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ORAL HISTORY TRANSCRIPT

STEVEN A. HAWLEY
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is December 17th, 2002. This oral history with Steve Hawley is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Sandra Johnson is the interviewer, and is assisted by Rebecca Wright and Jennifer Ross-Nazzal.

I want to thank you for coming back to speak with us again.

HAWLEY: My pleasure.

JOHNSON: During our last interview, we ended by talking about your first flight, STS-41D, and today I'd like to talk about what you did between STS-41D and your next flight, 61C.

HAWLEY: Okay. I was lucky enough to get assigned to be assistant to Mr. [George W. S.] Abbey, who was at the time Director of Flight Crew Operations. So I spent my time in Building 1, and basically being his assistant.

It was interesting for a number of reasons, but in particular it was really my first exposure to kind of what goes on outside my organization. I had pretty much been working exclusively within the organization, within the Astronaut Office, and the things that we did at the Cape [Canaveral, Florida, Kennedy Space Center] and elsewhere, but I wasn't really too familiar with a lot of the other senior managers at the center or what their organizations did, and so I was just lucky and felt fortunate that he had given me the chance to come up and do that. So it was a

good broadening experience. And seeing how he did business as well, running FCOD [Flight Crew Operations Directorate].

JOHNSON: So you did that until you were assigned, or were you already assigned?

HAWLEY: No, I did that till I was assigned again. I was kind of—I don't remember—seems like it was probably in the fall of [19]'84, so I guess I did that—I didn't have to do that too long before I got reassigned. And then, of course, I continued in that assignment till it was time to actually leave and go back to training. So just because you get an assignment doesn't mean that you drop everything and start training full time. But it's nice to know you've got one coming.

JOHNSON: Right. So you were assigned to 61C.

HAWLEY: Yes, although at the time, back in those days, it wasn't very unusual to change flights several times, as we had discussed in the context of 41D, STS-12, back then. I think initially it was a TDRS-B [Tracking and Data Relay Satellite] flight, and then it was a TDRS-C flight, and then it became the complex of payloads that we actually flew. So actually, I think, when we were assigned initially, we were assigned to 51I. We weren't assigned to 61C, although that's the one we ultimately flew.

In fact, as I recall, we were assigned to two or three different flights before it stabilized out, including 51L at one time, we were the crew for that, and 61B, because for a while it looked like we might get an EVA [Extravehicular Activity]. And then we got—whatever happened, I don't really remember. It may have been that some of the other flights of payloads weren't

ready, and therefore some crews maybe slipped.

We may have mentioned last time, but it's common today, you get assigned to a flight, and that's the flight you'll fly. And if the payload's delayed, then you delay with the payload, and a lot of that's driven by the specific training requirements, in particular for the assembly missions.

Back in those days, a lot of the flights were similar. They were launching satellites or running some experiment operations that could be quickly learned, and, therefore, it wasn't quite as important to stick with your payload. In some cases, Spacelab crews, for example, where the complement of experiments was very complex and specific, and there was a lot of training involved, they did stay with their payload, but other crews rotated. If your payload went away, you just got the next one that popped up, and that pushed everybody else. So I think we did end up having three or four different assignments before we ended up—the crew stayed together. We finally ended up on 61C.

JOHNSON: That was what I was going to ask you. The crews normally stayed together at that point instead of following?

HAWLEY: Yes, with the exception in those days, we were flying payload specialists more commonly than we do today, and sometimes the payload specialists would stay with the payload. In fact, of course, that was in many reasons why the payload specialists were flying, was for a specific payload. In fact, I remember we trained for a while with [Gregory B.] Greg Jarvis when we thought we were going to be flying with him, but the five NASA individuals stayed together.

JOHNSON: And along with those five NASA individuals, you had Congressman [Clarence William].

HAWLEY: Right.

JOHNSON: Who was going to fly on this one.

HAWLEY: Yes.

JOHNSON: And, as you said, I think Greg Jarvis was assigned at first—

HAWLEY: For a while—

JOHNSON: And then he switched out—

HAWLEY: Yes, and, and then we had [Robert J.] Bob Cenker, who was an RCA [Radio Corporation of America] engineer, who was flying, because they were flying, as I remember, some cameras, some payload bay cameras that flew—we also had, I think, an RCA satellite on board. So we had two payload specialists, Bob Cenker and Bill Nelson.

JOHNSON: Well, how was it having a U.S.representative on this flight, assigned to this flight? Did it affect your training, or did it affect the mission in any way?

HAWLEY: The answer, most certainly, is sure. [Laughs] I guess it affected the training in some ways, because I don't remember exactly when he was assigned, but it seems to me he was assigned fairly late in the flow. So he had a lot of catching up to do, and so it affected the crew training from that point of view. He also, of course, didn't come to the flight with any experience like we did, I mean didn't have ops experience, didn't have previous spaceflight experience, and so it took resources from the crew to help Bill get through some of the training and keep an eye on him, and make sure his experience was going to be safe and successful.

He also had demands on his time because he was still in office, and I remember he was going back to Washington [D.C.]. I assume that he went back only as often as he absolutely had to, because I'm sure he would have preferred to stay and train with us, but he was gone some, and I remember that was kind of a scheduling issue, to try to work around his schedule.

Let's see. Did you ask me—what was the other part of the question?

JOHNSON: Well, just how it affected your training and the flight itself, I mean, having him onboard.

HAWLEY: Oh, the flight itself. Yes, it's actually kind of interesting, because we all suspected, although no one ever said, that because of the delays that we got into and the fact that, frankly, our payload [complement] wasn't very robust, that were it not for his presence on the flight, we might have been canceled. We had one satellite and some other experiments. It was almost, as I recall, kind of a clearinghouse sale, if you will. I mean, we had a lot of GAS [Getaway Special] cans [canisters] and Hitchhiker payloads and a bunch of stuff that hadn't been able to fly previously, and here came a flight that for whatever reason that I don't remember, we only had

one satellite and nothing else on board, so they were able to put some of this other stuff, which was important in that they had commitments, but in the great scheme of things, after we got into delays, you could conceive of somebody saying, "Well, you know, I'll bet we can put that satellite somewhere else and just not fly this flight." We wondered about that and always thought, without knowing for sure, that that might have happened if we hadn't had a congressman, but this was his flight, and so we had some guarantee that it would happen.

JOHNSON: You'd get to go up one way or the other.

HAWLEY: That's what we thought, yes.

JOHNSON: Well, as you mentioned, you had several delays. You had seven delays on this flight. What did you do during those times, I mean in between the delays? I mean, did you just continue to train? I think the flight originally was scheduled at some time in December and then—

HAWLEY: Right, December 17th or 18th, as I recall, and then—

JOHNSON: And it was a month later before you flew.

HAWLEY: Yes. We continued to train. Of course, in the middle there was kind of the Christmas-New Year's holiday, so I don't recall that we did a lot of training during that interval, although we stayed in quarantine a lot of the time. In fact, we went back right after New Year's

and tried again. So, actually, even though we didn't launch till kind of the middle of January, we were trying to launch for about the first two weeks.

