

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

MARY L. CLEAVE
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is March 5, 2002. This oral history is being conducted with Dr. Mary Cleave for the NASA Johnson Space Center Oral History Project at NASA Headquarters in Washington, D.C., where Dr. Cleave currently serves as the agency's Deputy Associate Administrator for Earth Science. Interviewer is Rebecca Wright, assisted by Kevin Rusnak.

Thank you again for participating in this project. We certainly appreciate your time, and we'd like to start today with your sharing with us how your interest in space began.

CLEAVE: I was interested in airplanes before space. I started flying when I was fourteen. No one's really sure why I was so crazy about airplanes when I was a little kid, but I was crazy about airplanes. Nobody else in my family flew except for my mother's brother, who was a pilot that was killed in World War II, so I didn't even know him. They always had his picture up on the mantle of my grandmother's house.

So I don't know how I made this connection, but anyway, I started making model airplanes and took my first flying lesson at fourteen. My parents said if I wanted to fly, I'd have to make the money to do it, and so I gave baton-twirling lessons and babysat a lot, and got the money and went ahead and took my first lesson.

Then after that, they realized I was really serious about it, and I was really lucky I had an old retired Army Air Corps test pilot who was my instructor pilot, and he was nice and told my parents that I had an ability to do this, because I didn't have any cross training. I had no idea

how to drive a car. He said, “This is the first person I’ve ever had in an airplane that doesn’t have anything to forget about [driving] mechanics; her whole interaction is with an airplane.”

[Laughter]

And so they were nice and said if I made the money, they’d match me. So I went through and soloed when I was sixteen, got my solo license and then got my private license when I was seventeen. Since I lived in New York City, you had to be eighteen to drive a car, so there was a period of my time where I was legal to fly people before I was legal to drive people, which is a very bizarre thing.

When I went to undergraduate school, I thought I wanted to be an airline stewardess, but in those days, you had to be 5’4” to be an airline stewardess, and I was 5’2”, so in 1969 when I graduated from college, I was rejected as an airline stewardess. In 1979 when I graduated from college with my Ph.D., I applied and ended up going down to Houston [Texas]

So that’s what happened in that decade for women. Affirmative action made a huge difference, and I was right on the leading edge of it. My interest was airplanes, and, in fact, when I found out there was a possibility of flying in T-38s, I really thought that was neat because I never thought I’d get to fly in a high-performance jet. So, for me, space flight was great, but it was gravy on top of getting to fly in great airplanes.

WRIGHT: You were out in Utah when you found out that there was an opportunity to apply as an astronaut.

CLEAVE: Yes. I was working at the Utah Water Research Lab, and one of the other research engineers working at the lab was at the Logan post office and he saw posted in the Logan post

office an ad from NASA saying they were looking for scientists and engineers to go work in space, and it was right up next to the “Ten Most Wanted” posters in the post office. [Laughs] He came back to the lab and he said, “You’re the only engineer I know that’s crazy enough to want to do something like that,” because I was always liking to do crazy things, ski too fast, among other things, and that kind of stuff. So it sounded great to me.

At that point, I was just working on the tail end of the course work for my Ph.D., and I was in the middle of my dissertation research. That was the first application, and I didn’t get in that time. There was this little post card that came and said, “Are you still interested?” I sent it back saying yes, refilled out my whole application to make sure they got the whole thing, sent it in, and the second time around, I got the call for the interview.

WRIGHT: Tell us about the call. Was it a surprise?

CLEAVE: Yes, but the first inkling I had was, when you go past a certain point, they start doing a background check on you. Although nobody was supposed to know they were doing this and they asked everybody not to talk about it, if you live in Wellsville, Utah, which is a town of 2,000 people, I mean, forget it. This stranger shows up, and I was getting phone calls saying, “All right. He’s just left the building. It looks like he’s driving down to 23rd Street. I bet he’s going to see Maude,” something like that. So those poor guys, I knew where they were the whole time they were in the valley. [Laughter] So I had a feeling something was going on. I knew things were happening because of that, but the interview was fine. It was great. It was a good experience. So even if it had stopped there, I would have been happy.

What I was really surprised was when I got [the acceptance] call. My sister answered the phone. She worked part-time for the Forest Service, and so she said, “Mary, it sounds like there’s a fed on the phone,” and in fact, it was George [W.S.] Abbey. [Laughter] “Yeah, that’s a fed on the phone.”

That was neat, but we had a very short time then for me to pack up and leave the valley and wrap up all my active research and stuff. It was pretty hectic, because they called around Memorial Day weekend, and then we had to report on July the 7th or 14th. After that, they gave people more time, because we all showed up exhausted because we had so much to do to get down there in time.

WRIGHT: Was that the first time you had been in Houston?

CLEAVE: For my interview?

WRIGHT: Yes.

CLEAVE: Yes. Yes, and it was mid-March, and the weather was perfect, and the mockingbirds were up in the trees, and it was gorgeous. Little did I know what it was going to be like in July. When we moved down, it was a record-breaking heat wave and I was in an un-air-conditioned U-haul truck with all my belongings in the back, hauling across Texas with a governor in [the truck], and it was unbelievable. Yes, Houston’s a little tough in the summer.

WRIGHT: The adventure had begun. [Laughter]

CLEAVE: Yes, that's right. The climatic adventure had begun, that's right. That was a challenge I never really met. I never got used to the climate. It was just too hot for me.

WRIGHT: It hasn't got any better; it's still pretty hot. [Laughter]

CLEAVE: Yes.

WRIGHT: Except today; it's pretty cold here today. The interview process—before we actually get into your moving—were you surprised at any of the questions they asked, or did you feel like you were prepared for that whole process?

CLEAVE: It was the funniest interview I'd ever been in, because I came from academia and I was a research engineer, and so I was totally prepared to go in and knock their socks off with my technical ability, and the first question was, "So, did you play any sports in high school?" [Laughs] I went—because I was just—it was just totally unexpected, and it went on from there, because I didn't really understand what they were looking for. This was not a technical interview, because I wasn't going to be asked to go, necessarily, do my technical work. I was being asked to go do other people's technical work. So it ended up being, I think, much more an interview where they were trying to probe whether I was going to thrive in that environment, which was my take on it afterwards. But, yes, it was very unusual.

WRIGHT: Any other aspects? They gave you a tour? Or what other parts of the process did you go through when you were being interviewed as a candidate?

