always did it pretty much on worst case. If we flew this many missions and we did this, and this many people left, you’d need to have this many. Because you select them in, say, 1993, I need them in 1997. So it’s kind of tied in, the selections of the crews to that, but then also picking how many people you need to pick in your astronaut classes.

Picking them every two years worked out pretty good, as long as we were flying fairly regularly. When the flight rates start getting low, you don't need to pick as many or as often. It is a tremendous amount of work to go through a whole astronaut selection. It takes a year and a half. First, you have to announce you're going to do it, get the applications. Then you have first screening committees, second screening committees, then you have your final interview panel.

Then you have to certify and do background checks on all these people. Then the Director of Flight Crew Operations has got to convince the Center Director that this is the right thing to do. Then you have to go to Headquarters and talk to the Administrator. Then if you're picking military astronauts, you've got to convince the heads of their service that they should give up these people that are probably in line to go flag rank or command ships and do all kinds of stuff, and they aren't real happy that you're taking their good people.

And it's a very long process until it finally happens. And then you have to satisfy—if you look at the mix and if you had picked eighteen females, that wouldn't go over very good, or if you picked eighteen males. Not that that's an overriding thing, because you're always going to pick your best people, but you do have to look at that and say, “Did we skew this for some reason?” and go back and look at the interviews and stuff.

So you have a group that is really compatible, that are going to be the right folks. There are some people that we interviewed that are really topnotch folks, but they didn't quite fit for some reason or another. And they'll probably go along their whole life, “Why wasn't I picked?”

And you can't tell them; it's more of an intangible of, “You didn't fit in this mix, because you're just too domineering,” or, “You're too focused on just one thing.” Or, “Yes, you're a very smart peach, Steve, but all you know is this. You don't know this.”

But it's a very interesting process. It's kind of exciting to be part of it. And you feel very responsible, because you're affecting probably some people's dreams that they might have had for their entire lifetime. It's very, very carefully done. I can tell you that the people that are in charge of it, from the Director of Flight Crew Operations, down to the astronauts on the panel, to the people we put on the panel, and especially to Duane Ross and Teresa [Gomez] and the other folks that they have working for them, the process is kept as pristine as we can do it. Very meticulous records are kept.

And when you get all done with it, you go, "Wow, it turned out okay," because the people that come here are good folks, they really are. There are some, you go through their records and people are very good at keeping résumés and submitting applications. You're in the screening committees and you go, "There's a good one. Wow. Let's interview them."

And they walk in the room and you're sitting there, and somebody walks in and you look down and go, "No, we asked for this person. What are you doing here?" [Laughter]

And vice versa. Somebody that you weren't sure about, but they walk in and you go, "Wow! Yeah!" They didn't convey it quite as well in the application, but when they walk in and you interview them, you go, "Absolutely. They blew us away. That person is—we ought to pick them."

And most of them, the ones that get picked, are that way. They're the ones that, after the interview, you go, "Yeah. That person would fit in real well and will do a great job."

ROSS-NAZZAL: What really catches your eye?

LEESTMA: Oh, I don't know. It's different on all the different panel members. One, it's whether they're at ease in an uncomfortable situation. You don't make them comfortable when they come in for their interview. Different people have all expertises in all different areas, and so you test them technically and you find out whether they're going to try to bullshit you or not. And if they do, that's it. They may be a great person, but the panel can't be hoodwinked. They will know, because there's somebody on there that's really smart. So if somebody tries to tell you how technically they are, there's somebody on there that's going to ask them a very, very pointed technical question on that and find out whether they know it or not. And that'll happen to every one of them; everyone's going to get that.

They're going to get asked questions that, they'll be talking maybe about—there'll be a pilot and they'll be talking about the airplane they were flying, and the next thing you know, they'll ask him, "Have you ever played a musical instrument?" Whoa, where did that come from? Just to see how they'll react to a different question. And you ask the musical question because most of the people that come for this are very left-brained, but you'd like to see if they've exercised the right side of their brain, too. Not just music, but art or anything else.

So you're looking for a very well-rounded generalist, somebody who's pretty smart, can learn fast. Can they present themselves well? Can they talk okay, or if you put them on a platform in front of a TV camera, would they just kind of not be able to convey the message that they had? So you want to pick people that can convey a message.