When you're in the launch mode down in Florida, the pace is not very hectic. I mean, you're not in training typically like you would be if you're here in Houston and going to the simulators every day. You're, you know, reviewing procedures and checklists, and having—it's actually kind of a nice time, because you have the opportunity to sort of sit back without the pressure of having to be in a sim, and maybe just think about, "Okay, here's what's going to happen. Let's think through the normal time line and think through how we're going to do this task."

On later flights, we've used that time to sit down as a crew and just sort of talk through how things are going to go. It's a luxury you don't always have in the training environment because the pace is so hectic. You're running from one event to the next. Of course, the events are never normal. They're always full of malfunctions that you have to deal with. So the chance to just sit down and as a crew say, "Okay. Here's how it's probably really going to go. Let's talk through that and make sure we all understand what we're going to do."

I've always enjoyed the time in quarantine, although for that flight, as I recall, because of the launch time, we were getting up at two in the morning every day. And, you know, several weeks of getting up at two in the morning gets old. And we enjoyed each other on the crew, so that made it nice. We had a good time together.

JOHNSON: So the delays, did that create a feeling of frustration, or was it just part of—

HAWLEY: No, my approach to that has always been, hey, you know, I'd go out to the launch pad every time expecting not to launch. In fact, I don't know if I said it last time, but if you think about all the things that have to work, including the weather at several different locations around the world in order to make a launch happen, you would probably conclude, based on the numbers, that it's not even worth trying. So I always figured that we're going to turn around and come back. So I'm always surprised when we launch.

So my mindset was always, you know, we'll go out there and try and see what happens. So I never really viewed it as a disappointment or anything. I always feel a little bad for, you know, maybe family and guests that may have come out to watch, that now they have to deal with the fact there's a delay and whether they can stay, whether they have to leave, and that's kind of a hassle for them, but it never bothered me particularly.

Now, in those days, the launch windows were much longer than they are today. Typically today with [the International Space] Station we have five-minute launch windows, and in those days the launch windows were two and a half hours, and if you add the normal two and a half or three hours that you're in the orbit or prelaunch, you're out there on your back for five or six hours, and that gets to be pretty long, day after day. But the fact that you didn't launch never bothered me particularly.

JOHNSON: Well, you came up with an innovative idea to fool the *Columbia* there for the last—

HAWLEY: Yes, we were getting kind of desperate. [Laughs] I had discussed that with the commander, I don't remember, maybe a day or two before, because I had been through the 41-D

experience, and so even only my second flight I was developing something of a reputation for not being able to launch. So they must know it's me.

So then I guess—I don't remember how we came up with the specifics of the disguise, but I decided that if it didn't know it was me, then maybe we'd launch, and so I taped over my name tag with gray tape and had the glasses-nose-mustache disguise, and wore that into the [white] room. I had the commander's permission, but I don't remember if we had told anybody else we were going to do that.

JOHNSON: Well, evidently, it worked because—

HAWLEY: Evidently, it worked, because we did launch that day, yes.

JOHNSON: Well, as you mentioned, there was a variety of experiments on that flight. Were you responsible for any of those experiments, or are there any in particular that you remember?

HAWLEY: I kind of remember the suite of experiments, although I don't remember specifically any one for which I was in charge. We kind of shared all the responsibilities. Frankly, I mean, there's no such thing as a nothing space flight; but, you know, maybe if there ever were, that would have been it, so it's kind of hard to divide up the nothing you're doing five ways.

But, again, we enjoyed each other. The crew got along really well, and I remember that crew, in particular, we developed a lot of techniques for backing each other up and learning how to do things together, so you had a different set of eyes watching a procedure or a separate independent brain making sure that whatever you were doing was right, and maybe because of

that I sort of remember being involved in everything without really remembering who was responsible for it.

I think Franklin [R. Chang-Dìaz] and [George D.] Pinky [Nelson] were responsible for the satellite deploy, because I had done one on a previous flight. Again, in those days, a lot of us—you know, on this flight there were two of us getting our second flight—no, three of us getting our second flight, and two of us getting the first flight, so we didn't have a lot of experience, so as we looked at the tasks, I remember we talked about, well, you know, I had launched a satellite on my previous flight, so maybe on this flight Franklin and Pinky should do it so they get the training and the experience. And I had trained for EVA on my first flight, so maybe on this flight Franklin and Pinky should train for the EVA. We didn't have one scheduled, so we kind of, as I remember, divided up the responsibilities along those lines just so that we could maximize the resultant training and experience on everybody on the crew.

JOHNSON: You and [Charles F.] Charlie Bolden [Jr.] and [Robert L.] Hoot Gibson tracked some spiral eddies in the Earth's oceans.

HAWLEY: Yes.

JOHNSON: Do you want to talk about that for a minute?

HAWLEY: The only thing I really remember about that is that as hard as it was to launch, it seemed to be equally hard to land. We were supposed to be the first flight to go back to KSC [Kennedy Space Center] after [Karol J.] Bo Bobko had blown a tire on 51-D, and the weather

just didn't cooperate. So they kept waving us off and making us wait another day to try to get back into KSC.

And what I remember is that by the third day we had sort of run out of most everything, including film, and part of our training had been to look for spiral eddies near the equator, because the theory was, for whatever reason you didn't see them near the equator, and Charlie was looking out the window and claimed to see one, and I told him, "Well, you'd better draw a picture of it, because we don't have any film." So we couldn't take a photograph. But we were pretty much out of everything by then the end of the flight.

JOHNSON: So you just drew pictures of spiral eddies?

HAWLEY: So we drew pictures of spiral eddies. That's all we had.

JOHNSON: And waited to land.

HAWLEY: Yep, waited to land.

JOHNSON: So you finally did land on that one.

HAWLEY: Yes, and that was finally in California.

JOHNSON: Well, not long after you landed, the *Challenger* accident happened. Do you remember where you were and what you were doing during that?

HAWLEY: Yes, I do. I was, in fact, in Topeka, Kansas. I had been invited up after the flight to participate in Kansas Day, which is the 29th of January anniversary of Kansas's statehood. So I was up there at the request of the governor, and I was going to do some speaking and go to the ball. I had just flown into the air base in Topeka, and they had actually let me go in the VIP room there and watch the launch on TV while I was waiting for—I don't know if I was waiting for a ride, wherever I was going. So I was there when it happened.

Right afterwards, we were all recalled to Houston, and I remember Joe [H.] Engel flew up and picked me up, and we flew back.

JOHNSON: Your father was actually asked by the astronauts to speak at the Memorial.

HAWLEY: Yes, George [Abbey], I think, had asked me if he would do that. So, yes, he was here as part of the memorial service on site. President [Ronald W.] Reagan and the Administrator came, and my dad was part of that.

JOHNSON: I imagine that was an honor for him to be asked.

HAWLEY: Yes, it really was, and I think he still feels very honored and grateful to have had the opportunity to participate in something like that. A lot of the guys in the class had gotten to meet him, so it was, I think, of some comfort to have somebody involved that a lot of the astronauts had known. He had met a lot of them, so he had some kind of kinship with the bunch at the time.

JOHNSON: In [19]'87, as part of the recovery after *Challenger*, the STS 61-C crew, you supported the countdown demonstration test for the *Atlantis*.

HAWLEY: Yes.

JOHNSON: Can you describe that for us?