CLEAVE: I was shocked at the depth of the physical, because there were a number of people in our class that bounced. The majority of the people that came down—not the test pilots, but the civilians—they found something that disqualified them. Now they sort of changed the process so that they go through this preliminary flight physical at home before they'll send them down, but they weren't doing that then. So quite a few of the guys didn't make it through the process, and, in fact, one of the guys in the group, they found something really funny with his blood, and they sent him home to his family doctor, which was sort of depressing.

But then they had a party for us, and they had lots of alcohol, and then I started thinking, "Oh, this is interesting. They're probably checking to see whether we drink too much." Which they were, I'm sure, because we all did. [Laughter]

WRIGHT: Did you get a chance to get around the aircraft?

CLEAVE: Not on that first visit, but half of the class were test pilots, and so it was really interesting to be around people that were aviators. There I was, 30,000 feet kind of stuff, which was fun. In those days, it was really different, because these guys had never worked with women before—period. So it was all sort of this, "Ooh, there're girls here," kind of thing. So that was very, very different. When we started flying in [T-]38s, it was not a world where women were.

[Margaret] Rhea Seddon was able to argue to allow pregnant women to fly at all when they were pregnant, through their first trimester. Before that, the Air Force grounded them, and

she was a medical doctor and was able to argue that she should be allowed to fly. I can remember watching her down the flight line at El Paso [Texas]. She's small, and when she was pregnant, she was going into the restroom at El Paso, walking down the flight line, and she was already slightly showing in her bag. All military pilots, they were just [Cleave demonstrates]. They couldn't believe there was pregnant woman on the flight line. [Laughs] Things like that. There were no ladies' restrooms, so we were flying with these guys who were tough guys, and they had to stand guard for us outside the restrooms.

There were a lot of awkward things just because it wasn't set up for women. When we went through our survival training, the canopies weren't set up for people our size, so we were doing the parasailing off the boat and it was a pretty windy day. I took off and started going up and I cut the lines like we were supposed to so we could start coming down, and I kept going up.

WRIGHT: Oh no.

CLEAVE: There were all these little air force guys in their little speedboat. I watched them just going around and around that. They saw their military career just flying out to sea. They were just petrified. [Laughs] "Yeah, well, we lost one at sea today." [Laughter] That would be really popular. Finally, I came back down. I didn't feel that bad. I was heading for Miami, so I figured I was going to be seeing more boats anyway, but finally the wind shifted and I started coming down and I was way off course. I've never seen guys so happy to pull me into a boat. They were, just, "We never thought you were coming down," kind of stuff.

And afterwards what happened was, eventually they started issuing two sizes of parachutes, one regular and one extra small. Luckily, none of us had to bail out of an airplane

before, because we would have started going up instead of coming down, and you freeze to death up there. You run out of oxygen and you can't breath. So there were things like that.

It's exciting to be part of the first wave through that gets into a system, does okay. There's a lot of satisfaction in getting to a system, doing okay, and then opening up the doors for a whole bunch of other people.

WRIGHT: You were at the beginning of that new era, so you served as the guinea pig, the role model, all types of things.

CLEAVE: Yes, yes, it was fun.

WRIGHT: What other parts of the training do you recall, those first days that you were there?

CLEAVE: Well, the first-year training when we got down as a class, I think we were all pretty shocked at the amount of course work that was involved. We all expected more action stuff, and there was a lot of bookwork. My first flight in a [T-]38 was with Bud Ream [phonetic], who was an IP [Instructor Pilot] at Ellington, and here I've been waiting my whole life to get into a high-performance jet, and he had been given firm instructions, "Don't get the new scientist sick." So that whole flight was me pleading with him to do something with the airplane. [Laughs] "I'm not going to get you sick." "I won't get sick. I won't get sick." [Laughter] Things like that, people bending over backwards not to do stuff, and you're trying to do stuff.

But after the first six months when we were all getting our first assignments and stuff, then it became more like what I expected it to be, which is more on-the-job kind of training stuff, so that was fun.

WRIGHT: Also when you got to NASA, a group of astronauts that had been in the astronaut program for a while were still there. Did you have much interaction with the older astronauts, the ones that had been in front?

CLEAVE: Yes, because when we first came down, actually the guys in the class of [19]'78 had more of this than we did. They were so understaffed, bringing the Shuttle on line, that they were just so happy to see some extra people that were coming to help, that they just started throwing work at you. "Yeah, you can do this." So that part of it was really interesting.

The office was extremely small then, so there is any number of opportunities, because there was too much stuff to go around. I was the first guy in my class to get assigned to a real job, because the head didn't work on the first flight of the Shuttle, so John [W.] Young gave me my personal assignment: fix the head. I said, "Sir, I'm used to working on the other end of the pipe." "You're a smart girl. You'll figure this out." And I did. Well, we did. There was a tiger team, and we worked on it.

That was a funny thing, because you do these press conferences and everybody would stand up and go on attack this and fighter that, and all that kind of stuff, and I'd stand up and go, "I'm Mary Cleave, sanitary engineer," and everybody would go, "What is she doing here?" And I was the first one to get a real job and I had real jobs involved with life-support problems the whole time I was down there.

WRIGHT: It must be how you got that title of “first space plumber.”

CLEAVE: Yes, or “sanitary fairy.” Yes, yes.

WRIGHT: I’m sure Captain Young must have enjoyed giving you all types of tasks to do.

CLEAVE: Yes, he did, and, in fact, to this day, when I go down to Houston, I stay with John and Susie, because I think he felt so bad because he kept giving me all these dumpy jobs to do. [Laughs] But it was good. I was happy to do it and that kind of stuff. So, yes.

WRIGHT: When you mentioned about the interview, that you were thinking they were going to talk to you about your technical experience, at what point or did at any point in your training, did you feel like your technical experience and your background helped you get your jobs done?

CLEAVE: Well, it helped me a lot. In the classes, there were times—as a sanitary engineer, I had a lot of fluid flow, Reynolds numbers, and that kind of stuff, but it was all in the inside of pipes. I remember sitting in this aero class, and all of a sudden I was looking at the bookwork and I started saying, “My god, this airplane is just an inside-out sewer pipe.” I sort of shared my great “aha” with my classmates, and none of the test pilots were at all impressed with this great visualization of their airplane being an inside-out sewer pipe. [Laughter] But it really was. So, yes, there were things like that that happened. And when it came to life-support stuff, yes, I did a lot of work, and I really worked based on what I had learned in school.

WRIGHT: We know that Mr. Abbey assigned you to the Shuttle Avionics Integration Laboratory.

CLEAVE: Yes.

WRIGHT: Could you tell us about your experiences there and the duties that you had?

