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MARGARET RHEA SEDDON
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is May 9, 2011. This interview with Rhea Seddon is being conducted in Murfreesboro, Tennessee, for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright.

Thanks again for making time to sit with us this afternoon.

SEDDON: You're very welcome.

ROSS-NAZZAL: We certainly appreciate it. Last time we had talked about your first flight, but we didn't talk about the Toys in Space experiment, and I thought you'd like to talk about the toys that you experimented with.

SEDDON: We had a lot of fun with that. Bo [Karol J. Bobko], wanted us each to choose a toy that we thought would be fun to use and demonstrate in space. Of course, Carolyn Sumners from the Houston Museum of Natural Science sponsored the experiment. She brought a bunch of different kids' toys, so we all got to select one. I took the Slinky and jacks, because they were toys that I was familiar with from my childhood.

So we had to demonstrate what they did on Earth, and they filmed that. Then we took them into space and played with them there. Of course, the Slinky didn't slink. It wasn't much fun at all, but Jeff [Jeffrey A.] Hoffman and I stretched it out, and it had some very interesting

waveforms when you shook it. The waves reflected upon each other, so it was kind of fun to see a different way to play with a toy that obviously wouldn't slink in space.

The jacks were a lot of fun because I had played a lot of jacks as a young girl and had my rhythm down, how to throw the ball and collect the jacks. Of course the first time I released the jacks in the middeck when we were in space, they flew all over the place. Just that small amount of momentum from your hand and they went everywhere, so I had to go collect them all up again. Then I learned how to release them very slowly, and I got that part of it right so that they would stay in one general area.

Then I was perplexed by the fact that the ball wasn't doing what I expected. Usually in jacks you throw the ball up, then it falls down and bounces and you catch it as it comes back up. Well, I was standing in the middle of the middeck. I'd throw the ball up, and it took a long time for it to get up to the ceiling and then a long time for it to bounce back to the floor and come back up. I'd be standing there with a jack in my hand, and the ball was sort of drifting around. I tried just throwing it at the floor, but then my hand wasn't quite positioned right.

So what I ended up doing was just throwing it up to the ceiling, picking up a jack and catching it on the way down. Then, of course, I would release it and try to get two jacks, and then finally, after a little bit of practice, I managed to get all ten of the jacks in my hand at once. As soon as I'd let them go, they start drifting apart, so it was really hard to get all ten of them before the ball came back down.

It was, again, illustrating gravity. You get so used to it and you get used to interacting with it in a certain way, and then you go into space and you have to learn how to react differently. But we had a lot of fun.

I think Bo selected a spinning top and a gyroscope because he wanted to show gyroscopic motion. It was a nice demonstration, of course, of why our satellites would spin up. He would spin the gyro and then bump it to show that it stayed pointing in the same direction. He used that as a teaching moment about gyroscopes and why our satellites spin.

Jeff Hoffman had some magnetic marbles that were fun. He would put one out and then throw another one near, and they would clump together. You know, a lot of kids aren't sure whether magnets would work in space. Will magnets work in weightlessness? Well, of course. Adults would say, "Yes, of course, magnetism works without gravity." But if you ask kids, they don't really know. So this was a nice demonstration. Plus, he could get three or four of them in a string and then pass one nearby but not quite near enough to join up, but it would move the long string of marbles that he had. So that was a nice demonstration too.

He also took a car and a circular track. He would start the car going on the inside of the track, and it was really using centrifugal force to hold it on the track. He could demonstrate that as long as the car was moving, it had enough centrifugal force to keep it in the track going around and around. Once the car slowed down, it would just drift slowly out of the track. So, a nice demonstration of centrifugal force.

Dave [S. David] Griggs had a yo-yo, which was a lot of fun, and it took a good bit of practice for him to get it going at the right speed where it would come back. Originally he'd sling it out there and it would just drift around, but he got pretty good at it. He had a lot of fun with that.

Jake [Edwin Jacob Garn] had a paper airplane that the Smithsonian gave him to fly, and, again, it took a little bit of practice to get the right kind of momentum to get the air going over

the wings so that it had a normal trajectory. If you didn't throw it hard enough, it just sort of floated.

So they were all very nice demonstrations to kids, and I've used it in schools before and asked kids to predict what would happen. It's very interesting to hear what children will postulate, because they don't quite understand physics principles, but these were learning tools kids could relate to, and we had a lot of fun playing with them. It was a fun experiment.

ROSS-NAZZAL: Some of the photos looked interesting, so I was curious about that. Was that used in Houston classrooms, or was that used in the museum primarily?

SEDDON: I think it's been used widely. People could request it. They did, actually, a whole series. Our was the Toys in Space I, and I think they did several others, but I think that's in the NASA educational armamentarium that schools could request. I think they did a narrated version and had a study guide that went with it, just one of those fun things that NASA did for education and continues to do for education that connect kids to space.

Our flight ended up being very complex in many different ways, and we had a lot of things going on, and so the toys was kind of a respite from the stressful stuff. It was just the playing-around stuff, and we had a lot of fun doing it.

ROSS-NAZZAL: You mentioned the complexity of the time period, and I don't know if you recall this moment, but I was reading through an article that talked about how Dave [David C.] Hilmers, the CapCom [Capsule Communicator], congratulated you on your sewing ability.

Apparently Sally [K.] Ride was there, and she jumped in and said, "Well, she didn't get that sewing ability as a homemaker; she got those skills as a surgeon."

SEDDON: I think the quote, or at least what I heard, because I obviously wasn't there, Dave said something about, "You're a good seamstress," and Sally said, "No, she's a good surgeon," something along those lines, which I appreciated very much, but I would have taken the kudos as a seamstress, too, because I've done that in my lifetime. But that was very nicely put by Dr. Ride.

ROSS-NAZZAL: I was just curious what you had thought of it at the time. I thought it was very interesting.

SEDDON: I didn't hear about it till I got back. [Laughter]

ROSS-NAZZAL: You were too busy making the flyswatter.

SEDDON: But I told her I appreciated it.

ROSS-NAZZAL: I thought I'd ask you about the Astronaut Science Support Group that you formed with Jeff Hoffman and Bonnie [J.] Dunbar and Jerry [L.] Ross, some of those folks after *Challenger* [STS-51L].

SEDDON: As we got into a more mature phase of the Shuttle Program, we came to realize that scientists who either wanted to propose experiments or had proposed experiments frequently designed both the hardware and the experiment itself before they ever had crew members that they could work with. We likened it to saying, well, they've designed this experiment to be a "flying brick." In other words, the only switch on there is the on/off switch, and the only indicator on there is a light that comes on when it's on. If you take it to space and you flip the switch and the light doesn't come on, there's nothing you can do. It's sealed up. They didn't design it to be repaired. There's no way to understand what went wrong, no insight into the mechanisms. We felt that was unfortunate, because crewmembers are more than willing to learn everything there is to know about an experiment. They take the responsibility for it.

For instance, scientists I knew were designing life sciences experiments, and they were told, "We can't guarantee that you'll have any physicians on the flight or anyone that knows anything about life sciences." So again, they would dumb-down the experiment or they would worry about it or they wouldn't propose it. Or they would do something that they ordinarily wouldn't do, in order that any person could do it.