HAWLEY: Yes, well, I think what they were really trying to do was, because it had been a while and probably would be a while yet before we flew anything, they wanted to process the vehicle kind of through the flow and get it out to the pad, and practice the countdown, and so that everybody could kind of rehearse the skills that they would need once we returned to flight. George asked or assigned—I don't know that George ever asked—he probably directed us as the last crew to fly to go down and participate as the crew for that practice countdown. And we were happy to do that, and that was kind of a nice experience, to go down and be part of the team again.

JOHNSON: Well, since you were the last crew to fly before *Challenger*, what procedures had changed with this test compared to—

HAWLEY: I don't know that really any procedures had changed. During that time, the whole program was looking at a whole bunch of things in terms of how to improve the safety of the system. So there were a lot of design changes, engineering changes, procedural changes that were being incorporated in the program before return to flight. But this test really was just an

opportunity for the team to get back to thinking about launch procedures so they wouldn't become rusty, and I thought that was a valuable thing to do, the close-out crews and the launch team getting to go through their procedures. I think the countdown itself was pretty much the way it had always been. It was just a chance to kind of remember and get re-familiar with the procedures.

JOHNSON: Also, after *Challenger*, you took part in Sally [K.] Ride's task force.

HAWLEY: Yes. It wasn't really her task force. She was part of the Rogers Commission.

JOHNSON: Right.

HAWLEY: And my assignment had been to actually be part of the KSC team, and I worked with [John J.] Tip Talone [Jr.], who was one of the flow managers at the time, and our job was to look through the processing of the vehicle itself prior to launch to see if there was anything in all of that that could have contributed to the accident.

Now, when we started that activity, nobody knew exactly what had caused the accident. It was not too long after that, that it was pretty clear that it was a solid rocket motor problem. But I think, wisely, all of the teams continued. You know, you don't want to drop what you're doing, thinking you know the answer, only to discover later, "Well, maybe that wasn't really it. Maybe it was something else."

So we did that for several months, and then when our report was complete, I went up to [NASA] Headquarters and kind of provided staff support to the Rogers Commission. Sally was

actually a member of the commission, and I was one of the guys there just helping to integrate all of the information. I think all of the sub team reports were made available to the Rogers Commission for their report, and since I had worked on that one, I was able to kind of help integrate that into what they were doing.

JOHNSON: And how long were you there doing that?

HAWLEY: Oh, I don't really remember. It seems like it was a couple months. It wasn't probably full time. It was part time, as I remember. It was kind of interesting. I mean, to get to meet, you know, the people that were—it was a pretty high-powered commission, and to get to meet some of the members was very memorable, getting to meet Chairman [William P.] Rogers and getting to talk with him. Neil [A.] Armstrong was on the team, and Professor [Richard P.] Feynman, who had always been sort of a hero of mine as I grew up as an astronomer-astrophysicist. I mean, he was legendary as a physicist, and to actually get to meet him was really special, and there are many other members of the team that were also very well known and famous in their own right. So that was a really unique experience.

JOHNSON: Of course, the "Leadership in America's Future in Space," the report that was produced—

HAWLEY: Yes, we helped write that.

JOHNSON: Did you?

HAWLEY: Yes. Those of us that were—a lot of that was, you know, a lot of that report writing is done by the staff, and then the members kind of critique it. So some of the stuff I remember writing myself.

JOHNSON: Oh, really?

HAWLEY: Yes, I don't remember how much of it survived.

JOHNSON: What parts of it do you—

HAWLEY: I don't really remember. Probably a lot of the parts about—it addressed some things that were not—I guess I'd put it this way. The chairman felt that it was appropriate to look not only at the specifics of that accident, but other things that his group might want to say about safety in the program, and that included, among other things, the role of astronauts in the program, and that was one of the places where I think I contributed, was how astronauts ought to be involved in the program.

I remember one of the recommendations of the committee—I don't think I was responsible for this one—but talked about elevating the director, the position of director of FCOD, because at the time of the *Challenger* accident, he was not a direct report to the center director. That had been a change that had been made sometime earlier. I don't remember exactly when. And that commission felt that the guy that was head of the organization with the astronauts should be a direct report to the center director. So several people went back to

Houston and put George's desk up on blocks in an attempt to elevate his position. [Laughter] I think he left it there for some period of time, as far as I can remember.

JOHNSON: Enjoyed the elevation?

HAWLEY: Enjoyed the elevation.

JOHNSON: Well, in May of [19]'87, you replaced Henry [W. "Hank"] Hartsfield [Jr.] as the Deputy Chief of the Astronaut Office. What were your duties and responsibilities in that position?

HAWLEY: The chief and the deputy are responsible for a lot of the technical issues the astronauts get involved with, all of the individual astronauts in one way or another involved in their various program issues. Usually there comes a time when the office itself as a group needs to take a position on some technical issue or program issue, and we would orchestrate that.

Of course, we would make recommendations for job assignments for people, who would get to go work as a CapCom [Capsule Communicator], who would get to work down in Florida, who would go work at SAIL [Shuttle Avionics Integration Laboratory]. We made recommendations about crew assignments, and basically just running the administration of the office.

Now, when I came in as deputy to [Daniel C.] Dan Brandenstein, who was the chief, I felt that it was my job to be the guy that was available for people to come talk to, because the chief is pretty busy, and he's involved in lots of stuff that take him away from the office, and

maybe he doesn't have as much time to spend listening to the people in the office. And so I felt like it was my job to sit there with the door open, and I actually did that. I sat at the end of the hall, and I'd always leave my door open, and I sat there with my desk facing the hallway, so people could see if I was in.

Painful as that was, I felt it was my job to be the guy that was there, that if people wanted to come and say something or vent or ask for something, that they had somebody to go to. So I remember, for whatever reason, I remember that being something that I thought was very important in the job.

JOHNSON: So that was something that you decided yourself, not something that was expressed that that was a part of your job?

HAWLEY: Yes.

JOHNSON: Were there any other major issues that you remember dealing with during that time?

HAWLEY: Oh, well, you know, we were dealing with all the issues associated with return to flight. I remember auto-land being a big deal back then. That was something that people were pushing on that we had a concern about in the office. Not so much that—I think there's been a misconception over the years that the astronauts are macho, and they're not going to sit there and let the computer land it; they want to land it themselves.

I never thought that was the real issue. I always thought that the real issue was you've got to have confidence that the auto-land system is going to work. And we didn't feel like we

had enough confidence in the redundancy in the system, nor preflight predictions in how it would behave, that is, the different simulators, as I remember, the SAIL and the Shuttle training airplane, and the Shuttle mission simulator, tended to behave a little differently with respect to auto-land, and so we weren't confident that for a given set of circumstances we knew exactly how it was going to perform. And there were some other technical details. But I remember that being an issue.

One of the reasons that was an issue was because in those days they were talking about long-duration Orbiter, and wanting to fly for twenty-eight days or longer, and they didn't feel like a human could come back and land the Shuttle after a month in zero-G. And if that was true, then they needed to have an auto-land. I remember getting involved in that.

Maybe the biggest issue was just coming to closure on all of the different technical activities that were under way after *Challenger*—hardware improvements, procedural improvements, software changes, all the stuff that made us ready to go fly again. And I also remember there was just a lot of administrative stuff. We do a lot of, you know, travel, and other things that always seems to be a headache, for some reason, in that job, at least in those days kind of fell on the deputy to be the guy that dealt with those problems.