CLEAVE: We were testing flight software, and a lot of what we were doing was just running different scenarios, and it was fun. For me it was fun, because usually I was assigned—there was a pilot and a mission specialist assigned, and we'd do the payload stuff. But a lot of times we'd end up having to fly or help fly scenarios. When you're working a simulator, it's up a lot and then it's down a lot, so it gives you time to really get to know everybody. The people you're assigned to, you get to share war stories. So it was a lot of fun, really get to know people that way. For me, it was really good training.

WRIGHT: At what point did you get moved into doing the CapCom work? Were you there for a while?

CLEAVE: I know I was there for STS-7 because I was on when Sally [K. Ride]—we were the first female-female connection.

WRIGHT: Would you like to talk more about that, since you brought that up, about that mission and—

CLEAVE: Well, no, I mean—

WRIGHT: —your memories about that?

CLEAVE: No, I didn't even notice it. Here's Sally and I, we didn't even notice it. But I was on duty, and one female reporter, who will go unnamed, afterwards said, "Mary, it was so disappointing."

And I said, "What do you mean?"

"You and Sally just had a normal conversation."

"Yeah. We were working."

"Well, you should have said something special for this momentous occasion."

"What momentous—?"

"First female-to-female communication."

And I went, "Oh, we didn't notice." [Laughter] Sort of like, "Well, I'm sorry I disappointed you, but really we didn't notice it."

WRIGHT: Just doing your job.

CLEAVE: Yes, yes. And that was good. That was really good. That was fun.

WRIGHT: You mentioned that off and on, about this new beginning and new era of women. Did you feel any kind of resentment from the test pilots or any type of animosity with your other astronauts, or did everyone just feel like you were just there working as astronauts?

CLEAVE: No, I never got any feeling of overt anything. There were issues to deal with all the time. These guys, when you change society like that, these guys are all dealing with having to go out in the field with women in a situation where their spouses weren't used to this kind of brave new world, and so there were issues you had to deal with in that situation. I'm sure it would have been easier for them not to have to deal with it, but they did that.

Some of the guys didn't want to fly with women because of that, so you might have had a little—I mean, the only thing I ever really noticed was you might have had a little more trouble trying to get your flight time in back seats just because some of the guys are reticent to go TDY [Temporary Duty] with you, because they got pressure from at home. Other than that—

WRIGHT: But the duties assigned—

CLEAVE: No, no. There was one thing. It seemed like they assigned women to fly the arm [Shuttle Remote Manipulator System (SRMS) or Canadarm] more often than guys, and the rumor on the street was because they thought women did that better. But I never bothered to check on that. It was just something. I mean, that's really a real thing you could do. When I was down there, there weren't any women pilots, so that whole half was not available to you. In fact, when I got assigned to fix the head and I actually fixed it, after I did that, Joe [Henry] Engle made me a little sign saying, "The best man for a job may be a woman." [Laughter] So, yes.

WRIGHT: Well, in November of 1985, you launched with the crew of STS 61-B. Tell us about what led up to that. How did you find out you were selected for the crew?

CLEAVE: I found out I was selected from the crew like everybody else finds out: George [Abbey] told me. You don't know, and then George calls you over and you find out.

That first crew was great. The D.C. contingent, Bryan [D.] O'Connor and Woody [Sherwood C.] Spring and I, still get together two or three times a year. Our families all get together. It's almost like we—and Jerry [L.] Ross. When I'm down here, I always see him. To me, it was sort of like an extended family. All of us were rookies except for the commander, [Brewster H. Shaw, Jr.], so we were all sharing this for the first time around. We had to train for two years, and we flew three semi-payloads, because there were so many manifest bumps, that we were training together all the time. We just got to know each other really well. It was great. We just had a great flight; everything went well. The EVAs [Extravehicular Activity] were fabulous.

WRIGHT: Did you have any idea that you were going to be selected for this flight?

CLEAVE: No.

WRIGHT: No indication?

CLEAVE: No, no. I didn't really expect to be selected yet, but I was happy. And Bryan O'Connor and I, when we first got down, we were doing our initial skit for our class. You do all these skits. He did a Guido Sarducci kind of comedy routine, so we were the first "mother-father" team in space. We figured George probably assigned us to a flight together because of that skit. [Laughter]

WRIGHT: Well, that's a new reason.

CLEAVE: Well, we were just teasing.

WRIGHT: No, I know.

CLEAVE: The thing that was different about that flight was everybody else on the crew had been through test pilot school at [Naval Test Pilot School at Naval Air Station Patuxent River, Maryland] Pax River or [USAF Test Pilot School at] Edwards [Air Force Base, California], and Woody, because he was an army aviator, had been through both Pax and Eddy, and I was the only non-test pilot in the group. Jerry was the flight test engineer on a B-2 bomber and Woody was an army helicopter pilot. So as we got into the training, we slipped into this payload that we ended up with, with the space construction experiment, because it looked like we were going to go EVA. There was this rule that says, if you can avoid it, you don't have a flight crew member go EVA because you're going to need him for reentry. So they couldn't fit me in a spacesuit because I was too small, and they decided not to buy these small hard upper torsos to save money. They were going to fit the mid-range of the astronaut corps, so they ended up having to

train me as a flight engineer. So I was a flight engineer on that flight, and I flew the arm. That was, for me, a real disappointment when I found out I couldn't go EVA, but I was happy with how it came out. So, yes, it was fun.

WRIGHT: During that mission, the crew deployed three satellites. You recorded the deployment with the camera that was on the arm. Could you tell us how you prepared for that and your experiences while you were doing that?

CLEAVE: Just flying the arm, in general, the training's really interesting because you have the simulator that's the cartoon one, with the models, and then you have a physical simulator, which is a hydraulic simulator. You have Captain Cardboard in there, and the hydraulic one sort of gets the palsy. Captain Cardboard sort of shakes, so you never get anything with the dynamics of the arm, so everybody said—who you talked to who flew the arm, “Once you first get up there, just take some time before you do anything else and just move the arm around before you have to do anything with it, because you're going to be shocked at how fast it goes.” And, yes, they were absolutely right.

So right before I did that, I had my first chance to really fly the arm. You push the thing in and it just goes “poof!” So it was an experience, just getting used to doing that. It was easier, which is what you want out of a simulation. When you get up there and actually do it, you want the task to be easier than it was when you were training, and it was, except for one thing. We were facing the Earth and I was working the arm. This was when I had Woody and Jerry on it, doing the space construction experiment, and I had them up in the top window and we were payload bay to the Earth like we usually work. So you had the Earth going at Mach 25

underneath you, and it was a moving target. So I was trying to move them against the truss, against the Earth, and ended having to make a big mark on the window so I had something to move them against. It was really distracting until we figured this out, putting them on the edge of the window, and that kind of stuff.