And all that kind of comes out in the interview, and the interview usually lasts an hour or so. The people that come out of it have been through the wringer, so to speak. The ones that have the most stress are the ones that, this is all they've ever thought about doing. Usually the

ones that do the best are, “Hey, I like what I’m doing, whatever I’m doing now. If you pick me, great. If you didn’t, I’m okay with that.”

They’re the ones that really do the best. They’re very content with what they’re doing or what could happen to them. If you pick them, wonderful. If you don’t, it’s okay. Those are the kind of people you want to look for. The ones that are so focused on it—“Man, I’m going to die if I don’t get picked.” Well, then pick out your plot. [Laughs] Because you’re probably not going to get picked.

Anyway, there’s lots of aspects to it. You carefully put together the interview committee that’s there, and there’s lots and lots of debate then, when you start scaling down. In one of the ones that I chaired we had, I think, seven thousand applicants. It’s very easy to get down to, let’s say, a thousand. That doesn’t take long, just from looking at their records and their applications.

Then you have to screen them again and go through them again and get down to those four hundred to three hundred that you’re really going to look at closely to get down to the hundred you’ll interview. That takes a long time. It takes months and months to get down to the ones you’re going to interview. Then the group’s got to schedule them and make sure the committee is available and all that, so that takes a long time.

And then once you’ve been all this, you usually come up with thirty people that are great, and they say, “Well, you only get to select fifteen.” Oh, man. Now, we did select some very, very large classes in the time that I was there. In fact, one of them, I think, had forty-four people in it, which was really way too many to pick. But Mr. Abbey said that “We might not get to pick for a while and let’s fill up the Astronaut Office while we can.” He was able to convince the Administrator that we needed to do that. As the chairman of the committee, I really didn’t want

to pick forty-four. That was a little bit too many, but, that's the way it is, and the bosses get to do what they—that's why they get to do what they do. So we picked forty-four.

My biggest objection to that was that some of those folks are going to be waiting a long time to fly. Even if you flew two new people per flight, which you wouldn't always do, because this was the time that we were starting to go to Mir and to Space Station, and the insistence was that everybody on those flights had to be experienced. We couldn't take any risk at all with a crew messing up on a Space Station assembly flight, or going to Mir, or anything like that. And so you throw those flights out, there might be two flights a year, and if you fly two new people, which we didn't always do—sometimes we would—but if you fly two new people on those flights, it would take fifteen years before you fly all these people. So we had to sometimes move more through than we had before.

Being a part of the Astronaut Office is one thing, but then being there a very long time and not flying can be very frustrating, too. So my opinion was, you don't want to pick too big a class. And if you have some really good candidates, but they're young, give them two more years to mature a little bit, and do it outside NASA. George's opinion was that it's best to have them mature within NASA. So, you can argue that either way. That's not a bad idea either.

ROSS-NAZZAL: When you talked about the selection of crews, I found that very interesting, and I wanted to ask you about the selection of Eileen [M.] Collins, the first [female] commander of the Space Shuttle mission. How did you [make] this decision? How did [it] all come about?

LEESTMA: Well, it was time. We had a couple of women pilots that we'd kind of selected. We had flown them as pilots, and it was time. It was just time to go do it. Eileen was my prime

choice. She's a very good pilot. She's very good at public relations. Kind of like, I think, Sally handled being the first American woman in space, she could handle that without it being a big deal.

I mean, even like Neil Armstrong being the first man on the Moon, I think he was picked to do that because he's humble enough to take that and accept it and be able to go on. Sally was the same way, low-keyed it all the way, and I felt that Eileen could do the same thing with being the first commander, because it was going to cause a big hoopla, and it did. I mean, I don't think there was a radio station or TV station in the United States that didn't want her. And all that demanding on her time when she's trying to command her first flight and work through that is a very difficult thing to go through. I think she did a very commendable job. It was new to her. We put a good crew with her, a strong crew, and gave her as much help as we could. I was very proud of her, in the way that she handled that. And when you put everything on top of it, her job was probably twice as difficult as most commanders have it.