JOHNSON: Well, were there any concerns being the person that—you were setting yourself up to be the person that people would come to with complaints because of *Challenger*? I mean, were there any worries or anything that you had to deal with in that respect?

HAWLEY: Yes, I guess there were some. That wasn't what most people came to complain about. It tended to be, as I recall, a lot more mundane. And probably there was just about as little as I

could do about it for them as I could about the big problems. But, no, I think the things that I remember, the whole issue of crew escape, I mean, we had a crew escape activity going on after *Challenger*, and I remember there was some testing about using rockets mounted to the side hatch that would actually forcibly extract you from the vehicle. People looked at ejection seat designs. Finally, we settled on the pole system, which is still the one we fly today, where in an emergency you would go and attach a lanyard to a pole and basically slide out the hatch, and the pole's designed to get you clear of the wing so that you don't hit anything getting out.

But the whole issue of escape and the new pressure suits we were going to wear was kind of an issue. There were some people that thought it was unconscionable to not have an ejection system in the Shuttle. Not many, but there were a few that—and some of them still feel that way today, although the ones that I know about aren't in the office anymore, but they still feel like we should have a crew-escape system, more sophisticated than what we have.

We felt that, frankly, the design of the Shuttle just really didn't permit it, in terms of weight, and amount of money it would take. There were also people that thought the suit was kind of burdensome and didn't really want to have to wear it. And we sort of just had to say, "Well, yeah, but you do have to wear it."

And there were people that understood, "Well, okay, we should wear it for ascent," but they didn't really want to have to wear it for entry, and we said, "Nope. Yes, you do."

And those discussions still go on from time to time, as far as I know.

JOHNSON: Well, you also served on the selection board for the 1990 astronaut class.

HAWLEY: I think pretty much every class since [19]'84, as I remember.

JOHNSON: Oh, really? Okay. What exactly were your functions on those committees? Do you make recommendations? Can you describe the selection process and your part in that?

HAWLEY: Yes, there's really two parts to it. There's something that's called a ratings panel, and that group is the group that has to go through all of the applicants' folders and make some preliminary decision about who are the most qualified, because from the most qualified you select the ones that actually come down to Houston and go through the medical tests and actually get interviewed. And some subset of the ratings panel ends up being on the selection board itself that actually does those interviews. So fundamentally, the selection board's job is to have looked at the folders, to have reviewed the contents, to have looked at the recommendations, to have sat through the interviews, and ultimately make some judgments as to who are the best candidates to recommend to the center director, who is the selecting official.

I actually sort of always enjoyed being on the selection board. It was kind of a humbling experience, because I thought over time we seemed to always get a more and more qualified bunch of people wanting to come work for us, which I always thought was kind of an honor, that all of these really capable people wanted to come work in your program. Several of us used to joke that we probably wouldn't even be competitive if we were trying to get selected now.

But it was also, I thought, very important to select the right kind of people to come into the program, and so being on the board was also, I thought, a great responsibility. So I was always proud to be entrusted with that responsibility. It's a real burden, because it takes a lot of time. The interviews themselves take basically six solid weeks if you interview, you know, 100, 120 individuals, which is typically what we would do, plus the time beforehand to go through

hundreds or thousands of folders and try to make a determination who are the most qualified applicants. But, like I say, it's a real honor to be asked to do that, and I always enjoyed it.

JOHNSON: Do you think the process has changed significantly since you were selected in [19]'78?

HAWLEY: I don't think the process has changed much. I think the quality of the people that apply has gotten better, in part, frankly, because it's a little easier now to prepare if you want—I mean, when I was a kid, people like me didn't get to be astronauts, because I didn't want to be a military test pilot. Nowadays, as a kid in school, you can—well, plus in those days, you know, in fact, before my class, I don't think they had—NASA hadn't actually picked astronauts for ten or eleven years. So the chance of actually even getting a chance to apply was very remote. Now, today, that's not true. We select more or less regularly every couple or three years, and you sort of know what the job is, and so you have a chance to tailor your development in that direction if you want to, and I think that does tend to give you more qualified applicants.

JOHNSON: So you see that more and more in the applicants—

HAWLEY: I think so.

JOHNSON: —that they are being tailored?

HAWLEY: Yes. I think they know what the job—they have a better idea what the job's like. They kind of know what the skills are that we're looking for. And we've had a number of astronauts come into the program and be successful, and if they want to, they can pattern themselves after the people that have done that.

You still get that today. It's a little bit humbling and a little bit different now. When I first started on the selection board, people would say, "Oh, yeah, you know, I always wanted to be an astronaut ever since I watched Apollo 11 land on the Moon," and now in later years it's been, "Yeah, I really wanted to be an astronaut ever since I was a little kid and I watched the first Shuttles launch." And you think, "Ah, jeez."

Nobody ever says, "When I watched Steve Hawley launch," but they will say, "Hey, when I saw Sally Ride launch, then I really wanted to be an astronaut," or, "I thought I could do that, too." [Laughter]

JOHNSON: They're getting younger and younger, I imagine.

HAWLEY: Yep.

JOHNSON: Well, you were assigned to STS-31, but, actually, you had been assigned to 61-J, which was planned before the *Challenger* accident.

HAWLEY: Right.

JOHNSON: It was planned to happen later that year.

HAWLEY: As a matter of fact, I was assigned to that even before 61-C. flew, so it wasn't unprecedented, but it wasn't common that you'd get assigned to two missions at the same time. That was kind of neat, although as a practical matter, it didn't figure into it because we didn't do much training for 61-J before *Challenger*, and, then, of course, it all became sort of irrelevant.

JOHNSON: So you knew for a while that you'd be a part of that crew that deployed the Hubble [Space Telescope].

HAWLEY: Right.

JOHNSON: And so then you did, after a while—I think you were actually—when were you assigned for 31? Was that in [19]'88, I think?

HAWLEY: I don't remember. That sounds about right, yes.

JOHNSON: Yes, okay. Well, since it was postponed for so long, when you were reassigned, did they assign the entire crew at that point, or was it still—

HAWLEY: They didn't assign the entire crew, but it was mostly the same crew. The commander was different. When I was assigned to 61-J, John [W.] Young was the commander, and then they got around to assigning 31, John was no longer the Chief of the [Astronaut] Office. He was

the Special Assistant to the Director [of Johnson Space Center for Engineering, Operations, and Safety], and Loren [J.] Shriver was assigned to be the commander.

JOHNSON: Do you think that you being the astronomer, is that why you were assigned to that mission?

HAWLEY: Yes, well, it's interesting. I probably have told people that. I like to think it was because they thought I'd be a really good arm operator. [Laughs] But, in fact, there is value in having—I always thought at the time; I think it's true today—value having an astronomer involved in something like that for the simple reason that we want to make sure as we design and execute the mission, that the needs and requirements of the customers are understood and dealt with appropriately, and we want the customer—my opinion is, we want the customers to know that we value that.