I came back and was debriefing that, and somebody pointed out, in the Gemini Program, they almost missed a rendezvous because of the same phenomena. What they did was, they always did it against deep space, and I went, "Well okay, so we made the same mistake twice."
[Laughter]

WRIGHT: Did you find that the training that you had in the simulations was very much an advantage once you got into space?

CLEAVE: Oh yes, couldn't have done it without it.

WRIGHT: And how about the CapCom experience? Being part of that, did that help you as well, and in what way?

CLEAVE: Yes. Well, you live the mission with the people up there, so you know exactly what to expect, and vice versa. I think flying made me a better CapCom, because you really know what people are doing up there. The one thing that I really thought helped through this whole process was particularly when it came to building instructions on the ground. When I got them up there, I could look at them and there'd be some really strange stuff in there, but because I had been

doing that on the ground, I understood why they seemed a little bizarre. Those kinds of things, yes, yes.

WRIGHT: Also part of your duties, you had a series of experiments that you were responsible for in the mission. Could you tell us that procedure and how you prepared for those, to do somebody else's work, as you mentioned earlier?

CLEAVE: The experiments I did on this first flight—then I want to go back and make a comparison between the first and second flight for you—the experiments I did on the first flight were for 3M. That was really a great group to work with. They were serious about trying to do commercialization of space, very professional. You'd make comments on what you needed out of their equipment, and they were right there, both preflight and postflight.

I did five different crystal experiments for them, of which four I had to sign a proprietary agreement on, so I still can't talk about them. But the fifth one was an organic compound that conducted electricity. So even back then, they were thinking about making organic compounds that you could use as a chip, at a molecular level. So it was interesting work.

Talking about the training, one thing I realized after my second space flight—on my first space flight I was a flight engineer, so during the whole ascent phase, I was totally focused on what I was doing. On my second flight, I realized how much I'd missed, because on my second flight, I was flying with Mark [C.] Lee and he was a rookie, and so I said, "Mark, what do you want, the flight deck, ascent or entry?" because we were doing the Magellan deploy so we weren't in the flight crew. He wanted to fly upstairs. There were five of us, so one person had to be alone downstairs. He wanted to fly upstairs for ascent, so I was downstairs all by myself.

That was post accident [STS-51L (*Challenger*), 28 January 1986], so all I had to do was deploy the bailout pole and stuff. I had a little altimeter and little switch so I could depressurize the cabin. That was it. I was by myself and I was push to talk and I got to enjoy the ride. I thought it was a really lousy deal. “I’m going to be all by myself down there and I can’t see a thing.” It was great. It was great, because I could hoot, I could holler, I could have a marvelous time, and, man, that’s a ride. You know, when you’re working so hard, you don’t even appreciate it. It’s really a great ride. [Laughs] So my bad deal ended up being fabulous.

Except when I got up to orbit, I was so aware of what was going on, I felt like I had turned upside down, and I had to fight with myself to undo my seatbelt. I mean, I go, “Mary, you’re not going to fall on your head.” I feel like I’m going to fall on my head, because I really could feel like I was upside down. Rationally, I knew there was no gravity, but I mean, I had to fight with myself to undo my seatbelt. It was really weird.

WRIGHT: A little different from the KC-135.

CLEAVE: Very, very different. Yes.

WRIGHT: On the experiments, the process that you did on the ground, did it differ much from what you were doing in space? And how did you prepare for that change of what you were going to be doing, how you prepared for it on the ground, but yet you were doing it?

CLEAVE: It really wasn’t that much different. I’ve flown on a KC with these guys, and this whole experiment was pretty automated. It was mostly inputting data-recording devices and

inputting stuff. Now, we were the first guys to try to—on my second flight—collect information on a floppy, and we did this furnace-control experiment using a laptop. That was a much more interactive thing. My first flight had really helped me get ready for my second flight.

WRIGHT: You were so busy, did you have any other times that you enjoyed while you were there? Did you get a chance to do other photographs?

CLEAVE: On my first flight, very few, because I was really working a lot. On my second flight, we did the Magellan deploy, and it was a four-day flight. It was fabulous. That was crew selection where Mark and I had worked on—after the accident, we had worked on deploying different kinds of spacecraft. So I never expected to get assigned that fast after the accident, so I was really surprised when they assigned Mark Lee and I to do this Magellan deployment. I mean, I was thrilled, because it was the first time we deployed a spacecraft that was going to another planet from the Shuttle. So it was a lot of fun. It was great work. [Working with] the guys from JPL [Jet Propulsion Laboratory, Pasadena, California]—it was great. That was, to me, one of the slots you could give a mission specialist that was a meaty assignment, so I was really happy.

We ended up working real hard until we deployed it, but the thing is, get it out of the payload bay as fast as you can because then it's not JSC's problem anymore, it belongs to JPL. So get rid of this thing. First day, it's out of there. Then we had three days. So that flight I got to do a lot more picture-taking. I also wasn't [part of] the flight crew, so I could stay up. I didn't have to worry about crew rest. So basically for the rest of the mission, I didn't sleep too much. I was up taking pictures and just having a good time.

WRIGHT: Enjoying the Earth?

CLEAVE: Yes, yes.

WRIGHT: Sounds like a good deal. Before you flew, as you mentioned, in between your first mission and your second mission, the country and NASA experienced the *Challenger* tragedy. Where were you at the time when the *Challenger*—

CLEAVE: I was in the meeting room at CB [Astronaut Office] watching it with everybody else, and we knew right away what the problem was. In fact, a bunch of guys got up and said, “We’re going out to Ellington [Field, Houston, Texas].” They got in the 38s and went down to the Cape [Canaveral, Florida]. Then it was damage control on the floor, because a lot of people, mainly just staff, were really upset. For the guys in the [astronaut] corps, when you’re in the test pilot business, you’re sort of a tough guy. It’s a part of the job. It’s a lousy part of the job, but it’s part of the job. But I mean, the secretaries and everybody else were really upset, so we spent some time with them.

When we flew, it was the heaviest payload to orbit. We were already having nozzle problems. Before my first flight, I had signed up. I basically told my family, “Hey, I might not be coming back,” because I think a lot of us understood that the system was really getting pushed, but that’s what we’d signed up to do. I think probably a lot of people in the corps weren’t as surprised as a lot of other people were.