But she had already been to Mir as a pilot, so she had done a lot of things that we had asked her to do to get ready to go do that, and that's what they're there for. After you've flown the right seat, you'd like to fly in the left seat. It was time to move her over. She was very well received. She'd done very well publicly, which is good for NASA, too, that happens.

ROSS-NAZZAL: Did you and the Center Director prepare her at all?

LEESTMA: We did. We did talk to her. I had her up several times, and I know that George talked to her quite a few times. The chief astronaut would counsel her a lot, and actually spend—not because we think that she would mess it up, but just to make sure that, really—that

mission was going to get more scrutiny than most missions do, so we had to make sure that it was going to be done right to the letter, that MOD was getting all the right training to them, and if there was something that she was weak on, let's make sure that we get her trained on it and get them strong. So there were a lot of folks that worked with her pretty hard, just as we do with anybody else in that kind of situation.

I mean, I think Kathy and I probably got a fair number of extra NBL [Neutral Buoyancy Lab] runs, not because she couldn't do it, but just because this is one of those things that's going to be looked at very, very closely and you just can't mess it up, so let's make sure. Kathy was a terrific EVA person. She was probably better than I was. [Laughs]

ROSS-NAZZAL: Were there any efforts made to shield Collins from the press before her mission?

LEESTMA: Yes. And we do that with all crews, but we had to take extra steps. About three months before you fly, no more interviews, other than ones that are scheduled as kind of PAO [Public Affairs Office] days. The crew has usually one or two. And things that get directed by powers which we can't control. The Administrator says, "Eileen, I need you to be here in Washington because of—" da-da-da.

When Charlie Boldin was the commander, that happened to him a couple of times. If John Young commanded things, things would—you'd be asked to be at certain places. You know, "Meet the president. The Administrator has got to have you here when he goes to the Hill." Those things happen, and so we try to minimize those as much as possible. And other than that, there's no interviews and no stuff, and concentrate on your training and get ready. And

then about a month before flight, you have this one big all-day media blitz that anybody can come and interview you.

And so when I flew, Jon McBride and I went off and sat inside and had a Coke and a candy bar, and watched Sally, Kathy, and “Crip” all get interviewed all day long. [Laughter] And we were happy as clams about it. We thought this was great. And Sally, being like she was, she would occasionally come over and she’d grab one of us and sit us down, and then say, “You ask him that question, because that’s not my question, that’s his question.” [Laughter]

We always say the poor PLT [Pilot] was the one person that’s the unknown on the flight. Nobody cares about the PLT. All they care about is the commander and the lead mission specialist, and then if there is somebody from another country or something, they get all the attention. That’s always fun. [That is] a fun day. And then you’re done with it until after you come from flying, other than waving when you’re going to the van. We always called that the last walk on Earth. [Laughter] And there’s always crowds of people there to see you in case you never come back or something. It was one of those little bits kind of gruesome humor. All the wavers and checkers.

And then you go out to the launch pad, and you’ve been through this. You’ve been there many times before, because you train in the orbiter a few times and you have countdown demonstration tests and things. And this time you get to the pad and there’s nobody there. You go, “Ooh.” And the vehicle is steaming and creaking and groaning and you go, “This is for real.”

You get up to the White Room, the access arm, and there’s only two, maybe three people there and that’s it. There’s nobody else on the pad and everybody’s blocked off for four or five miles away. This is for real. And it’s groaning and moaning and you know that it’s going to

launch, and it's fueled and ready to go. It's a big bomb there, sitting on the pad. And you hope that all the fire goes down and you go up, and let's go, let's get on it with it. It's great.

ROSS-NAZZAL: Must be exciting.

LEESTMA: Yes, it is. You get in and you just can't wait for it to happen. I mean, probably one of the most frustrating things is when you get near your takeoff time, your launch time, and then you know there's a problem, and you go, "Please solve it. We don't want to wait here. Get us off the pad."

The last people you want to have to make the real technical decision whether you go or not is the crew, because they're always "go." "Yeah, we'll be fine. Let's go." That's why you've got a whole team of folks in the launch control room doing that.

ROSS-NAZZAL: Talk about your role in the Space Shuttle Management Independent Review Team. It was headed by Chris [Christopher C.] Kraft, [and it was] a review of the Space Shuttle. What role did you play?