By having an astronomer involved—I mean, I suppose people may think that an astronomer is there because this is a telescope and maybe he's looking through the telescope or doing something—I mean, in flight, there's not much you can do that's really astronomy. I mean, you need to be a good arm operator, but preflight you can hopefully—I felt I was in a position to understand what the astronomers needed to accomplish and also, of course, understanding how the Shuttle program works, how the Shuttle vehicle works, what our constraints are. It put me in a position where we could perhaps suggest ways that the customer requirements could be best met.

So, hopefully, it helped the Hubble science team believe that there was somebody on the crew that really understood what they were trying to accomplish and was part of their team as

well in trying to help get that done, as opposed to maybe creating the impression, "Well, here's a bunch of guys that don't really care about our payload. We're just a payload, and they're just trying to launch it," and maybe creating some problems there.

There's a lot of technical issues anytime you do something like that, where you have to reach a accommodation between what the customer may want and what the Shuttle is capable of providing, and I think what the customer wants to know is that we really do understand and care about what they're trying to do rather than, "Ah, you know, we're the Shuttle. We're going to do it the way we want, and we don't care about you."

So I do think that happened from that point of view. So, yes. The short answer is, yes, I think that was part of why I was assigned.

JOHNSON: In the last interview, I believe you mentioned that you had a chance to see some of the satellites and where they were being created and built and meet with the teams. Did you do that with the Hubble also?

HAWLEY: Sure did, yes. I always thought that was really important. Even perhaps more so for Bruce [McCandless, II] and [Dr. Kathryn D.] Kathy [Sullivan], who were the two crew members that would have done an EVA had one been necessary. There were several scenarios that were all in the case of a problem, but where two of our crew, Bruce and Kathy, would go outside and intervene by EVA in order to make the mission successful.

And so their ability to see the telescope and do fit checks and handrail location assessments and things like that were important. It's tremendously important to be able to see something like that and understand where the antennas are, understand where the handrails are,

understand where the Magnetic Torquers are, and knowing not to touch them. And, frankly, even more so for a payload like Hubble, which is going to be there—it has been there now twelve years and hopefully will be there another eight years, it's the one time that we have the real telescope there where we can fit-check tools, and we can dry-run our procedures.

So we were working on things not only for STS-31, but also with the knowledge that we'd be going back to Hubble over the years for servicing missions. At that time we didn't know we'd be going back in three years to, you know, correct a mirror problem, but we knew we'd be going back and doing some things, some tasks on it, and the ability to see it, to fit-check the tools, to maybe—and Bruce and Kathy were good at this—to look at some worksite or some task and say, "You know what would really make this easier for a suited astronaut to do would be if you made this connector bigger," or if you had a different sort of interface for opening the compartment or if you put a handrail here or if you put a little grip on the black box.

So we were able to improve the serviceability of the telescope by the fact that it was here and we could actually see it, and I hesitate to say "play with it," but evaluate tasks and tools, knowing that astronauts would have to be working on this for the next, you know, twenty years. So that was critically important, plus the fact that it was just big and beautiful. [Laughs] And to get to see it—I mean, today we've seen enough pictures now of it in orbit, I guess, but back then to be able to show a picture of it to somebody with a technician standing next to it and show how big the telescope really is, is pretty impressive.

JOHNSON: Well, how did you train for the RMS [Remote Manipulator System] arm and for the deployment of it?

HAWLEY: Primarily in computer-driven sims [simulations]. So I actually didn't get—the sims are very good. I didn't get to do anything really with real hardware, maybe like Bruce and Kathy got to in training for EVA. We did have a big Hubble-sized balloon that we had in Building 9 facility called the MDF, Manipulator Development Facility. It's been shut down now, but it was the one training location where you had a real Shuttle arm. That means you could really—it was physical, and you could really drive it into a structure and damage it.

We had a balloon that was shaped like Hubble, at least the Hubble without the solar arrays, and so you could practice maneuvering this big object around, and that was kind of interesting, although I found that in Building 9, the robot arm in Building 9 can't really lift very much weight, and so the balloon is filled with helium because it sort of floats, which is a nice stimulation, but it's also susceptible to the air currents in the building, and it was interesting and somewhat frustrating, I think, to try to maneuver it, and particularly in proximity to the payload bay, because it would sort of drift around in the air currents in the building. It wasn't near as stable as the real HST [Hubble Space Telescope] was on the real arm. Most of the training, therefore, we did in the computer-based simulations, where the Hubble was basically a cartoon in the monitor.

But some of those simulations were very good, and after the flight, we made them even better, because we discovered the arm didn't work exactly like the simulator when we actually got around to deploying the Hubble. That was kind of interesting, too.

JOHNSON: Well, why don't you walk us through the actual deployment.

HAWLEY: The mission was designed from a couple of different perspectives. The one which was important was the way the telescope got power during ascent was by being plugged into basically a cable from the Orbiter. By necessity, the solar arrays are stowed during ascent so it'll fit in the bay, and until you get the Hubble out of the payload bay and raised above the Orbiter, the solar arrays can't come out, and the cable wasn't long enough that it could still be plugged in while you're waiting for the solar arrays to come out. The reason I mention that is because, therefore, you had to unplug it before you raised it, and if for some reason the solar arrays didn't come out, you had to send the EVA astronauts outside to manually deploy the solar arrays so it could get power before the telescope died, because the batteries wouldn't survive indefinitely.

For space adaptation reasons, we don't normally schedule an EVA before the fourth flight day. In a contingency like that, we wouldn't normally schedule it or be vulnerable to it before the third flight day. So that meant that—I'm trying to remember. I think maybe we were going to deploy Hubble—we had deployed Hubble on the second day, with the knowledge that if we had to, we could do the EVA, and that would give them time to check out the suits and everything else.

So, anyway, the design was, we'd go up, we would get on orbit, we'd check everything out on the first day, and then the second day we'd get into Hubble deploy. It's done with the robot arm, so you grab it with the robot arm and then lift it out of the payload bay, lift it up, kind of rotate it end for end, and then the solar arrays come out, and then you put it in the proper release position and let it go. If all that works, then it's all done with the robot arm.

Two things happened. One, we, on purpose—see, the way the robot arm is designed, it's electric motors that drive the individual joints, and you can determine the rate at which the joints drive by how much current flows to the electric motors, and how much current can flow can be

determined by how you configure the software. It's all run by software in the Shuttle computers. And for a very big payload, for a massive payload, in particular one that's going to be in proximity to the Shuttle, what you're worried about is a very, very remote failure case that the arm could fail in such a way that it drives by itself. And the operator is always there watching, but, obviously, if it's close to structure, you may not have much time to react. So they intentionally limit how fast the joints will drive so that they give you some time to react in the case that there's this far-out failure that happens and the joint fails on by itself and gives you time to intervene and save the day.

What that means for Hubble, Hubble being at the time the biggest payload we had ever deployed with the arm, the amount of motion you could command was limited, because it was designed to protect for this failure case, at least while you were close to the payload bay. So what we found as we started to lift Hubble out of the payload bay was that it didn't come straight up, not that we would have expected necessarily for it to come straight up out of the bay, even though that's what we were commanding it to do, but it seemed to wobble around a lot more than the simulator had predicted, and that was a bit of a challenge.