So we wanted to go out and tell them the capabilities that people had. Even if you were an astronomer, you could learn to draw blood. Even if you didn't understand a lot of the complexity of the payload that you were operating, you had the opportunity to talk to the ground. A lot of times you could do the mechanics of it and do it very well and understand how it could go awry without understanding how the telescope was built or what the internal workings were.

So being a resource to scientists was something that we felt was useful for us to be doing. I think in the time after *Challenger* all of us were trying to look at not only how to recover from the mechanical problem that happened on *Challenger*, but how we could use this time to improve

the product of our office. We could make ourselves available to scientists who didn't understand, for instance, how to work in zero gravity.

Scientists would say, "All this experiment requires is that you draw blood and that you collect urine." We would remind them that we didn't have a lab centrifuge on board, and we frequently didn't have a lab refrigerator on board. So something that sounded pretty simple, would have been very simple here on the ground, like collecting urine was hard to do with the things that we had in the space environment. But we would let them know there are flights that you could stow the urine-monitoring system on board; they might want to group their experiment with some other people's so that they could assure that that equipment could go on board to support several experiments.

So it was that kind of interaction, and we all enjoyed it. Most of us that were working on the support group had flown, so we understood what weightlessness was like, what you could and couldn't do, what equipment you had or could have. So it was earning our keep as good scientists to go and share some of what we had learned and what we knew about the Shuttle Program.

ROSS-NAZZAL: Now, I understand that you put together a film. Did you star in one of these films?

SEDDON: I don't even remember. I may have. You'll have to tell me about it. There's so many pieces and parts of work that I have done that every once in a while I think, "I wonder whatever happened to that?" I vaguely remembering doing something like that, or one of the crewmembers will ask, "Do you remember what we did about so-and-so?" And I have no

memory of it. I had a question for Jeff Hoffman about something. "Did we roll that camera out or not?" And he said, "I have no idea. I don't even remember that that was the problem," or something like that. We each remember pieces and parts, and parts of it are gone, not in the memory bank anymore. If you tell me we did a film, I'll believe you.

ROSS-NAZZAL: I know you all did a film. I don't know if you starred in it or not, but I was curious about that.

SEDDON: I'm sure I didn't, but I'm sure I contributed.

ROSS-NAZZAL: Were there any groups or universities that you worked with on experiments at this point?

SEDDON: Can't really recall, but, you know, all of the experiments were somebody else's. Some of them were from JSC, but many of them were from other places and some of them were sort of good ideas that people wanted to talk to somebody about, and we were happy to either talk to them on the phone or send them pictures or descriptions of equipment or go there. They would invite us to come and talk about something to their graduate students and, in the meantime, come to their lab and help them figure out what was the best way to design the control interface with some experiment. I remember doing that quite a few times. It was just part of our work and something we certainly enjoyed.

Back then, astronauts were kind of special people, so the investigators frequently liked to have the nice P.R. [Public Relations] parts of that. The local newspaper would come and take

pictures, and we could talk about how wonderful their university was for proposing space experiments, so it was a win-win for everybody. There were grad students that were thinking about becoming astronauts, probably some that did become astronauts. Every once in a while, someone would say to me, "Oh, I remember when you came and talked to my school." Now I see grownups that say, "I remember you talked to my first-grade class." But, again, going out and helping and talking to people was part of the responsibility of the job.

ROSS-NAZZAL: Would you tell us how the office changed as a result of *Challenger*, in terms of leadership, management, those sort of things?

SEDDON: Of course, Mr. [George W.S.] Abbey moved, I think, to Washington [DC, NASA Headquarters] after that, but we had different leaders. I think that things were a little bit—how shall I put it—more straightforward as far as crew assignments, as far as job assignments, as far as where everybody was going. We had a little bit better idea of where we stood and whether we had done a good job or not done a good job. The one thing I remember that changed significantly was the Family Support Plan, and I don't remember whether we talked about that before.

ROSS-NAZZAL: No, I don't think that we did.

SEDDON: Pinky [George D.] Nelson was tasked with putting together what they called the Family Support Plan; I think they realized with *Challenger* that no one was really looking out for an astronaut's family. We were all kind of on our own, getting family to the Cape [Canaveral,

Florida], finding a place to stay, figuring it all out if the launch slipped, changing your condo. The spouses could ride down on the NASA plane, but what did you do about your kids? There was concern about how expensive it was for a lot of people to go to Florida, having a flight delayed at the last moment, having to go back down again, flying the kids down several times, flying Grandma down so she could be with the kids. It was just very disorganized.

And after the *Challenger* explosion, where are the families? Where are the kids? Because we need to round everybody up. We need to make sure that if the kids stayed at home, there's somebody with the kids. It was just this sort of horrible realization that we always had family support people from our office, two people that were there to help, but suddenly, after *Challenger*, where were they all? Where were those spouses and families staying? How do we get into their hotel rooms to get their things so we can get back to Houston? It was a mess, and I think they realized that they needed to organize it. There needed to be more support for families. We needed to know where people were. We needed to have a plan if things went awry. We had to do a lot of different things. Pinky Nelson put together a terrific plan, put it together at the right time, and after that, it was just much different.

Of course, I got to see both sides of that coin. I got to be the flyer, and I got to be the spouse. I can remember when I was the person flying, the concern I had for my husband, my children. I'd worry about how are they were going to manage. Of course, "Hoot" [Robert L. Gibson] could manage making hotel reservations and renting a car and getting himself where he needed to go, but there were a lot of wives for whom it was very difficult to figure all that out. They did it by word of mouth. They'd talk to somebody that had done it and found a good place to stay. Did the condo or hotel have anything available, will they have anything later, would they slip the reservation if the flight slipped?

Afterwards, the plan was in place; everything was taken care of. They did some very practical things like helping people to make sure that they had a will. They instituted something that they called the CACO [Casualty Assistance Call Officer]. That wasn't the family support who accompanied a family to the Cape; that was the crew member's representative. If anything happened to you, they were the liaison between the family and NASA. They actually had those people for the *Challenger* families, but they were named after the fact. It was much nicer if you could go to your best friend and say, "Will you be my ASP [Astronaut Support Person]? Will you be my support person?" And find out whether they felt like they could do that or not. I don't think anybody ever turned anyone down. I was a support person for people and had good friends that were support people for me. As a close friend you could ask the tough questions. Where's the will? What do you want me to do about this? Have you thought about whether you want to be buried at Arlington [National Cemetery, Virginia] or in your local cemetery? Questions that are very difficult sometimes. I think they found with *Challenger* that not all of those questions had been discussed within families, so it was nice to have this other person that could walk you through some of the questions that needed to be asked and the things that needed to be settled. It made it a whole lot easier. All of that got taken care of well in advance, and you didn't have to worry about it as much.

So the Family Support Plan was part of what happened during the time after *Challenger*. We, again, were looking for how we could do things better, and to my way of thinking, that was one of the really fine things that NASA did.

ROSS-NAZZAL: So NASA now rents the condos for the family? Is that correct?

SEDDON: Yes, they take care of that for you. It was financially very difficult for people to manage on their own. Of course, we were a two-income family, so we managed, but I don't know how some of those families did it. When you went down for launch and spent a week waiting for it to go, have many days of delays and then fly home and have to go back down again, it was really costly.