LEESTMA: I was just a member of his team, and we went from Center to Center. This was to figure out whether you could do things significantly different to make it efficient to process the Shuttle or not, and whether you could turn it over to private industry, first look at that, or whether a private company ought to do the turnaround operations. It kind of led to the USA [United Space Alliance] contract.

You learn a lot about how to process orbiters, and you wonder why we do a lot of the things we do. And Chris is a very—when he makes up his mind about something, by gosh, that’s the way he’s going to write it up and go do it. I probably learned as much just watching him operate than I did from what came out of the committee itself. But that was a very interesting experience.

ROSS-NAZZAL: What made it interesting for you?

LEESTMA: Oh, just the way that he would handle certain people, and you could tell that he had certain likes and dislikes. Sitting back, I could see that he was leaning a certain way and he would work his committee to agree with him. He was a very good—I don’t know, “manipulator” isn’t the right word, but he was good at getting people to see things the way that he saw them, so that they would kind of agree with the way that he wanted to go. But if you had a real good technical reason, you could convince him. He wasn’t much for political correctness. There might be a politically correct decision to be made, but Chris Kraft would be the one—you’d better convince him it’s technically correct or he would never go along with it.

And that’s how the Center kind of got that attitude, I think, because of the influence that he’s had on the Center. You can go to a lot of Centers, or even Headquarters and stuff, and you can certainly get a politically correct answer, and that’s correct politically, but if it isn’t correct technically, this Center doesn’t go along with it. It’s kind of the culture that goes with this Center, and I think that goes right back to Chris Kraft and the work that he’s done. So I credit him with a lot of that. I think that’s great.

ROSS-NAZZAL: Well, now you're actually working in Engineering Directorate. How did that come about?

LEESTMA: That came about, I had been Director of Flight Crew Operations for almost eight years, and when I took the job, I was told that the most directorates last is about five years, and then it's time to go on and do something else. I started out, when I first got picked, I was the junior member on a senior staff and I think I'd been in my directorate position longer than anybody else on the Center except—let me think. There's probably one other that had been here a little bit longer than me when I left. You go, "Wow." Still young, but I've been in this position for a long time.

And I think George was ready for a change like all directors are. You've got to move your people around because you get new ideas and things. The Mir Program was over. We had done the first couple flights of Space Station, and now it was into Space Station building and that. Jim [James D.] Wetherbee had been involved in a lot of that, so it was time for me to move down.

Leonard [S.] Nicholson had a position to help out working on the government-furnished equipment for Space Station, and so George thought that would be a good idea, asked me if that was acceptable to me, and I said, "Sure. Let's go on and do something different." So I moved into the Engineering Directorate.

I worked on government-furnished equipment for a while, and then getting involved again in an institution that's very different from Flight Crew Ops. Engineering is a different animal. And finding out how they operate, it takes a while to get used to working in that environment, because most of the people in Engineering have been in Engineering a long, long

time at this Center, and you have to earn their trust and respect. It isn't something that just comes because of a title you held or something that you went in there. So I think that worked out okay.

Then I got asked to work with the Space Launch Initiative for a while, and I've been working that for a while. And now that it's been branched off into the OSP, I've been now the Assistant Program Manager for the Orbital Space Plane, so that's what I'm working on now. Hopefully we'll get that program going such that they can build a vehicle and fly it before too long. Since the Shuttle, it'll be the very first launch and entry human-rated vehicle since the Shuttle. And that's been twenty-some years. It'll be almost thirty years by the time we fly it. Long time between vehicles.

ROSS-NAZZAL: Sounds like a great opportunity.

LEESTMA: It is. Oh, it's a great opportunity. I'm excited about it. Talk about politically correct versus technically correct decisions. There's a lot of those that get made early out in a program, I'm finding out. Washington has some ideas on how to do things when technically it may not be the right way to go, but, again, politically that's the only way you get the program started, so you really have to steer it through a tortuous course, I think, sometimes to get a program going. I don't know how they ever got the Shuttle Program started. There are probably some really incredible heroes that you've interviewed that were involved in that.