WRIGHT: Did you have specific duties assigned to you after the *Challenger* to continue on with work, or did you have new duties assigned? Basically, what did they ask you to do during the time that we weren't flying?

CLEAVE: I did crew family escort afterwards. I was assigned to help when the families came down, as an escort both at JSC when the President came in to do the memorial service. I was working at—Jim [James F.] Buchli was in charge of the group. They put a marine in charge of the Honor Guard. So I got to learn to be an escort from a marine, which was interesting. I learned how to open up doors. This was sort of like it doesn't matter if you're a girl or boy, there's a certain way people need to be treated when they're escorted. So I did that. That was interesting. And it was nice to think that you could help at that point, because they had people from the corps assigned to all the families to try to help them.

Then my official duty, I really just sort of worked at what I was working at, and then when they located the crew compartment, I got assigned to be in charge of the area where they brought the crew compartment back, probably because I'd been working the personal-equipment issues, so I understood how they recorded numbers and kept track of all that stuff.

WRIGHT: I guess it was a very good piece of news when you found out you were going to get to take your second mission then.

CLEAVE: It was wonderful. It was wonderful. We were all really working hard supporting the twenty-sixth flight. We were all really busy, because after the flight, we were extremely busy

because we did a piece-by-piece safety review, and that took an incredible amount of time and incredible effort.

WRIGHT: You think your contributions during that time period were implemented or at least listened to?

CLEAVE: Yes.

WRIGHT: And you were the first woman to fly after the *Challenger* accident. Did you feel like there was any pressure or any undue attention that was given to you because of that?

CLEAVE: They tried to. They tried to. People tried to make a point of it, and I just let everybody know that I didn't think that anybody should be making a special point out of this. There were two women that were on the *Challenger* when it went. Judy [Judith A. Resnik] happened to be a very good friend of mine. So it was just a normal part of the thing, and I just didn't think it was good to make anything special out of it, because at that point we really were part of the corps.

WRIGHT: You didn't have any hesitation about taking that mission assignment?

CLEAVE: It was safe. It was much safer the second ride. Are you kidding? [Laughter] Much safer.

WRIGHT: I know during the STS-30 mission, you had some minor problems, or I guess they sound like they're minor now. You had different things happen. Did that affect you?

CLEAVE: We took a single-event upset on a computer. Yes, because...it was during a high solar cycle. Yes, so we got to change out a computer. It was really fun. We really were surprised that they had us change it in the first place, because we took it down and brought it back up and it seemed to be running okay, so when they said, "Go ahead and take up the spare computer." Mark Lee and I were the IFM [In-Flight Maintenance] guys. We sort of looked at each other like, "Are you sure we want to do this?" [Laughter]

WRIGHT: The new job as the jumpmaster and taking care of that, you were ready to do that if needed to?

CLEAVE: Yes. The biggest issue with that was that all the gear that we were wearing—I got assigned to do tests on it because all the gear was about seventy-five pounds, and coming into a flight, when I was working real hard—this doesn't happen anymore—but I used to lose a lot of weight when I was really concentrating on stuff. So I could get down, weighing in at about 102, 103 pounds right before flight. So you dump seventy-five pounds on your back and then run around with this and escape from this. So you have to sort of hope for a lot of adrenalin, and you would have a lot of adrenalin. That was the hardest part of that, was putting up with the gear. The suit was really uncomfortable. There wasn't active cooling in the Shuttle at that point. They added it afterwards. First flight, things were really loose. There was no pressurized suit. You

pretty much unstrapped, sat on the back of your chairs, joked around and had a good time, because of everybody was so excited. The second flight was safer, but much more serious.

WRIGHT: You were assigned to another mission, but did not go. Could you share with us the reasons of not going on that one?

CLEAVE: I had four years between my first two space flights. I'm an environmental engineer, and the more I thought about it, the more it bothered me how fast the Earth is changing. I mean, only four years and I was looking down and there were just huge changes, in my mind, for a four-year period, because that's really no time at all. It just started really, really bothering me. I just couldn't get that excited about what I was doing, because it wasn't related to that.

When I said I wanted to go to Goddard Space Flight Center [Greenbelt, Maryland], everybody said, "You're nuts. What do you want to go to Goddard for? God, work with those unmanned spacecraft. You must be crazy. Don't do this. It's a one-way gate." I was told, "It's a one-way gate. Don't leave Johnson Space Center. Go over, work in Engineering for a year and make sure what you're doing before you leave." It was standard military practice: don't do any traumatic decisions until you think about it for a year.

So I said, "Okay, I'll go work in Engineering." And after the year in Engineering, I worked in crew systems. I had a great time. I worked life-support issues, came back.

And they said, "Don't you want to rejoin the corps, take another flight?"

"No, I want to go work at Goddard Space Flight Center."

So at that point, then they were really nice. Aaron [Cohen, JSC Director] dumped me on his airplane when he was coming up to D.C., and I stayed with Dee Lee. She was up here. I

went up to Goddard and had an interview, talked to a bunch of guys on projects, found a project I happened to think I was meant for all along, and then sort of moved. For me, it was the right thing to do. It was fabulous.

I had a hell of a time making the decision. The amount of pressure that goes in to people when you decide you don't want to do what most people consider to be the best job on the planet was really pretty tough. This is a very tough transition, because basically you're going from a job where you're saying, "This job is so important, I'm willing to risk my life for it." Then you have to go through the mental trip of going, "Okay, this job is that important, but now I'm going to do something else." For me, it was a really hard transition, but it worked out great. I have no complaints at all.

WRIGHT: Between the first mission and the second mission, what type of differences or what type of observations could you make from space that you could tell that the Earth was changing?

CLEAVE: Cities were gray smudges; the gray smudges were getting bigger. The air looked dirtier, less trees, more roads, all those things. I was concerned about the environment before I went to Houston, and I'm still concerned about the environment, but now my job, I'm in the middle of trying to make effective policy for the country. It's not always the way I want it to be. I'd be the first to admit this, this year, but at least I feel like I'm working towards an end in a very effective way, and that's how I spend my time every day.

WRIGHT: I wanted to ask you, too, about being part of the astronaut corps. You had your specific duties, you have your missions, but overall, as part of the class, could you share with us

the experiences of being a member of that group of people who, as you mentioned, have the best job on the planet, or maybe off the planet? I guess it depends how you look at it.