For Hoot's second flight, [STS]-61C, we went down several times, and we stayed in Florida for several weeks waiting for that flight to get off the ground. It was very expensive, not to mention stressful. Of course, the families all try to take that worry off of the crew member, because they have other things that they need to be worrying about, so we were told, "Don't worry your husband with all these things."

Again, it was much better after they had a formal plan. Your bags were packed when you went out for the launch, and the people knew where to collect your stuff. They knew where you were. You were asked, "Where's the astronaut's parents, and where are your parents? Where are your support people if you need them?" So it was just much more organized.

I think later on, the *Columbia* accident [STS-107], I don't know, but I would guess it was much more coordinated. They were ready. So that's what NASA's very good at—where are our failure modes, and how do we plug those holes so that that doesn't happen again.

ROSS-NAZZAL: You brought up a subject that I was going to ask you at the end of the interview, but since you brought it up—you, of course, flew as an astronaut and then Hoot flew five times. It's my understanding that the spouses of the astronauts who are flying have to host parties and do a whole bunch of other events for the crew. Can you talk about that, being on both sides?

SEDDON: Yes. Of course, Hoot flew first, so I got to see the spouse side of it, and there were certain traditions. Of course, once you're named to a crew that becomes your closest social circle. The spouses get together, the crew members get together, and then you all get together with spouses, kids, at somebody's house and have dinner every now and then. So you really get close to the people that are flying with your spouse or flying with you.

There is a tradition that a party is thrown for the spouses right before they go to the Cape, and it's thrown by the next-crew-up's spouses. So it's sort of this rolling thing, and it started out to be kind of a ladies' get-together. Then when there were male spouses—I guess Sally's was the first [Steven A. Hawley]—it became a spouse party rather than the wives' party, so that tradition changed a little bit, and it went from being a ladies' party to being a Happy Hour or something. It was a little bit less feminine, I guess.

The other thing that the spouses had to work on, usually spouses gave a reception down at the Cape the day before the launch. Because most of the venues were reasonably large, you would frequently pair up or triple up or something so that there would be two or three of you that would have a party together.

For Hoot's first flight, I think Ron [Ronald E.] McNair's family and somebody else's family, there were three of us that had something at the Officers' Club. That all had to be planned out. You had to get invitations and send them to your guests that were going to be at the Cape and organize all of that.

At the time, if you needed you could rent buses. NASA would give you, I think, one bus for your guests. If you invited more, you had to rent buses. I can remember for Hoot's first flight, renting buses for extra guests. Then, of course, when you had family coming down, Grandma and Grandpa and everything, you had to direct them as to where you were going to stay

or where was a good place for them to stay. So there was a lot of coordination of the social part of flight. And, of course, your spouse was gone most of the last couple of months. They just get really, really busy, and it's up to you to plan all of that out. We printed up notecards with the crew patch on it to use for stationeries and thank-yous, and sometimes we printed invitations on them. There were a lot of sort of social things that were part of the tradition of flying. I'm not even sure I remember them all.

I enjoyed that. I think it was a little more difficult in the Shuttle era because many of the wives worked. I think prior to that, a lot of the wives didn't work, and so the social part of it was sort of their bailiwick and something they knew how to do. All of us were trying to work and raise kids and throw parties and plan events. But, luckily, all the spouses were good people. I think the only time that it was difficult was when on one of Hoot's flights there were only three spouses. That was on Spacelab J.

ROSS-NAZZAL: STS-47?

SEDDON: Yes, because Curt [Curtis L.] Brown, the pilot, wasn't married, and [N.] Jan [Davis] and Mark [C. Lee] were married to each other.

ROSS-NAZZAL: I think it was Mae [C. Jemison]. She was single.

SEDDON: Mae was single; Momoru [Mohri]'s wife [Akiko] had the Japanese delegation and Japanese things that were all kind of taken care of for her, not that we didn't include her in all

our things, but E.B. [Eleanor B.] Apt and I were sort of only two people to plan all the social stuff for people.

But Jay [Apt] was great. Before the flight, you had to plan the post-flight party, and Jay said, "Oh, I'll take care of that." I thought, "How are you going to do that with all the stuff?" But he did. He planned it all out. After you do it a few times, you get pretty good at it. You know where you can throw the party and how you get the invitations out and who you have to invite.

ROSS-NAZZAL: Did you find it complicated things having two astronauts in the household?

SEDDON: Definitely, but, you know, I guess we were lucky in that our flights went on different years. I don't know what we would have done if we had had flights close to one another. We probably just wouldn't have done some of the social stuff. We would have just had to say, "Too busy." We did it one year after another, and Hoot's pretty good. He's not real good at party planning and how to find invitations and things like that, so I sometimes had to do some of the spouse stuff for my own flights. But he was pretty good about pulling a lot of it together, so that helped. So, yes, in some ways it was complicated and it got a little crazy at times, but we just worked it out.

ROSS-NAZZAL: I was just sort of curious about that. We just talked to Anna [L.] Fisher, and she talked to us about how she left the office for a time just to stay home with her children, because things had gotten so complicated.

SEDDON: Yes, and I'm sure I have guilt feelings about the times when I didn't have enough time to spend with my kids and I didn't get to see some of things they were doing, or I wish I'd been there for some of those things, but it turned out just fine and they don't remember those things anyway.

ROSS-NAZZAL: I do want to ask you about the role you played in the NASA Aerospace Medical Advisory Committee. Can you tell us about that group?

SEDDON: Oh, you have dug deep.

ROSS-NAZZAL: Try to.

SEDDON: I was assigned at one point to the Aerospace Advisory Committee. I wasn't quite sure what my role was, but I felt like it was like being part of the Science Support Group. You bring a different perspective, and you understand what the issues are within NASA about flights.

Advisory committees, I have learned, frequently are only told about things that someone wants them to know about, and while I felt that I was useful in many ways, I got a little frustrated by having sometimes a different perspective on what the burning issues were. I felt like an outside advisory committee could do a good job of discussing issues and providing some input as to what was the right thing to do scientifically, but frequently those were not the issues that were presented to them. That was a little frustrating to me, and eventually I got busy and I didn't feel like I was making the right kinds of input or being very useful, and so I didn't continue with it. It was an eye-opener for me, and it reminded me that later on when I was on different kinds of

advisory committees, that probably whoever was briefing us sometimes had an agenda or sometimes only brought up the things that they wanted the advisory committee to talk about. I think there're sometimes a limited role for advisory committees, or it's sometimes the responsibility of an advisory committee to dig a little deeper.

ROSS-NAZZAL: Can you give an example or two?

SEDDON: After I left NASA, I was put on an Institute of Medicine Committee looking at astronaut health. I'm trying to remember some of the issues. There was a question about whether astronauts should have to be given informed consent before they were assigned to a flight that required them to participate in certain experiments. There were a number of scientists who felt like if you sign up for the astronaut program, you sign up to do those things. I had worked on some committees at NASA, and we basically said informed consent for scientific experiments is informed consent. You can't tell someone they have to do anything that you later assign to them as part of their job. That's not fair. It might something like, "Oh, it's just drawing blood," or, "Oh, it's just giving them this radioactive substance," or, "Oh, it's just testing their eyes," "Oh, it's just putting an EKG [Electrocardiogram] monitor on them when they're doing a spacewalk," and if they could get irregular heart rhythm, then you don't let them ever fly again.