ROSS-NAZZAL: Let me just ask you a few general questions. What do you think is your most significant accomplishment while working at JSC, if you can pick one?

LEESTMA: The best accomplishment that I feel that I had was being able to work with the Astronaut Office on their big, diverse things and keep them focused on the missions that they had to do, try to equitably and fairly assign people to flights, keep them motivated, and keep them doing the things that they provide the expertise to for this Center for a long period of time.

I was kind of their boss for forty-one missions, which is a long time. Talk about becoming a nervous wreck. I had to be at the Cape for every one of those, and every one of those, those are your guys and gals on board that thing and you feel very responsible for them and you want to make sure that everything that can possibly be done has been done to make sure that they do their mission successfully and safely.

So that's been very rewarding to have gone through that and been successful at that, and come out and they will still say hi to you and they don't think too bad of you at the Astronaut Office.

ROSS-NAZZAL: What do you think has been your biggest challenge while working here?

LEESTMA: Well, right now I've probably got the biggest challenge I've ever had, and that's this Orbital Space Plane, and trying to bring it around so that we can get a full-scale development decision and actually go build this thing; get the requirements right and get this Center lined up, as well as making sure that we're working with the Marshall Space Flight Center. There's a lot of inter-Center rivalries and competition that are going on with that; some good, some bad. And making sure that as much as I can do to get this program lined up so that we really can build a new vehicle.

Probably the other biggest challenge was working with the Russians, and the things that we did, and asking people to do something that sometimes I seriously thought if I had asked to do it, I probably would have said no. So, to ask people to do something that you have doubts that you would want to do, like go to Russia for a year to train as a backup, not even fly in a flight. [Whistles] If somebody had asked me to do that, would I have said yes or not? I'd waver on that one, and I had asked people to do that, and that was not easy. That was probably the hardest thing I ever had to do.

ROSS-NAZZAL: Well, if don't mind, I'd like to ask Rebecca and Sandra if they have any questions.

LEESTMA: Sure. Go ahead.

WRIGHT: I have a couple. One being, you shared technically with us a few minutes ago about your EVA and shared some of the technical challenges of it. Could you spend a few minutes with us and tell us about personally what that meant to you to be in that position?

LEESTMA: To be in your first space flight, and then to have gotten it years before you thought you'd get it, and then to be able to do an EVA, I was kind of on top of the world, I have to admit. And then going out the hatch and getting your entire faceplate filled with this Earth, which is just a spectacular sight. It's emotional and spiritual. The Earth is an incredible creation. Your heart rate goes up and you're going, "I cannot believe I'm doing this."

You're going almost 18,000 miles an hour and you're weightless. You've got this 400-pound suit on, and yet you can move yourself with just a finger. Your faceplate is filled with all these clouds and ocean and ground and greens. It brings tears to your eyes. I actually had tears going on. And you don't want to have tears in your eyes, because you can't do anything about it inside the faceplate. [Laughs] So you've got all these things going on. "What's going on here? Calm down, Dave. You've got a job to do."

But it's a very emotional rush. Then to get out there and start unhooking and getting your safety lines on, and then saying, "Okay, Kathy, time to come out." And then Kathy comes out and you know what's going through her. You don't really communicate that. And then she's doing something that is historic. Man, you just go, "Wow! Why do I get to do this?" So then you go, "Well, okay. As long as it's me, that's great. Let's press on."

It's an emotional thing. And then you're going, at that same time, in the back of your mind, which is always the thought that astronauts have right from the time of launch is, "Don't screw this up." [Laughter] Make sure you do it by the book and you're very careful and very meticulous, and you're going, "Oh, don't screw this up."

WRIGHT: Did time seem like it went by fast?

LEESTMA: I felt like it was five minutes, and then "Crip" or Jerry [L.] Ross—, Jerry Ross was the CapCom [Capsule Communicator]. I think it's what he said, "Dave, it's time to get back in the hatch and wash your hands for supper," or something like that.

It didn't last as long as you'd want to, but you're tired. By the time you get back in from an EVA, you have spent a long day, because there's a long prep time in getting ready just to go

out the hatch. Then you go out the hatch and there's a long time of just getting out of the hatch and depressing the airlock and cleaning up the suit and recharging it. By the time you're done, you're just exhausted, but you're so exhilarated. I mean, I went out and parked myself on a window and watched the world go by for about two hours after it was time to go to bed. I probably had a quart of adrenaline in my body and I wasn't going to be able to get to sleep anyway.