CLEAVE: It's really a great experience, because you're working with a whole bunch of very smart people that are very focused on what they want to do. And if you have a shared interest like that, it's great. The only thing that really sort of surprised me was, I think, how much it is—you also can find this kind of thing in a research setting, too, same thing. You have a bunch of smart people and you're pushing towards a common goal. I mean, for me, it's where you want to be in life. It's not a job; it's an avocation.

WRIGHT: The astronaut corps works with so many other facets and aspects and employees of Johnson Space Center. How was the interaction? How was your interaction with those other groups, the engineers and all the other types of people at mission control that you worked with? Could you share some of those experiences on how you got to know them and to know those duties so that you could do those jobs well?

CLEAVE: I was an engineer. I am an engineer. So I ended up working with the guys in crew systems and thermal when I got my first assignment to work on the head. I'm still close with Gene Winkler. When I go down for a physical, I still see all these guys, stop down and talk to them. I'm still interested in life-support issues. I'm just working them on a global scale now. They work them on a smaller scale. It's the same issues. I got along with them, and I still get along with them.

WRIGHT: As an astronaut engineer, did they take your input as seriously as they would as an engineer that worked with them every day? Were you able to trade information and assist each other in—

CLEAVE: Well, there's one difference. After you fly—and I still utilize this—it's very hard to design equipment and do things for an environment you've never been exposed to. So anybody in the corps that's flown has this advantage of having an intimate knowledge of what Zero-G really is like. It helps you in design. Imagine trying to design a car if you've never been in a car, that kind of thing. So in that way, you can provide them with special assistance, and they understand that, as long as you're polite about it. What you have to watch out about is that you don't drive the system because of that special knowledge. If you aren't careful, you can overdrive the system and they'll be too responsive.

WRIGHT: Do you recall any specific item or any specific issue that you brought to them to look into or to enhance or improve after you returned from your missions?

CLEAVE: Every single time, yes. And that's why I ended up working with the life-support guys. In the first flight, it was dirty air and air quality. That was the biggest thing. There were a whole laundry list of things. Second flight, I'm sure there was something involved, but now I can't remember what it is, besides the moving targeted stuff on the arm, and how to design things better so they work better in that kind of environment, when it came to RMS-related issues, those kinds of things, how you position yourself in front of the panel to get better stability and those kinds of things.

WRIGHT: Did your size in any way help or hinder you in space because you're only 5'2"? Did that help you be able to do more or did it affect anything other than the EVA suit?

CLEAVE: I'm sure that because of the expense of putting people in the front part of the spacecraft, that they got more from me per pound than they got from the other guys in the crew. Being small was an advantage. For someone that's attitudinally challenged, it's great. I spend my whole life finding a stool, and that wasn't a problem there. You just sort of float up and get stuff. It's great. I was in there in the old days. Most of the test pilots are pretty small, too. Most of the guys are small. I used to fly with [James D. A.] Ox Van Hoften in a T-38 when he went to put the canopy down, he'd go like that [Cleave demonstrates ducking her head].

WRIGHT: As an astronaut, some of the other duties that you had included doing public-relations duties as well. Is that an aspect that you enjoy doing or is that something that you did as just part of your job?

CLEAVE: I like the role model part of it and going out and being in situations where, potentially, girls or young women might consider doing something they wouldn't consider doing before. In particular, I liked working on math-anxiety issues. I worked with Muriel [Schloss] on a book. She wrote a book. There's a series of books for junior high school girls and there is one on a veterinarian. We did one on my job, like that, so that girls will think about doing different kinds of jobs.

It's getting to be less and less of an issue, but there is still an incredible issue with targeting young women so they don't decide that they don't want to do math in junior high school. They were good at it in elementary school and they get into junior high school, and because of peer pressure, they like to pretend they're not good at it. We still have a lot of work to do in that arena. I'm on an academy diversity panel now at the National Academy of Engineering, working on those issues. I really got introduced to working on them down in the corps.

WRIGHT: After you returned from your missions, did you have any specific public-relations-type duties that you had to do?

CLEAVE: First flight, we had the first Mexican astronaut, so we had a trip to Mexico as a post flight. The second flight, we got to come up to the White House and President [George H. W.] Bush—the first President Bush—we had dinner at the White House. That was really fun.

WRIGHT: Other duties that you had after the mission, were they many and varied that you had, or were they minimal and nonspecific?

CLEAVE: You mean—

WRIGHT: After return from the missions, what all did they have you do?

CLEAVE: No. There was a lot of work to do. After the first flight, we were still in a post-flight period when the accident happened, and then we ended up all doing different stuff. Then after the second flight, I didn't have that much time before I was reassigned to this other flight, but I was consistently working on life-support issues, because there was always—and there still is—a lot of work to do in that arena.

WRIGHT: Were the expectations, when you went down for that interview in Houston in March, the expectations that you had if you got to be an astronaut, did they meet up, or did they match, or did they exceed of what you ended up with once you left the astronaut corps?

CLEAVE: I guess I haven't really thought about that. I didn't really know what to expect. I just knew I wasn't going to be driving a desk, which was good. And I didn't drive a desk, and that was good. I guess I went down there really hoping that I could provide a real contribution to the office. I never got the feeling that I didn't do that, so I guess it did meet what I wanted it to meet.

WRIGHT: You were all individuals, and each one of you contributed something to the space program that is still long-lasting. Could you share with us what you feel is probably the greatest accomplishment that you had while you were there?

CLEAVE: That's hard. Uniquely, probably what I contributed, I think, was in the area of habitability in these life-support issues. They didn't have any civil engineers that had specifically worked these issues before, except for one gentleman who was over in the space

science side of the house. He didn't have anybody to interface with in the corps, so we got to work together pretty closely, because the corps was pretty guarded about what happens in spacecraft and stuff, so it's hard if you're working issues that butt right up against the corps, particularly in the earlier days, less and less so now, to really work issues.

I felt like I did a lot of work on the arm and contributed to that. What we did on my first space flight with the construction experiment was a stretch. The first time we used the arm as a cherry picker kind of thing, that intensely, and [for space construction] it worked out really well. So that was good. Second flight, it's obvious because it was the first deployment of a spacecraft out of the Shuttle. Magellan did great work, great work, and got me interested in unmanned spacecraft.

WRIGHT: What would you consider probably the most challenging period that you had to do while you were there?

CLEAVE: I guess it was the cultural differences between somebody like me that came out of a university research environment, and interfacing that with the military environment, because that was back in the seventies, and the seventies were closer to the sixties and all the guys in our class flew in Vietnam. In fact, it was always interesting in the first flight when we had daylight over Vietnam, getting a lot of war stories. Then load that on top of the fact that these guys weren't used to working with women at all, they weren't used to having women in their environment, but that was probably the biggest challenge to try to work, not to take stuff personally, but rather to just see it as part of an unfolding of events, something you're mutually working on.