So astronauts have a very different perspective on what they're willing to do, and that's fair. That's the scientific principle behind informed consent. Someone needs to agree, understanding what the side effects might be or the repercussions might be or the fallout might

be. They need to agree to participate, and not just, "Yes, I agree to fly on that flight, and I'll take whatever is on there."

So the Institute of Medicine Committee, they were leaning toward saying that astronauts should sign basically an unlimited informed consent when they signed on to be astronauts. There was someone who told them, "Well, the reason that we need to do that is that astronauts don't agree to participate in experiments." They'd had a detailed supplementary objectives program before *Challenger* that were NASA experiments that were assigned to flights. "Here's a bunch of experiments. Which ones do you want to do?" And some of the scientists said, "We have trouble getting people to sign up for them." That was sort of presented that, "We have trouble getting astronauts to volunteer."

And I said, "You know, that's not what I remember." That's, again, where the difference in perspective and having someone in the Astronaut Office who can say, "Wait a minute. Now, the NASA people told you this, but let's dig a little deeper here and look at how many of those experiments were completed. You had three on this flight and two on that flight and one on that flight. You didn't get everybody from the same flight." And when they looked at it, that was true. Astronauts were volunteering.

There were a couple of things that were very difficult to do or people felt might compromise their career. I had someone tell me on one of my flights they didn't want to do an eye test, how close up can you read, because this person was afraid that it might affect their assignment to flight, because they might need to wear bifocals or something.

I found that on my later flights some people are willing to take a risk where you know whether or not there's a side effect right away, and there are other people that don't want their flight to get messed up because this experiment made them sick, but they're willing to take the

risk of a 1 percent increase in cancer risk over your lifetime. That's okay with them, but they don't want to do something that might make them sick on the third day of the flight. So everybody's comfort level was different.

Again, getting back to the advisory committee, I think it sometimes is helpful to have someone like that on the advisory committee. I think that there were people on other advisory committees who got frustrated. I won't name names, but a friend of mine was on an advisory committee, and the advisory committee kept advising NASA in one direction, and NASA just didn't take the advice. So that's another kind of frustration. If you're going to have an advisory committee, then you either need to do what they say or explain to them why that's not going to work and how can you do something different. So I learned a lot about advisory committees by being on that one, and I think I was useful in many ways and perhaps I was a rabble-rouser in others.

ROSS-NAZZAL: Did that committee focus solely on human spaceflight, or were you also looking at things like animals experiments?

SEDDON: As I recall, we were looking at life sciences overall, so it included the animals. I don't remember whether we did plant stuff or not. I was particularly focused on the human part, but I think they had other groups that were more focused on the other parts of life sciences.

ROSS-NAZZAL: So you had a chance to work with people over at Ames [Research Center, Moffett Field, California] and some of the other Centers that were represented?

SEDDON: Yes.

ROSS-NAZZAL: Probably a good thing for your other flights.

SEDDON: Yes, definitely. Definitely.

ROSS-NAZZAL: Let's talk about that first Spacelab Life Sciences flight. *The Roundup* says you were selected in '84, and you didn't end up flying until '91.

SEDDON: Yes.

ROSS-NAZZAL: So tell us about working on that flight, essentially for seven years. I'm guessing in between you were working on other things as well.

SEDDON: Actually, I worked even longer on that flight. When I first got to NASA in 1978, I sort of noodled around to see what I was interested in. We were learning about all of this other stuff: flying airplanes and propulsion systems. I really felt like one of the reasons that I was there was because of my medical background. Even though I got my medical license and I practiced medicine on the weekends, I really wanted to figure out how I could be useful to NASA in the life sciences.

One of my best mentors was Joe [Joseph P.] Kerwin, and I went and talked to him about what was going on. Even back then they were beginning to think about the Spacelab payloads, and Joe invited me along to a number of the meetings that he went to. We first went out and

talked to scientific groups about proposing experiments, you know, "Here's the Space Shuttle. Here are the people that have been selected to be astronauts. Here's the platform. Here's what Spacelab is supposed to look like," and we just went out and met people and talked it up, you know, "You ought to propose experiments."

Then I guess the research announcement went out in probably—might have been '80 or '81, so people began to propose experiments. Joe sort of kept me up to date on where things were and what people had proposed, and he was following the life sciences payloads. At the time it was called Spacelab 4. So I got to meet people and learn about it and follow it along as much as I could, from a distance.

It was supposed to fly in early '86, and so it came close to time to name a crew. I think I probably didn't go talk to John [W.] Young; I probably talked to George Abbey at a Happy Hour or something and told him that's the flight I really had been interested in, that I really wanted to go on, and I was sorry that at that point in time I was already assigned to another flight. I was supposed to fly the summer of '84, and they were naming a crew, like, in April, and I told him that I was sorry that I was already on another crew.

He said, "Well, Spacelab flights take a long time. That might not be a problem."

So I was named to that crew in, like, March, I think, of '84. In early '84, we were supposed to fly in August of '84, and so we were getting close to that flight. So there wasn't a lot I could do with the Spacelab crew. I did a few training items, met the other people, went on a couple of tours of scientists' labs, but I really didn't have any time to do any of that, but they were all taking care of it. We had four payload specialists, two of whom were going to fly with us, and we had the rest of the payload crew. We didn't have a flight crew yet (commander, pilot,

and flight engineer). So it was Jim [James P.] Bagian and me and then the four payload specialists who were working the flight.

It became even more complex as my flight slipped from August of '84. It was supposed to be in February of '85, and then it ended up being in April, a third different payload. So I did what I could, but it was all kind of a scramble, because I didn't have much time to devote to it. So it was a most interesting flight. It turned out to be what we called oversubscribed.

ROSS-NAZZAL: What does that mean?

SEDDON: There was too much to do, too many things, too many experiments, too much crew time required. Neither Jim and I had flown before, so we didn't know how to plan timelines. We didn't know how to look at it and say, "The crew says, 'This is not going to work.'" So it was mushing around out in there.

Then after I got back from my flight in April and everything kind of settled down, by the summertime the flight had slipped, I believe, into '87 so we had a little bit more time, but there was a lot of work to be done as we realized we needed to descope. What they ended up doing was dividing it into two missions. All the experiments were good, the scientists were on board, everybody was happy, but they broke it into two separate missions, which worked out well. We were glad we had extra time because the animal cages that were supposed to fly on missions had not performed very well on their first flight, so they kept being on the flight, off the flight, on the flight, off the flight, so that was an uncertainty.

So at first we were training for everything that could have been on the one flight. We saw we didn't have enough time, and we really didn't have a timeline that we thought was

doable. There were a lot of pieces of equipment that were new and different and weren't performing well or had the potential to not work in flight, and just a lot of stuff going on. But that's basically what I did the last half of '85, plus getting Hoot ready to fly on his mission that was supposed to go in December.