And the EVA that I went on wasn't one of those that was really a max [maximum] exertion-type thing. Like some of these assembly missions, boy, they're working real hard all the time. I didn't have to work real hard all the time. What I had to do was a lot of manipulation, which tires your hands out, and your wrists and your arms. But, there were times I'd just get tired and I'd be in the foot restraints, and I'd just let go and I'd just lean back and just kind of hang there and watch the world go by, and then go, "Okay, I'll feel better," and then get back at it again. Because I had the time on that EVA to do that. That was kind of unique. There wasn't any timeline that was going to be so demanding that if I didn't get this task done in this time I'd have to skip something and then wouldn't get it done. That was really all we really had to do. And then if we had time, we were going to inspect the antenna. And then if we had time after that, we'd do the Ku-band antenna. Well, we had plenty of time to do it all. It went by real quick.

WRIGHT: You also told us about that Saturday morning when you got the phone call from Mr. Abbey. I was thinking about all the times that you called people. Could you tell us how the reverse of that felt?

LEESTMA: You call them into your office and they sometimes wonder why you're there. George used to call—at least in my first flight, he called people as a group and let them know. And when you get there in a group, you kind of know. And I started out doing it that way, but then I started doing people individually and telling them, “Don't you get to tell anybody until the day's over.”

So then in the course of one day you'd bring them all in at different times, and you just see their reactions. The ones that you knew pretty well, the ones that I knew better than others, sometimes I'd pull their leg a little bit and kid around with them. “I've got this new assignment I want you to do.”

And they're thinking, “Oh, a flight.”

“Now, I want you to go out to L.A. and I need you to go to this aerospace meeting,” or something, [groans.] “Oh, and while you're there, there might be an announcement that comes out.” Just kid them around a little bit. But I really want them to take it seriously, too, when they get assigned to a crew, that it's a big responsibility and here they go.

And then calling new astronauts, now, that's really fun, because if it was me calling, then they knew they were selected. Some of them would recognize my voice, others wouldn't but then when I tell them it's Dave Leestma, [screams]. And then trying to get hold of people. I got hold of—oh, man, I can't remember who all they were, but one of them was on vacation in New Zealand, and I talked to him on his cell phone when he was out climbing on the southern Andes, what they call the southern Alps out on the south island of New Zealand.

Another one, one of the gal pilots, the Navy one, she, [Susan Still-Kilrain], was out on a carrier. I got on the phone and I got hold of the carrier, and the carrier said, “You've got a

telephone call.” I heard his voice in the back. “I can’t. I’m manning up right now. I’m out the door.” And she ran out. [Laughter]

And then I told the duty officer, I said, “Don’t tell her who called, but tell her to call this number when she gets back.”

So then about two hours later, she’s back from her hop. She called me. She said, “I don’t understand this number. I’m supposed to call you.”

I said, “Yeah, you ran out on me, so I guess you don’t want to be an astronaut.”  
[Screams]

WRIGHT: Duty called for her.

LEESTMA: Yes.

WRIGHT: The last one’s a quick one. You mentioned your call sign when you were talking with the ham operators. Did you have a specific sign you used all the time?

LEESTMA: I was N5WQC. That’s my ham radio license number, and that’s what you use. N5WQC. And I haven’t done much ham radio operating at all since that flight, but that was really a lot of fun. I enjoyed that a lot.

ROSS-NAZZAL: Well, is there anything else that you would like talk about? Something that we may have missed?

LEESTMA: Just, one of the things that I was involved in was the selection of John [H.] Glenn to fly.

ROSS-NAZZAL: Yes, let's talk about that.

LEESTMA: People were either black or white on that one. It was either, "This is the stupidest thing we could ever do," or, "This is something we really ought to do." The final decision was made way beyond me. It wasn't really my decision, but I had to figure out how to integrate John into the office if he was going to do this, and there were some people that were upset that, "Yes, he was a senator and, yes, he flew in space, but why is he taking up one of our seats?" I mean, that's kind of how it goes.