After the flight, we found out that the explanation was reasonably simple, and it was that in the real arm there's noise in the joints, and because we had limited the signal by the software in order to protect for this case where you got this strange runaway failure, and you've got to react, that the noise was actually a fairly significant contributor to the intended signal, and so there was a lot of sort of random motion that was being imparted. Normally, you wouldn't see that. You'd command high rates and noise in the joints is small compared to the amount of signal that you're actually commanding to get the joint to move. But in this case, because we weren't able to command a lot on purpose, the noise was a contributor that manifested itself in

uncommanded motion.

So we actually managed to make the sim more realistic when we got back and actually modeled the noise in the joints. So forever more it was more realistic. But for me, that day, it was interesting, and not quite what I had expected.

The other thing that happened was, once we finally got the telescope to the position where the solar arrays are to deploy, the first one deployed and came out fine, and the second one began to deploy, and then it stopped. And this was exactly the case that we had protected for but had worried about, which is now you can't get the solar array out, so you're not generating electricity. And if you're not generating more than you're using, eventually the batteries will run out and Hubble will be dead. So Bruce and Kathy had to suit up and get ready to go out and manually deploy the solar arrays.

The ground worked on that for a while, and ultimately they figured out that there was a sensor that was erroneously reading too much tension. This thing was designed so that if it started to hang up, the motors would turn it off so you didn't damage the array. And the sensor, as I recall, was sensing that that was happening but, in fact, it really wasn't, and the ground figured that out, and they were able to bypass the sensor and then resend the command, and ultimately it worked okay, but by then Bruce and Kathy were in their suits in the airlock ready to go outside, and actually never got to see the deploy because they were in the airlock at the time.

As a matter of fact, there's a famous—well, I think it's a famous picture of the release of Hubble the first time. It's actually a scene taken from the IMAX footage that ultimately was in *Destiny in Space* [1994]. What had happened, as it turned out, was, we had trained for a bunch of failure cases. We had trained for the case where everything is normal and we have, you know, all five of us supporting the deploy, and we'd trained for a case where there were three of us

inside, and there were two guys out doing the EVA, but I guess we hadn't really thought about the case where there were three inside and two in the airlock. Bruce and Kathy, as I recall, were the photographers, and they were locked up in the airlock. So we didn't get as much photography of the Hubble deploy as—in fact, if [Charles F.] Charlie [Bolden, Jr.] hadn't remembered to turn on the IMAX camera, we probably wouldn't have got any, but fortunately he did, and the IMAX people were kind enough to give us a frame out of it, so we have a still of Hubble being released.

JOHNSON: Well, during the release, the camera on the end of the RMS that was there to assist you, you couldn't use it.

HAWLEY: Yes. I think it was—it may have just been overwhelmed by the sunlight reflecting off of the aluminum thermal protection system that covers the telescope, but for whatever reason, there was no picture. I remember we had sort of trained for that case, and I had a pretty good view out the window, so I could see the end effector and I could see the grapple fixture, and so as we separated, it was visible, so I actually wasn't too concerned about it.

One of the things I remember that I had subsequently forgotten was that—the telescope is exceedingly bright when the sun is shining on it, because of all the reflective surfaces, and we got back from 31, and it may have even been because of the end effector camera problem, but I remember saying, "You know, when we go back to it to service it on subsequent missions, you really ought to consider rendezvousing in the dark, because the payload bay lights would be adequate to light it up, and you wouldn't have to suffer the glare and all that other stuff.

And I remember, when I was assigned to STS-82, one of the things the Hubble team

wanted was a color camera on the end effector, because they wanted to use it for doing a survey, a close-up survey of the Hubble, and they wanted the color image, and I was concerned about that, because the color cameras don't provide as much low light sensitivity, so if you're going to rendezvous at night, having a color end effector camera could be a real problem. It won't show an image quite as well, and you might be able to see adequately with the payload bay lights or a floodlight or something like that.

So we went over to Building 9 and set up some tests to see, because I was really concerned about this color camera they wanted to put on the end effector. And I remember getting into a discussion about this, and thinking, "Well, the right answer would be just to rendezvous in the daytime, because then there would be plenty of light for this color camera, and who's the idiot that thought we ought to do this at night?"

And the guy, honestly, he did not remember. He just said, "You know, it was that STS-31 crew that recommended that." He didn't know that I was on the STS-31 crew, and I didn't remember we had said that.

And after he said it, I went, "Oh, yeah, that's right, we did." [Laughs]

It turned out that that camera worked fine, and we were able to do it at night with the color camera. So everything was okay.

JOHNSON: You have to be careful what you recommend.

HAWLEY: Yes, you might have to deal with it.

JOHNSON: You may have to deal with it later.

Well, there were some other things besides the Hubble on the *Atlantis* on that flight. Do you remember—

HAWLEY: Actually, it was *Discovery*.

JOHNSON: Oh, was it *Discovery*?

HAWLEY: Yes.

JOHNSON: Oh, okay. Do you remember anything about any of the other payloads or the experiments?

HAWLEY: I don't remember that we had too much else, frankly. Hubble pretty much filled the bay, so we didn't have anything else in the bay. We had IMAX, and we probably had some mid-deck experiments, but I don't remember much about them.

JOHNSON: What was it like for you when you finally, being assigned to this early on, four years before, and then finally seeing it fly, what was that like for you personally to experience that?

HAWLEY: Well, to be honest with you, the thing I thought of wasn't the fact that I had been assigned four years before or whatever, and finally got to see it fly, as much as the people that had been working on it basically their whole careers. I mean the scientists. The same thing years later I was thinking when we deployed Chandra [X-Ray Observatory]. But, as I remember,

Hubble got a—I think it became official sometime maybe in the early seventies, so we're talking twenty years since it's been a real formal project, and people had been working on it prior to that. And, you know, guys like Dr. [Lyman] Spitzer [Jr.] who had spent, you know, fifty years thinking about it, well, forty, maybe, really, thinking about, you know—this is really about all of the people that had spent their whole scientific career for this moment. The fact that it was four years for me, you know, in that context seemed to me to be nothing.

Also, frankly, as an astronomer, I really felt that I knew the potential of the instrument and what it could really do, if it all worked, and for me, that was tremendously exciting to suddenly have a large telescope in space and the things that it would be able to do. I mean, even now, though, in retrospect, I didn't have any idea how significant the discoveries would be and how profoundly revealing the Hubble observations would be. But I remember thinking, you know, "This is really going to be special."

And that's really exciting, I mean, as an astronomer, to have a tool like that that will allow you to see the universe in ways that you never thought would be possible was tremendously exciting. And to have it actually turn out to be that and more over the years, even though we had a bit of a slow start, is very rewarding. Probably, as an astronomer, that's about the greatest thing, if you're going to be in this program, that's the greatest thing to have been able to be part of.

JOHNSON: How long was it before you found out, or was it after you landed you found out about the problems with the mirrors?

HAWLEY: Yes, a couple of months. I remember being on the Hill doing a post-flight visit, which is typical after every flight, and we had the first light pictures, and we were running around showing these first light pictures to everybody. I remember the images were kind of fuzzy, but we were telling everybody, "Yeah, it's supposed to be like that." [Laughter] And then finding out that there was a real problem, and that was pretty devastating, really. Again, sort of for the same reasons. I mean, personally, I was convinced we didn't screw it up, but again, that so many people had spent so much of their careers working on this one instrument, and then to have it perhaps not work.