WRIGHT: Many changes happened in a really small amount of time, didn't it.

CLEAVE: Absolutely, absolutely. Yes. I was really lucky. If you compare what happened to me compared to my sister, who's six years older than I am, I mean, I had it just right. She was just ahead of it. If she had been born when I was born, she would have been a psychiatrist instead of a psychiatric social worker, because she ended up being a nurse first.

WRIGHT: Before we end, I was going to ask Kevin if he had some questions that he thought about asking you as well.

RUSNAK: Sure, I had a few, if you still have some time.

CLEAVE: Yes.

RUSNAK: You had spoken to Rebecca a little bit earlier about—you weren't really sure what your expectations were when coming into the astronaut corps. What idea did you have of what a Shuttle astronaut did, since pretty much the only astronauts they'd had were these Apollo guys and then some on Skylab, I guess. Did you have any kind of image of what an astronaut was going to be?

CLEAVE: I think we'd all watched the Apollo Program pretty carefully. Although they were test pilots except for one guy, they did do geology up there, so they were doing experiments. On

Skylab they did a lot of experiments. So I just figured we'd be doing stuff like that, and it wasn't that far off.

RUSNAK: You mentioned working with the engineers. I was wondering what interaction you had with the flight controllers and flight directors, learning to work with the mission control team.

CLEAVE: I don't know. I think of them as being engineers. [Laughter] They are engineers. The guys from the life-support group I was talking about, they're in there too. They're in the back rooms and then they've got somebody on console. I don't separate those two groups. I just don't. To me, they're the same thing. Sorry.

RUSNAK: Also you talked about how important your work was on the life support. I was wondering if you could be a little bit more specific with some of the issues that you mentioned, the dirty air, for instance, and then obviously the head on the Shuttle, but maybe some of these other things that were really critical problems as you were going along.

CLEAVE: Another problem we had on our first flight when we first got up to orbit, when we took water out to drink, it was brown, and that's because what you do is you use iodine to disinfect the water on orbit because chlorine's too reactive, so it's just like iodine tablets like you use in the field. They came out of a resin check valve. It got short-circuited by the hydrogen in the water that we were getting off the fuel cells.

It turns out that a number of the symptoms of space adaptation syndrome that they were chasing in the very beginning may—*may*—well have been attributed to overexposure to iodine, because they were overdosing the water because of this problem. It was also very unpalatable, so people were dehydrating, which isn't good, too. So, working those kinds of issues. Yes, there's a whole list of them like that

RUSNAK: Was that just part of the Shuttle system or did you work like the EMU [Extravehicular Mobility Unit] in that respect, as well?

CLEAVE: I very rarely worked EMU issues, because most of those were worked by guys that were going to go EVA. Since I was so small, I think they probably figured I probably wasn't a good bet for getting out there.

RUSNAK: Clearly a lot of your time was taken up training for flying your Shuttle missions, but did you have any interaction with the Space Station program that kicked off in 1984? And I'm wondering what your thoughts were then on that program and as its gone through your career with NASA, even including up to now when the various iterations and, I guess, also the role of earth sciences in the Space Station Program.

CLEAVE: Although I wasn't formally assigned a Space Station, I don't think, I worked life-support issues. All along we talked about putting a Space Station prototype head on the Shuttle and flight testing it before, and we worked all those things.

I remember being over in—what’s the building where they have the big Space Station mockup? And they had this huge habitability lab, and at that point it was incredibly fancy and they had all this stuff, and I was over there and I was working with someone, and they said, “Try this on. Do this, do that,” and I wasn’t in a good mood that day, and finally I looked at this person and I said, “Do you really think they’re going to launch something like this just for astronauts? By the time we get through this program, this thing is going to be cut to the bone because they’re not going to spend money like this just to keep the crew happy. Are you out of your mind?”

And I got a reprimand for that. I got pulled in saying, “This poor little engineer is just trying to do his job and you’re being miserable to him.” [Laughter] Yes, I was. I was. But, you know, I think we wasted a lot of money. It was too much. It was too much.

But I never really worked it that much except for the life-support issues. Then I ended going up to Goddard. I did get pulled back to Reston [Virginia] on the Red Team and worked Red Team issues in Reston. I did get pulled back to the Space Station redesign in Crystal City [Virginia], when I worked out of Goddard. I was detailed down there for four months and commuted to Crystal City for four months. I did the engineering payloads, attached payloads, life support, and those kinds of things. That was when we put—talk about earth sciences—that’s when we put Sage III on Space Station, which is the original and, to date, the only earth science payload on Space Station. And we’re still waiting to fly it. It was assigned in [19]’93. And we’ll leave that comment there. [Laughs]

RUSNAK: Since you’d mentioned the Station redesign, that’s when they’re looking at these three different options for what we do with Station, Option A, B, and C. I was wondering what your

comments were on each of those and maybe some of the strengths and weaknesses, if you remember that much in the area that you were responsible for.

CLEAVE: Oh man. Actually, we did. Specifically, I don't remember, but what we did was, I worked with Nancy [Bingham] from Ames [Research Center, Moffett Field, California].... She came up with a numerical system so we could rate all these things. I worked with those rating systems. Then actually we rolled up the rating systems into an overall rating. I never looked at the overall rating thing, because I was just dealing with my little subsystems.

So, by far the easiest thing and the fastest thing to do was going to be Option C. That was so obvious, it was just ridiculous, but for whatever reason, it was a nostarter. Who knows. I'm sure somebody will write a book about it someday that knows more about it than I do.

At that point, I was up to my eyeballs in a project at Goddard, and I kept saying, "But you guys don't understand. I've got a project at Goddard that's going to hell. I've got to go back and work on my project." [Laughter] So I was a little torn those days.

RUSNAK: I can understand. I was also wondering if you had a chance, or an interest, even, after your first flight following the results of your experiments that you ran or following the results of the Magellan flight after you launched that?

CLEAVE: Yes. Yes. For both of them. In fact, I still interact with Earl Cook, who is the guy that I did the experiments for with 3M. He's now retired from 3M, and we trade e-mails. So that even went beyond the results, because 3M pulled out of the space business. So there wasn't anything else to follow there. For Magellan, see that globe of Venus which I got from Dr.

[James W. Head]...he's at Brown [University, Providence, Rhode Island]. ...He sent me a globe of Venus.