But you kind of have to make this work. John did a great job. I mean, he was very, very—he just got into the role of, "I'm here. Just teach me what I need to know. I'm here to do these specific things. I will do those. I'm not here to take over anybody's job."

This got promised to him and he got the flight, so let's not argue about that, and let's go on. So I tried to do all kinds of prep in the Astronaut Office.

And then they were going to do the formal announcement. It was going to be at the launch of one of the STSs [Space Transportation Systems], and I was down there. They were having a Manned Flight Awareness Dinner and John was one of the guests of honor at it. And at that dinner they were going to announce that John was going to fly.

So I was there, and here was John Glenn, and [L.] Gordon Cooper was with him, and John Young. They were talking with him, the three of them were talking. I go, "You know, now is as good a time as any. I might as well go tell him who I am."

So I went up, and I had no idea what to say to him, and then it just hit me. I went up, “Hi, John Glenn. I’m your new boss.” [Laughter]

And John Young said, “What?” His eyes rolled back, he stepped back and he started to laugh. He told me later, he said, “I can’t believe you said that.” [Laughs]

I said, “I didn’t know what else to say. What are you supposed to say?” Here’s a senator, a space icon, and John Young has walked on the Moon and Gordon Cooper, one of the original seven. I mean, give me a break. So I thought, “Okay. I’ll go up and just say, ‘Hi, John. I’m your new boss.’”

He got a big kick out of it. He thought that was great. So, he said, “Yep, I’m willing to go work for you and I can’t wait to fly.” So he was great.

ROSS-NAZZAL: Talk about the selection of that flight crew, if you can, for that mission.

LEESTMA: Yes, that one you had to be a little bit careful of. For the life of me, I don’t remember who the commander was. But we were careful that we would get people that would be ready for a little bit more public eye and public notice of what was going on, and to make sure that we had a crew that was going to be compatible with John and what he had to do, and that were ready to take over. I think we did fly a medical doctor on his flight, too. I mean, that was just something that, you don’t know. Somebody that’s almost eighty years old, you’ve got to be careful.

We looked at kind of all the contingencies. I talked to the flight docs a long time. I said, “Is there something that we need to know about John that we need to be really especially careful for?”

And they said, “Nothing that you wouldn’t worry about with somebody who’s seventy-eight.”

“Then why’s he flying?” [Laughter]

So, yes, that went fine. Shoot. Anything else? Let me think. Oh, I don’t know. I just think my whole NASA experience has been neat. I have no regrets at all. If I had to do it all over again, I’d like to do it in almost the same way—the good and the bad.

I remember when George called me for my first flight, I was in the swimming pool in the backyard with my young boy. We were working on teaching him to swim, and my wife went in to answer the phone and she came out with his look on her face, and she goes—this is Saturday morning—she goes, “It’s George Abbey.”

I went, “What does he want? Aah!” [Laughs]

Because at that time I was not expecting to get selected, as I told you before. So here I am, dripping wet, and she brings the phone out and I’m talking on the phone. He says, “Yeah, can you be here in about ten minutes?”

“Yes, I can.” Aah! [Laughter] That was good.

I remember the guard down below at the time was [Mr. Arthur Moody]—oh, man. You probably know him. The short, little, very friendly—

ROSS-NAZZAL: Cliff [Carr]?

LEESTMA: No, not Cliff. No, no, no. He’s a short little black guy that’s been here forever, for absolutely ever. And when I walked in to get on the elevator to come up to the eighth floor, he looked at me and he said, “You’re going to like it. Mr. Leestma, you’re going to like it.”

[Laughter] How does he know? He says, "I seen all your buddies coming up here. I know what's going on around here." [Laughter] He was just great. He was just great. He used to kid. I used to drive a Volkswagen and he used to kid me about the car I drove all the time.

ROSS-NAZZAL: Well, you've had a great career at NASA, and we've enjoyed hearing about it.

LEESTMA: It's been great. You get to hear some really neat stories from a lot of folks. I'll have to go to that history page, though. I'm looking forward to that.

ROSS-NAZZAL: Great.

LEESTMA: All right.

[End of interview]