Now, one of the things that I suppose maybe affected me—this whole thing affected me perhaps a bit less was because I really think I understood, even in its degraded state, I mean, even if we had never done anything about it, it was still a [unique] instrument. The thing that people don't really understand, I believe, even today, is that despite the flaw, the telescope had the sensitivity that we had advertised it would have, and it had the resolution that we said it would have. The problem was, it didn't have both at the same time. And so there was still state-of-the-art science, cutting-edge research that you could do, that you couldn't do from the ground, but you couldn't do all of the problems that you had intended to address with that telescope because of the lack of being able to have the limit of sensitivity and the limit of resolution at the same time.

We had image-correcting techniques that could be applied, and they were successful to a large extent, although they cost you light to do it, and they threw away some of the input and, therefore, that affected the resultant sensitivity. But you could recover a lot of the resolution. If you didn't care about the resolution, you could get the sensitivity and just not worry about it.

But there were some problems, like determining the Hubble constant, that were

considered really important problems that the Hubble was designed to address that, because of the problem, could not be addressed. That was very disappointing, but I guess all I'm saying that in terms of a total disaster, I didn't ever view it as a total disaster. I mean, it was unfortunate, and certainly disappointing to everybody that had anything to do with it, but the telescope was far from useless, and it always frustrated me a little bit, I think, that people would paint this thing as a piece of iron floating around Earth that had no value, because that wasn't true. Scientifically it was still very important, even in its degraded state.

JOHNSON: Then the media pretty much painted it that way.

HAWLEY: Yes, they did, and people really wanted to believe that, I guess. And, frankly, it's tough—I mean, we had kind of collectively screwed up, and, you know, it's hard to go back and say, "Well, yeah, but don't worry about that because it's really working pretty well." I mean, people aren't going to buy that.

Furthermore, I think, you know, it's not for me to sit in judgment of whether this was a sound technique or not, but preflight they were making a very big deal about the images. Now, as an astronomer, I knew scientifically there was a lot more to what Hubble was going to do than to just make pictures. I mean, the spectra were going to be very important, and the photometry was going to be very important, and the astrometry was going to be important, and the images were going to be important, too, but all NASA appeared to want to talk about was pictures that were going to be obtained.

Well, fair enough, but now the thing launches, and now what's impacted? Well, the pictures. Now, we could still do spectra and we could still do photometry and some of the other

things, but you can't sort of go back and say, "Well, forget all that stuff I told you about the images being really neat. Here's some neat spectra."

So we didn't really have a good argument to convey, I think, that this was still a very capable instrument, even though I felt that it was.

JOHNSON: And the scientific community felt that it was.

HAWLEY: Yes, I think. I mean, the scientific community is sort of diverse, and I don't know that the scientific community ever, you know, speaks with one voice, but there were people that were using the telescope from [19]'90 to '93 and doing important work. I'm sure there were others that felt NASA had really screwed this up, and they were not very happy at all. So you could probably find a whole host of points of view on that.

JOHNSON: Well, you mentioned that you were sure that your crew had not done anything to cause the problem. Was there ever a question of that?

HAWLEY: No, but, you know, I mean, that's the sort of thing that—

JOHNSON: First thing you thought of?

HAWLEY: First thing you think of is, "What did I do to screw this up?" [Laughter]

JOHNSON: Well, after that, you came back. What was your position when you first came back from that flight? Were you still—

HAWLEY: I guess it was probably ill-defined, because I had actually had an offer to go to [NASA] Ames [Research Center, Moffett Field, California] before the flight happened, and [Richard H. "Dick"] Truly had called me, I think in December or thereabouts of—would have been [19]'89, and asked me if I wanted to consider going out and taking a job at Ames, and I told him I was interested and wanted to think about it, but I had this flight, and I really didn't feel like I was in a position to decide till after the flight. I had actually gone out to Ames before the flight and talked to the management out there and told them the same thing.

So when I came back, I suppose I was kind of in limbo, because now that I'm back, I had to decide what my next job was going to be. I suppose my two options were either take the job at Ames or to go back to my old job as deputy chief for the office, and I elected to go to Ames.

JOHNSON: Why did you do that?

HAWLEY: Two reasons, principally. One was because the Administrator asked me to. I always felt it was a good idea to do what the Administrator asked you to do. But, secondly, I had always intended to stay with NASA for my whole career, and at that time—that was my third flight, and I had been in management a bit as the Deputy Chief for the [Astronaut] Office.

So, I was thinking two things. One was, if I really want to be a management guy some day, I really thought nobody is going to care whether I had three flights or four flights, and I believed if I had stayed, I could have probably gotten a fourth flight. Don't know when, but—or

a fifth flight, and I said, "But they might care if I had management experience." So I felt in a career sense it was going to be more worthwhile to get this different kind of management experience than to just hang around and do another flight, which I, you know, felt I had already done that. It wasn't that I didn't like flying. It was just that I felt long term it would be more beneficial to me to get this other experience.

Plus the fact that I didn't know much about NASA other than what I did, and this was a chance to go see a different part of NASA, different from human spaceflight, different from JSC [Johnson Space Center]. It was a science center—is a science center. To be involved in the management of science as opposed to operations. I was a scientist by training in the first place, so I thought, you know, this is the right time to go off and do this. So I said, "Yeah." Although it was still a tough decision to go do that.

In retrospect, I'm very glad I did, for a variety of reasons. I did learn a lot that was extremely important to me later in life. I did learn that at least at that time I still liked operations a lot. That's what I wanted to do. And it turned out that I got a fourth and a fifth flight anyway. So it kind of all worked out.

JOHNSON: The best of both worlds.

HAWLEY: Yes, it really was.

JOHNSON: Well, what exactly were your duties and your responsibilities in that position?

HAWLEY: The way it worked at Ames, Ames is a Code R center, but they have a lot of Code S projects. Code R is primarily aeronautics and technology, and Code S is science. They asked me to be basically the guy that reported to the Center Director, who was responsible for the Code S stuff, so my title was Associate Director. I was kind of the Deputy Director for Science, and the real Deputy Director had the same job for the aeronautics, so he and I both reported to the Center Director in those two areas of specialty. So basically I had purview of all the Code S stuff, which was about 40 percent of what the center did.

A lot of that at that time was life science research. There were some planetary exploration. They did astronomy, infrared astronomy, specifically. In fact, I had some interaction with that group back when I was in graduate school, because we had a pretty good infrared group at [University of California] Santa Cruz [California], where I went to grad school, and I was aware of the Ames infrared astronomy program. They at that time were flying a C-141 aircraft with a telescope in it that did infrared observations.

The problem in doing infrared astronomy is that the infrared stuff, for the most part, doesn't get through the atmosphere. Water vapor tends to absorb it. And so they mounted a telescope in a C-141 and flew it up at 40,000 feet, which is above most of the water vapor, and they could do infrared astronomy that they wouldn't otherwise be able to do. They had a group there that did that, so that was all interesting.

That was the science disciplines. They also did a lot of things in aeronautics that I got to learn about. So I got to learn about the different parts of NASA that I didn't have any experience with.