So it was a long journey getting to SLS [Spacelab Life Sciences]-1. Of course, I remember sitting with our crew members in a training session in January of '86, saying, "We were supposed to fly in January of '86." Then we turned on the TV and watched the *Challenger* explode. Then everything became an unknown. What's going to happen. The payload specialists all went back to their other jobs until things settled down, and then we watched our flight on the manifest getting later and later and later. There were other priorities, to get military missions completed, to get the TDRS [Tracking and Data Relay] Satellites up. There were just other things that were ahead of us in the manifest. The science all got shoved downstream, and it kept being later and later. We kept training more and more, and it got pretty frustrating.

We tried, for a period of time, to get together once a month or every two months and do some sort of training and in the meantime look at the checklists or timelines, so I think we got smarter as we went along, but it was years, years in there. I think probably around '89, when the Shuttle was up and flying again, the manifest had settled down and we decided it was time for us to get back together. I think we were supposed to fly in '90. It was time for us to get back together and nail everything down: the timeline, the equipment, what we could do, what we could sign up to do. So we had worked together for a long, long time. One of our payload specialists dropped out early on, well before *Challenger*.

ROSS-NAZZAL: Was that Bob [Robert W.] Phillips?

SEDDON: No. I've forgotten his name. We didn't train together very long. Bob Phillips stayed with us. Then Bob Phillips developed a medical problem that disqualified him for the flight, but he agreed to stay around as our backup. He really wasn't a backup, but he trained with us, he knew everything we knew. He was going to work in the Payload Operations Center [Marshall Space Flight Center, Huntsville, Alabama], the science people who monitored us during the flight, which we were very grateful for. We just thought the world of Bob, so we were pleased that he was going to stay on with us. He could have very easily have said, "Well, if I'm not qualified to fly, I'm going back to Colorado." But we were kind of a team at that point in time, so we were happy that he stayed with us. Millie [Hughes-Fulford] took his place.

So we trained in earnest. I think we were still a little concerned that it was a very ambitious timeline with lots of pieces of new equipment, things that had never flown before that had a high likelihood of having a glitch of some sort. And there were stresses that developed amongst the people. I think it's just that anytime that you spend a whole lot of time with people, things that you could get along with in the short run can become very difficult, and so we had some stresses within the crew members and we worked hard on that.

We got our flight crew, which helped. Bryan [D.] O'Connor became our commander, just one of the best. If you asked people, "Who'd you like to fly with?" Bryan was one of them, straight-laced, hardworking, knowledgeable, good fellow. So I think that helped, to have a leader. Sid [Sidney M.] Gutierrez and Tammy [Tamara E.] Jernigan were also named. They didn't have payload commanders before that, so there was nobody in charge, and we were all in charge. That sometimes became part of the stress. So once we got the flight crew and we began training as a real crew, not just a science crew, things came together a little bit better.

I'm trying to think back about all the things that happened and occurred. I had a baby along the way. Is that right? Yes, Dann was born in March of '89. I went to Hoot's flight in late '88 six months pregnant, so I was dealing with pregnancy and all that kind of stuff in the meantime.

One of the jobs that I had, I guess right before I got pregnant with Dann, I became the Bubba. You ever heard of the Bubba? I was the Bubba for a while. I was the first female Bubba that they had, and I got pregnant shortly after I became the Bubba, so I was a very female Bubba. So I was working on that while we were training, but that was good management experience.

Eventually the flight got pulled together, and we got off the ground. I think we had some delays, glitches along the way getting off the ground, as usual. But it was a very interesting flight. It was stressful in that we had pieces of equipment that didn't work very well that we had to worry about. The one that worried us the most was that the refrigerator/freezers kept shutting down, and we had all these specimens, blood and urine, I mean the whole metabolic panel of things was going to be lost if we lost those specimens. So Jim and Drew [F. Andrew Gaffney] did most of the work on the refrigerator/freezers. It had to do with the fact that they could only use a small amount of Freon in them. Something would glitch, and we would have to turn them off and then later we could turn them back on. Sort of serendipitously, we learned—turn it off, something happens, and when you turn it on, it's okay for a while. They finally figured out that the failure mode was getting some frozen Freon in the line.

We had the same problem with the gas analyzer. All our breathing stuff had to go through the gas analyzer, and it would shut off. We tried a variety of different things, and finally we found out that if you just hit it, it would work okay. What happened was, the gas got sucked through a small orifice to go into the analyzer part, and there was apparently a little dust in there.

You don't think about that on the ground at all. The dust is all down at the bottom of the box, and the tube that it goes through is up at the top. But apparently dust would float around in there in weightlessness and then when stuff got sucked into the analyzer, some of the dust would get up there. So again, you could beat on it and it would dislodge that dust for a while, and then it would work for a while.

We had a number of things, just minor things, and everything worked out pretty well, and we got just about everything that we had hoped to get. We had a good time. I think we brought back some very important scientific data. It was the first time that a flight had been dedicated entirely to life sciences. They were looking at every system so that you could put it all together when you got back. Frequently they had done one experiment. They had done a blood experiment or they had done a heart experiment, but you didn't know what was happening in the rest of the body. There are fluid shifts. Are the kidneys doing what they want to do? Does the chemistry in the blood change such that it changes this other system? So now they had more of a full picture, and they had it on men and women. Skylab data from the '70s was all men. So I think they were able to put the picture together about how all of the different systems worked in unison to create this picture of what human physiology is like in weightlessness.

The animal cages worked well. We were pleased about that. One of the things we did, we got the ground to let us pull one of the cages out, take it over to the workbench, and take one of the animals out. We wanted to handle the animal, to see what the rats would do, because I knew on Spacelab Life Sciences 2 there would be experiments on the rats, but nobody had ever handled rats in space before. They didn't know whether the rats would get fritzy or if they got away, whether they would be hard to get back into the cage or whatever, or what they really

looked like when you pulled them out of the cage and what they did when they were free to float around.

So we were able to talk the ground into letting us do that, and I think we learned a lot about animal handling that we put to use on SLS-2. So the animal part of it was a success, and, of course, they could compare the humans to the animals, and I think they got some really good data on the things that they could test the animals for when they got back. But, of course, the animals had all gone through landing. They were back in 1-G for a while, and by the time they got them out, got them back to the lab, they had been back in gravity for a while. There was this question about did the landing change their data. So we got some answers, but we got some more questions.

Drew's experiment, of course, had the concerns about the safety aspects of having a catheter threaded up your arm to near your heart. It had always been an issue that people worried about. We went through many Safety Panel reviews and had to prove different things and had to do different things to make it less risky. Of course, it became considerably riskier when they put on the orange suits. You know, it was designed to be flown under the regular flight suits that we had before *Challenger,* and then once you put it under a pressure suit where you can't get to the catheter that's threaded up at the crook of the elbow, you had to go through another round of safety assessments.

The surprising thing was that it measured central venous pressure, the pressure of the blood going into the heart, and everyone had proposed that pressure would be elevated because if you look at astronauts when they get to space, the veins in their neck stand out. Jim Bagian with his bald forehead, you could see the veins in his forehead. Your face gets all puffy. So everybody felt like fluid had redistributed, there was more pressure in the upper part of the body.

Drew got to space, turned on his little thing to look at his pressure, and it was zero. Of course, he thought he had an equipment failure, so he changed out the pieces of the equipment that he could change out, he flushed the catheter, it was still zero. Again, that was kind of an unknown, but a data point of one, you don't know. That was one of those things that we got some data, but we weren't sure what to make of it.