WRIGHT: How nice.

CLEAVE: Yes. ...His name is Dr. [Jim Head], he's really nice, and he keeps sending me slides saying, "See the great work you did," and all that kind of stuff. So it's really neat. It's really neat.

WRIGHT: A nice connection.

CLEAVE: Yes, yes, it really is.

RUSNAK: Just a couple of more, I promise.

CLEAVE: Okay.

RUSNAK: You mentioned your flight being the first time they used the RMS as the cherry picker [for a construction experiment], and from what I understand, it wasn't necessarily a foregone conclusion that you could use the arm in that manner.

CLEAVE: That's right.

RUSNAK: Were you involved with any of that process?

CLEAVE: Yes.

RUSNAK: Could you tell us a little about that?

CLEAVE: That's why we worked so hard on this one-day-long thing. The first day, Woody and Jerry did the build without the RMS and then the second day, the experiment was to redo it using the arm with the cherry picker to see how we could accelerate the timeline. That was the basis of the experiment, and it went much faster, as you could imagine, when you could move the guys around. But we weren't really sure how much longer, and so we had planned a lot of time. We got done so fast that we had time to really fool around.

There were a couple of things that I remember about that day that were really fun. The guys loaded on to the RMS over the port [side]. I got them in. The arm moves fast, and these guys are test pilots and they're all really tough. So I really took glee, which was really nasty, but when I first take them off, I'd give them full throttle, because I always wanted to see them go [Cleave demonstrates]. [Laughter] You always could hear a little break in the mike, [Cleave demonstrates], because the arm really moves and here they are hanging out there all by themselves in the spacecraft.

What they really like to do—I did this with Jerry—we had time left, because again we were going so fast. I pulled him all the way back over the Shuttle and then turned him—we were payload bay to the ground again—turned him around so he couldn't see the Shuttle. So he was up there all by himself and couldn't take reference on the spaceship at all. This was all stuff we

did slowly in case anybody got upset—which these guys would never admit it if they did anyway, so I don't know why were fooling around like that, but Jerry wanted to do this.

He was so cute. I rolled the wrist of the arm and he finally lost horizon on the spacecraft. He was all by himself. He didn't say a word. He just sort of shoved his arms straight out and started humming the Superman theme, which was great. [Laughter]

Yes, it worked. It really worked. I had to train really carefully because there are failure modes in the arm where it can start just moving. At that point—I think they fixed this, but at that point there were failure modes in the arm where it could start moving really rapidly, so I had to be very careful to know exactly where it was at all times and where it should be going, so if I had to throw on the brakes, I didn't squash these guys and get them wedged in between the arm and the structure.

That was the hardest part of that whole thing, because there were definitely safety aspects of it that I had to be really, really careful of, because I did not want to go back to either Jerry or Woody's wife and say, "Sorry, I squashed your hubby." That was not something I wanted to do. [Laughter]

RUSNAK: They probably appreciated that too.

CLEAVE: Yes, I think they did. It was obvious. They hang in the airlock for about a half an hour, flushing the nitrogen out of their system, breathing oxygen in the suits before they go out, so they're hanging there for half an hour and they don't really have anything to do. I didn't really realize how nervous these guys were about this until the day of the flight. They were down there and they were talking about what a great guy I was. I was going, "Hmm. These

guys, they're a little nervous about this, aren't they? They're trying to butter me up." But it worked out okay. I didn't squash them.

RUSNAK: That's good. Just one final question from me. In what ways has your experience as an astronaut helped you in your subsequent jobs?

CLEAVE: It's helped me tremendously in my work at Goddard and here, just because, again, I've been on orbit, I've looked down, and all these guys are working on...an environment that they've never been in. So, a lot of this stuff, when you're doing spacecraft design, if I go to a CDR [Critical Design Review] or something, a lot of stuff that I react to as, "This doesn't sound right," for me it's a visceral reaction because I've operated in a Zero-G environment. For everybody else, that's a learned reaction. For me, it's a lived reaction. And that makes a huge difference, I think. I automatically think about, "Where's the sun? Where's the planet? Is there any contamination?" All these things that are second nature aren't necessarily second nature to a lot of people. So I've found it to be really helpful. I really am lucky I got to make a field trip. That's something not too many engineers get to do. Every day I go, "Thank you."

RUSNAK: That was all I had.

WRIGHT: I'd like to end by talking just a few minutes about the landing. You flew a plane when you were fourteen. You had to land that plane, but yet now you're landing in a Shuttle. Tell us what that was like and how you experienced that.

CLEAVE: On my first flight when I was a flight engineer, I had to write something on my kneeboard, and it was when we were pulling about a quarter of a G and my arm felt like it was about ten pounds and I went, “Oh god, I’m not going to make it. I’m going to be flat here.” But then I didn’t really notice it after that till I tried to get out of the chair.

For landing, it was my job to deploy the probes and do other little things like that. Brewster [Shaw] made such an incredible landing the first time that, honest to God, I swear—everybody goes, “Oh, you’ve got to be kidding”—we could hear the wheels on the runway at Edwards before we could feel anything on our rear ends. It was so smooth. It was better than any airline landing. [Laughs] It was an incredible landing. So I mean, that was really something.

We’d been up for seven days, and you just have to get used to [managing] your body weight again, which is—you don’t understand how much gravity is really worth until you do that.

The second flight, we’d only been up for four days. There really was a difference. Between knowing what to expect and then having a shorter flight, it was much easier.

WRIGHT: Did it take you many days to return to normal?

CLEAVE: A couple of days the first flight. When people would call me from behind and I’d turn around and I’d overturn, just managing the momentum of my body. You can’t beat sleeping floating around. It’s hard to get used to sleeping on a mattress.

WRIGHT: Well, is there anything that you would like to add or any other thoughts that you have before we close today?

CLEAVE: Just in general, I think, working—this goes for every NASA Center, but I'll say working at Johnson Space Center, I mean, you really are lucky if you get to do that. You get to work in an environment with a bunch of dedicated people that are smart, that want to do something, and it's a shared value kind of thing. I felt like I was really lucky because I got to work—sort of bridge the gap. I'm really happy I got in there early enough that I got to work with some of the old guys, because they were really incredible, and got to fly with them. I think that was really something that was very, very special, even though some of them were really difficult to work with. [Laughter] It was okay.

WRIGHT: We appreciate all that you've done for the space program and for taking the time today.

CLEAVE: You're welcome.

WRIGHT: I know you have a busy schedule, and we appreciate you being here.

CLEAVE: Sure.

[End of Interview]