JOHNSON: Then, as you mentioned, it was a different environment than JSC.

HAWLEY: It really was. I remember characterizing it at the time, we had something like 2,000—is that right? I'm thinking we had something like 2,500 civil servants out there. Maybe that's not right, but whatever the number was, I felt like if you went around and asked, you know, "Hey, what's the mission of Ames?" you'd get 2,500 different answers, and it would all be, "Well, it's what I'm working on," because it was very diverse, and people were working on their own areas of interest.

And I thought at JSC if you went around and asked everybody, you'd probably get about the same answer. People go about it different ways and they have different interests, but we had a common goal of flying people in space. I mean, I felt that there was more of a sense of "us" and a sense of teamwork at JSC. Ames is more like a university. It's not a criticism; it's just how it is. It's how it's set up. And you have a bunch of different research projects taking place in a common setting.

It was interesting because it was a little bit challenging to be, you know, at the director level for something like that, because there was probably less unanimity of purpose at a place like Ames than there is at a place like this. So it makes, you know, the job of focusing the activities of the center a little more challenging, because a lot of people may not care about the issue that you have if it doesn't directly affect their research.

JOHNSON: Is there anything in particular that you were in charge of or worked on while you were there that comes to mind?

HAWLEY: Well, there are a couple things. One of the things that—I didn't really work on it much. I remember, though, that there was a group there led by [G.] Scott Hubbard, who actually now is the director of Ames, to develop a Mars mission based kind of on the heritage of Pioneer. Ames liked to say—and I think they have a legitimate right to do so—that they were better, faster, cheaper before it was fashionable. They were behind some of the early planetary probes that were very successful—the Pioneer Series. In fact, Pioneer spacecraft are still operating today, and we're talking, you know, thirty or thirty-five years later in some cases, very successful missions, very well done and relatively inexpensive.

They had developed a mission to go to Mars, and that begat sort of a conflict between Ames as a Code R center, and Code S at Headquarters that was funding this project. And that was an example early in my tenure there of how difficult it is to be at the Center Director level, because Headquarters can fund these projects as they see fit, and they had chosen to fund this at Ames, and Ames had developed it. It ended up being basically the Mars Pathfinder mission that flew successfully several years ago.

But what happened while I was there was that ultimately Code S decided to move that project to a Code S center, so they took it away from Ames and gave it to JPL [NASA Jet Propulsion Laboratory, Pasadena, California], because, my prejudice was, they didn't really want to invest heavily at a Code R center when they had other Code S centers. Plus, the Code R Center Director didn't want to invest a lot of his Code R resources in this Code S project at his center. So Headquarters decided to put it as a Code S center, and that resolved the issue. But it's an example of the difficulties that arise in trying to kind of cross codes.

Now, maybe in today's environment we wouldn't see that so much as we did back then. But that was one of the things that happened early on in my job there that was kind of an eye-

opener.

The other thing I remember is at that time [NASA] Dryden [Flight Research Center] was part of Ames like [NASA] White Sands [Test Facility] is today a part of JSC. There was a lot of thought, I guess in particular at Headquarters, that Dryden should go back to being its own center. There was a time, I don't remember when, where we consolidated centers to some extent, and that was probably a political move. Dryden at one time was a center and became part of Ames, and, therefore, NASA had one less center. [NASA] Wallops [Flight Facility] may have been a center at one time. I don't recall. It sort of, I think, technically works now under one of the other NASA centers: White Sands, you know, works for JSC.

But the plan was to make Dryden—I don't know that at the time we were going to make it completely its own center, but we were supposed to be kind of autonomous, a wholly-owned subsidiary, and I got to work with the Dryden folks in figuring out how to kind of spin them off so that they had their own organization and maybe technically reported to the center director but were really independent. And that was interesting because I learned a lot about Dryden and Ames and all of the interfaces. That was [pretty] challenging.

Ultimately, Dryden did become its own center, and it is today its own center. The hope, I think, was to reinvigorate the flight research activities there. Maybe if they were on their own, they would have a more robust program than if they were reporting through another center like Ames. I don't know whether there was merit in that thinking, but that's what I think the thinking was. That was very much a learning experience for me.

JOHNSON: You feel like you got everything you wanted to out of that experience?

HAWLEY: Yes, I did. I had gone out there kind of with this plan that, figuring that for six months I was going to be stupid and not know anything, so I would spend that time trying to understand and learn about Ames and what they did. And then after six months I might be able to—maybe a year—start being able to contribute something back. And then I figured after a couple of years I'd be in a position to make a decision about, you know, did I want to stay and keep doing that? Did I want to do something else?

And that kind of worked out the way I had planned it. Maybe I had expected to spend a year learning and a year doing, and then evaluating. I probably felt like in six months I knew enough to be able to contribute, and I felt like I did for a while, and then when I was about eighteen months into the job, coming up on the two-year anniversary, I got to thinking about, "Okay, maybe it's time to think about is this what I'm going to keep doing? I mean, I could probably grow up to be a candidate for Center Director here one day."

After all of that, I kind of concluded that I really did miss the operations. So I really did want to get back in operations. JSC was my first choice, but I don't remember thinking it had to be JSC. I had talked to some people I knew at Kennedy about, you know, maybe they had positions there.

And so in addition to learning about a lot of things having to do with running a center, I learned, at that time, at least, what was important to me, and it was about still being in operations. So I was lucky enough to get a chance to come back here.

The only thing I tell people—a lot of people have over the years asked me about going to Ames, because particularly in the Astronaut Office, a lot of people go through the same thought process I did, which is, "Hey, I've done this for a while," and kind of thinking, "What should I do next?" and, "Where could I get some experience?" The thing I tell them is that for me it was

great. I mean, it was the right decision, and it all worked out. The thing that I would do different, though, is I assumed that I'd be able to execute this plan that I just described, and that at the end of two years, if I didn't like it or I wanted to try something else, I could just do it. I didn't realize [that] I was a little bit naive, and I'd tell people, the thing I would have done different was drop bread crumbs or attach a life line or get something in writing, because one of the things that happened when I was out there, when I went out there, I did so at the request of Dick Truly, who was the Administrator, with the knowledge of [Dr. William B.] Bill Lenoir, who was running Code M, with the support of my Center Director, who was Aaron Cohen, and the support of my immediate boss, who was [Donald R.] Don Puddy, who at the time was Director of Flight Crew Operations.

Well, in the course of those two years, Puddy was leaving, Cohen was leaving, Lenoir and Truly had left, and so all these guys that I knew and who had asked me to take on this job, and who I figured if I ever just told them, "Hey, here's what I'd like to do next ," you know, they'd let me do it, they were all gone, and there wasn't going to be anybody left that had any clue who I was. So that's the one thing I'd have done different, I think, is I would have had kind of an escape plan, if I really wanted to preserve the option to do something else. And that's what I have told people that asked me, is, "Yeah, it was a great experience, and I got everything out of it I wanted. The thing I would have done different—." I was lucky that it resolved itself the way it did in the way I wanted it to, because there's certainly no guarantee that you'd be able to be as mobile without some preexisting agreement. But, by and large, it was exactly what I had hoped it would be.

JOHNSON: I think we're going to stop and take a break here for just a minute.

HAWLEY: Okay

[End of interview]