Of course, there were only four subjects, and sometimes data points were not good. With only four subjects, you can't get it into a peer-review journal because the *n* number isn't enough, and sometimes, of the four of us, only three of the data takes for us were good. Anyway, it opened the door for SLS-2, and overall I think it was a very successful flight. It started a lot of the studies that we had hoped to accomplish on the Space Shuttle.

ROSS-NAZZAL: Did you have a sense of the background before the flight about the Skylab data? Was that something that you had looked at and got a sense of?

SEDDON: Oh, yes. I looked at that in 1978 when Joe Kerwin said, "Oh, you need to look at this." A lot of that data had been published in a Skylab book, I think. Again, they were, "Here's what we found." But then if you looked a little deeper, you found that the pressure on Skylab was not sea-level pressure; the oxygen content had to be higher. I think on the first one it seems like they lost weight. There were confounding factors on a lot of that data, so it was, again, a question mark. Yes, we have some data but are not quite sure what it's telling us. Scientists would argue, "Yes, but you know the oxygen content was X percent instead of Y percent, and the atmospheric pressure was lower and that would do all of that." So it gave us some hints, but we weren't sure exactly what that meant.

Early on in the Shuttle design, the scientists said, "We want it to be at sea-level pressure, 14.7 psi [pounds per square inch], and we want the oxygen to be 20 percent, nitrogen 80 percent, a small amount of carbon dioxide," and the life scientists really had those requirements. "We won't be able to tell unless we can keep more of the variables the same as what you would have here on the ground." So, yes, the scientists that proposed the experiments, some of them were repeats of the Skylab, so you could say, yes, that data is good or, no, there's a difference.

ROSS-NAZZAL: I noticed that Carolyn [L.] Huntoon was one of the PIs [Principal Investigators] for some of the experiments.

SEDDON: Metabolic experiments.

ROSS-NAZZAL: I know that you had contact with her, obviously, but had you worked with her on experiments before, or was this the first time you had worked with her in this sense?

SEDDON: I'm trying to remember. I think that was probably the first time that I had worked with her as an investigator. I mostly knew her as the director of the medical lab, and so our dealings were with that and more on a personal level. She was our den mother. But I think this was the first time that I had worked with her as one of the investigators.

ROSS-NAZZAL: What was she studying, do you recall?

SEDDON: I think she was doing part of the metabolic experiments, and I'm trying to remember, probably had to do with fluid balance, but I'm not exactly sure. They were looking at a number of the components of the blood, the hormones that regulated fluid balance. Again, faces got puffy, legs got skinny, fluid was redistributed. They felt like probably people got rid of some of that fluid the first few days of flight, but they had not quantified it. They didn't know what your salt balance was doing; they didn't know what hormones were involved in that, kidney hormones, pituitary hormones. I think that was what she was interested in. Again, the people doing the metabolic experiments had to coordinate, because certain of the tracers for one experiment would not be good for another experiment, or you couldn't do the metabolic experiments right after you had done the lung functions because the gases would change. So it was this big coordination thing, but I know she was involved with the metabolic on both of my SLS flights.

ROSS-NAZZAL: I had watched your post-flight video that you had all put together for this mission, and someone had referred to the Spacelab area as the slave quarters. I know you had mentioned that it was a pretty hectic flight. Was that something that you recall, that it was just so hectic, you kind of felt like you were stuck back in that lab?

SEDDON: Yes. Again, we were oversubscribed. We didn't know how to do a timeline very well when everything had to be coordinated. Jim and I, by the time we flew SLS-1, each had flown a flight, but the things that happened on those flights were pretty much standalone chunks of time. Deploy the satellite on this day. Film the toys on this day. Do this on that day. They didn't interact. The things didn't affect one another, really. And suddenly, on this one, I don't think

we completely understood how things could go awry if one piece of your equipment didn't work and they had to re-plan the day. The ground wanted to re-plan it for you before you took off and did something else, so you had to wait until they could tell you, "Here's what we want you to do."

We tried to make the most efficient use of our time, but we frequently worked late. When equipment failed, they would put it off till the end of the day, and so you'd end up staying up late to troubleshoot something that wasn't working too well or some piece of something that you hadn't finished because you were troubleshooting something else.

You know, I think we joked about it being slave quarters, but we knew, even if everything had gone well, that we had a full day's work in the lab. But we did take breaks to go eat lunch in the front, look out the window. Bryan would say, "There's a good pass coming up. Is it time for you all to come have lunch?" And we would try to do that.

I'm trying to remember whether we had a window. I think we had a window in the back of the lab. I remember that I made sure that we had a window in the back of the lab on SLS-2. They were going to take it out or it wasn't in there on that lab module, or something. I said, "Psychological health! We need a window to look out to see whether it's daytime or nighttime outside." There were times that you could sort of relax, and I think we realized that we needed to do that from time to time, because it did get pretty hectic.

ROSS-NAZZAL: Now, I read that some people slept in the Spacelab. Were you one of the people?

SEDDON: Yes. It was nice and dark and quiet back there. We were doing single shifts, so the lab was essentially buttoned up for the night. It was dark and we could cool it down, and so we just hung our hammocks back there and could sleep wherever we felt like sleeping.

We had the problem of noise. The refrigerators would come on and off. Seems like you could hear the mice. Because we were close to the tail of the Shuttle, we could hear the jets, the vernier jets "boom boom, boom boom," keeping the Orbiter in the right orientation but you got used to that. But it was a lot quieter and more peaceful than the middeck or the flight deck.

ROSS-NAZZAL: One of the things I had read, and I was telling Rebecca about this as we were driving down, you mentioned several times that you had to scrub your launch, and I had read that they had to take out the rodents and put in fresh rodents. Can you explain why they had to change them out?

SEDDON: I'm trying to remember why, and I think it's that some of the rats had been injected preflight with something, or it was that there was heat back there and they were stressed. I don't remember what it was, but we knew that we had a forty-eight-hour window. We could launch today or tomorrow, but if it slipped to the next day, they had to change out rats.

So I remember that happening, and we worried about it because they had to load rats with the Shuttle on its tail. So they had to lower somebody in a boson's chair down there with these rat cages, and there was concern about the person being injured. There was concern about the rat cages getting dropped—you know going "thunk"—down to the back of the lab, and people worrying about damage to the lab. It was more than just, "I gotta go change out these cages." Doing it in the vertical, that was a task.

Of course, the lab itself had to stay powered so that the air in the cages was continued. So that was one of the big advantages of a lab was that it could stay powered. You know the Spacehab, it was unpowered. So that was one of the good things and one of things we worried about, that you had to make sure that the animals were okay because you didn't want to lose your animals or mess up all the experiments that they were participating in. I'd forgotten that.

ROSS-NAZZAL: Did you have to take care of the animals when they were in space, or was there primarily some pellets that they had and water preloaded?

SEDDON: We had to take care of the animals. The Animal Care and Use Committee is responsible for making sure that you do all the right things to take care of the animals, and we had to check on them every day, number one. I think we had to change out their food bars. I think we had to refill their water bottle. We had to look in there and look at them every day and make sure they were okay and not floating around dead.

[interruption]

ROSS-NAZZAL: You were talking about taking care of the rats, changing out their food and water and checking in on them.

SEDDON: Yes. I think we had some tests of the cages themselves. There was great concern that the cages wouldn't work and there had been millions of dollars spent on redesigning them after

they had problems on the Spacelab-3 mission. So, yes, we spent some time watching what rats do in weightlessness.

When we first looked in there, when we first got to orbit, the rats were sort of clinging to the sides of the cage, looking out at us like, "What's going on?" Then they got more used to the fact that they weren't falling or something, and we'd look in there and they were sort of floating around. It wasn't big enough for them to do a whole lot of acrobatics, but they became much more relaxed.

Then we took the one out, once we knew that the enclosed workbench worked. We took a cage out and took the rat over to the workbench, and really the rat was kind of like a human. He didn't want to get stuck out in the middle of nowhere with nothing to hold onto. So once we got him in there, when we took him out of the cage, he would just hold onto your hand, and then once we got him sort of turned loose, we didn't want to throw him or anything. We just wanted to sort of get him off our hand. He floated around until he could grab onto the cage and he grabbed onto the cage.

The rat was very docile, didn't really try to bite, didn't try to get away, just was a little rat. One of the interesting things about it, he had a yellow streak down his back. We thought, "What is that?" What happens, I guess, when they're in a colony, when they groom, they can groom themselves except down the middle of their back, and then their cagemates or something clean down their backs for them or something. They couldn't reach the middle of their back, which was kind of interesting.

They were obviously healthy; they were eating and they were getting water. The cages worked really well, so that was a nice thing. Plus we had done this sort of unplanned part where we handled them. When you carry them around in the lab, they put them in this plastic cone and

then sort of close the back end so that none of the animal waste can get out. We tried putting them in there, and the animal didn't want to go in there. So we knew that on the next flight you were going to have to really push them in there, because on the next flight we were going to have to take them out of the workbench and put them on the animal weighing device, the animal scale. They had to go in something so that they would be kind of closed up. So we got some experience with doing that.

I was already hoping that I would be on SLS-2. It was interesting because we brought back the only video of rats in space, because after that, they decided that they didn't want us to do any videos of rats. So if you go in the NASA archives, as far as I know, that one rat-handling thing that we did was the only time that you'd ever be able to see what rats do in space.

ROSS-NAZZAL: Is that primarily because of PETA [People for the Ethical Treatment of Animals] and the other animal-rights groups?

SEDDON: Yes. There were probably people that objected to our taking the rats in space, so we had to be sensitive to how a lot of other people thought.

ROSS-NAZZAL: You had mentioned, I think it was on STS-51B, they did have the problems with the animal enclosures.

SEDDON: Yes.

ROSS-NAZZAL: Were you at all concerned, or you had spent enough time with the folks at Ames and were convinced that the enclosures would work?

SEDDON: Well, you know, the animal cages, like a lot of things that we do in space, there's just no way to simulate all of that on the ground. You can take things up in the zero-G plane and get part of it, maybe, but, yes, we were concerned about the cages, and we knew that if they didn't function well on this flight, that animals were not going to fly again. We knew that the problem had to be solved. But we had followed with great interest over this long period of time what they were doing to the cages. Early on there were people that said, "We're not going to spend this amount of money. We're not going to fly animals." And we knew that a lot was resting on whether the cages did well, so we had a significant interest in the design. We looked at it, we looked at how it could go wrong and what we could do about it.

We had some procedures if any of the animals got in trouble. That's why we had the sock that we could pull the cage out into when we decided to take it over to the workbench. So we had some plans. All we could do was hope that all of the fixes that they had made were what was needed and that the animals would be safe and well fed and well watered, that there wasn't going to be any waste floating around. I think we probably would have been very careful if anything had escaped from those cages, to make sure that it didn't float up to the flight deck and bother the commander, as it had on STS-51B. [Laughter]

ROSS-NAZZAL: Didn't sound very pleasant.

SEDDON: Marines don't like animal poop. [Laughter]

ROSS-NAZZAL: That's a good quote. We'll quote you on that. [Laughter]

Tell us about some of the training that you participated in. I'm assuming you went to Ames and to Marshall. Where else did you train?

SEDDON: We trained in many of the scientists' labs. The first thing we did was to go to meet the PI and look at the equipment that they had designed. They told us we were going to be their hands and eyes in space, and they really, really, really wanted us to be involved in the experiment, to care about it, to take responsibility for it, to know everything about it, to understand.

As I mentioned earlier, they were told, "We cannot assure you that you will have a life scientist on board." Well, they were delighted that they were given credible life scientists who obviously were already interested in the flight and were bona fide science people, and we understood what they were talking about. They didn't have to lecture to astronomers. So they were delighted to have us come. Sometimes we spent several days in the lab learning, "Here's what we're trying to get from this experiment. Here's what we think you will see when you do this experiment. Here's what you can see. Here's what we can see on the ground. Here's how we can advise you, yes, this data looks good or there's something interesting going on."

We needed to understand what might happen, not what was predicted to happen, but what might happen, so that we could watch for that. I can remember the pulmonary function study folks, John [B.] West and his folks in San Diego didn't completely understand how the blood would redistribute in the lung in weightlessness. They said, "Here on the ground there's more blood in the bottom part of your lung just because of gravity, and we think that when you go into

space, it will just redistribute so that it's more homogenous, but we don't know that. Here's what we predict it to look like. Here's what it looks like on the ground. Here's what you might see in space that we'll look for and we want you to look for, because that's very interesting and we need to verify on all of you that it happens." So it was things like that when we went to the labs.

Frequently the way they had planned the experiment, because Jim and I had some experience, or the other scientists, Drew, Millie, and Bob, could look at it and say, "You know, that may not be the way you want to do that," or, "It would be very helpful if we could do this before this." So there was a lot of back-and-forth discussion, and I think that the scientists appreciated our being there.

When we first went to visit, a lot of the procedures were just sort of in the scientists' lab book. "Here's how we do it in the lab." And they hadn't completely thought about how they would do that in space. So we spent an inordinate amount of time developing procedures. "How do you want us to do this?" If you're a scientist who's done these experiments in your lab for years, you just sort of know how to do it. It's like talking to old-timey cooks, where they tell you to put in enough milk that it gets to the right consistency. So we had to say, "Now, wait a minute. I don't understand how you want me to do it." We developed what we call long-form procedures, so we wrote down every little detail; you know, go here, do this, stand up, look at the screen. So there were these long-form procedures that weren't really in checklist format.

We did that first and sort of figured out how the equipment worked, how they wanted us to do the experiment, and then we had to pare it down into, "Now we've done it several times. We understand it. Let's get it down into a checklist format." So how we do abbreviate it so we have the right cues but, yes, we remember that we have to do this at this time. So we did that.

Then we had to go back and say, "What are all the malfunctions that could happen? What might happen? What are the failure modes that you can envision in your equipment?" That raised a lot of issues about what kind of backup things we ought to have. Do you have a computer board that you can put in there that will fix that problem? Should you have an extra one of these? In that whole evolution there was a lot of, "Oh, we need some more storage, because we hadn't thought about that. That's a single-point failure, and we need to be able to replace that part," or this, that, or the other. Going through all the failure modes that you could predict was another iteration that we had to go through. So maybe it was good that we had seven years to do this.

We would get surprises when we began to do our baseline data collection. You have to look at people's normal baseline physiology. Of course, scientists want eight data takes prior to the flight. "No, can't have that many. We've got twenty-one experiments. We can't give you all the time in the world."

We had to fit in the data takes. Once we began to do the data takes, we began to say, "Can we do that experiment right after that one?" Well, no, you can't, because it messes things up.

So we got into the timeline of how things could be done so that they didn't interfere. Some of the experiments used the same hardware. We had a strip chart recorder, a gas analyzer, and different pieces of equipment that were used by several different experiments, so obviously you couldn't do those at the same time. We had to spend a long time thinking about how can we do this. And because the people that were the subjects were also the operators, you had to timeline who's where, who's on first? Is the equipment available and does it interfere with something else? If we have to re-timeline, if we get behind, then how? It was kind of insane.

Most of it we got pretty correct, and most of it we figured out as we got into space and flew with it. I learned a lot about coordinating between crew, scientists, engineers, and managers. A lot of times you had to get them all in the same room and get everybody to agree what was the best thing to do, because if you just talked to the investigator, they would say, "No, I'm not going to do that." And the managers would say, "But you can't do this or that." And the engineers would say, "Well, that's impossible to do so on and so on."

Sometimes it was only the crew that could see the big picture. Of course, we were the people that were going to be the subjects, and we were the people that were going to be the operators, so we had to know the hardware and the science and what these scientists really needed. They would write down that they wanted a whole lot done, but they really only needed a little bit, but you had to sort of persuade them that they had to be team players, that they didn't have to be when doing science in their own lab. And they had to take care of their subjects because they didn't have very many subjects. If they wore us out, the data wasn't going to be good. If we didn't have time for lunch, they might see something that they weren't expecting on the metabolic stuff.

So it was a really interesting mission to be on and I learned a tremendous amount from helping to manage all the pieces and parts of that flight, and I think that really helped me on SLS-2, really, really helped.

ROSS-NAZZAL: Did you talk with Bob [Robert A.R.] Parker, who was the chief scientist for Skylab, or Joe, who had flown on Skylab, about how to balance all of these things? Because you were doing something similar.

SEDDON: I don't remember specific things, but, yes, I talked to everybody that I could talk to about how did this work and how did that work and how did you manage this. But the Skylab flights had a lot more time. We had nine days. If you're going to do three data takes during the flight on each of the experiments, on each of the people, it's so tightly interwoven if you lose a data point on day one, you can't exactly make it up on day three because the next data point's on day four. So they wanted a smooth timeline, so it was a little bit different. But certainly talking to them about how they did certain things and how blood draws worked and whether they had any surprises about this, that, and the other. The experiments were very different and the equipment was very different, so it was helpful to chat with them. But I think ours was a couple orders of magnitude greater in complexity.

ROSS-NAZZAL: I had read in a newspaper article that sometimes it took two or three people to do blood draws on this flight.

SEDDON: Oh, yes.

ROSS-NAZZAL: Can you explain why that was the case?

SEDDON: You can see the problem on our post-flight science video. We did one for a post-flight press conference, and then we put together a twenty-three-minute science.

ROSS-NAZZAL: I think I saw the first one, just the post-flight video.

SEDDON: There's a video sequence of a blood draw going on, and what you've got is my arm and you've got Jim Bagian putting the tubes on the catheter and collecting the blood and doing all that kind of stuff. Then he's handing off things to Millie, who's over here putting the right labels on and putting them in the right order in the trays. Some of them had to be centrifuged. Some of them didn't have to be centrifuged; they had to be refrigerated right away. Some were for this. Some were for that.

It wasn't like you just drew a tube of blood and put in the refrigerator. It was, you have to do a finger stick and get a hematocrit. You have to draw blood for this and spin it and separate the serum from the blood. You have to put this one in the refrigerator right away. It was like you collect six or seven things for each draw, and then you've got four people, so you've got lots of different moving parts. So, yes, it would take three people to do a blood draw: the subject and two operators, one person to really be the operator, and one person to keep track of what you'd drawn, what's the next tube that you're going to hand them, what's the label that goes on this tube and what do I do with it. So, yes, nothing was easy in space.

ROSS-NAZZAL: When I read that, I thought, wow, that's really complicated.

SEDDON: And if you're not careful, the tube goes floating off and you can't find it.

ROSS-NAZZAL: Did that happen?

SEDDON: Frequently you'd say, "Okay, we've got to collect three purple-top and three red-top tubes and one of something else. Do a hematocrit. I have to do three hematocrit tubes." So

sometimes you would label them ahead of time, and then if you knew you were supposed to have three and you've only got two tubes, you'd think, "Where's the other tube?'" So it was very interesting.

Again, I learned from that flight. When I came back and the scientists said, "Oh, you need to do it this way," and I could say, "No, you've got to have more than one person helping, and you just have to timeline that in. Sorry." Or, "It really helps if you'll label our tubes ahead of time and put them in certain places and know where they are. Practice doing it that way."

ROSS-NAZZAL: This was the first flight to fly three women at one time.

SEDDON: Yes.

ROSS-NAZZAL: Would you talk about that and the gender balance of your crew?

SEDDON: Well, I can remember they asked Bryan O'Connor, "Are you afraid of having three women on the flight?"

And he said, "No, I'm more worried about having three doctors on the flight."

It was nice to have the three of us. I can't say that we developed a strong group. We weren't the girls and didn't do girls' night out, but it was just kind of nice to not be all men, which is what I'd had on my first flight. I think we had a good relationship and laughed about things and laughed about men, but we were all very serious about doing what we needed to do and could support one another in that. If one person was going through a really rough time, you knew that you had a good support structure out there for you.

ROSS-NAZZAL: Bryan had also mentioned that you were one of the first crews to go through leadership and communications training.

SEDDON: Yes.

ROSS-NAZZAL: Can you talk about that and what benefit that had on the flight?

SEDDON: As I mentioned, we had some stress within the flight, just some frictions. Bryan recommended that we sit down and do the Myers-Briggs personality assessments, as I recall, and that we learn to work together a little bit better, and what approach works better with different personalities. I think that was very useful for us. I think everybody just assumed that everybody could get along. "Can't we all get along?" Sometimes that's hard to do, especially, as I say, when you've been training together in close quarters for a long time. And everybody has their own little quirks. I think it was helpful to sit down and take a deep breath and say, "What's the best way for us to work together?" Most of us are not going to change our personality, but we can certainly change our approach to how we lead when it's our turn to lead, how we follow, how we interact. I think that was very helpful. I enjoyed it, and I think the rest of the crew agreed that it was what we needed to do at the time.

ROSS-NAZZAL: Earlier you had mentioned the change in suits. In the first flight you had gone out in the blue jumpsuit. This flight you were in the launch and entry suit. Can you talk about that and the fit and the challenges you might have faced?

SEDDON: I hated those things. I hated those things. I hated those things. And you can quote me three times. I called it suit wrestling whenever we had to do a training exercise, because when you're small, proportionately the weight of those things and the size of those things and muscling those things around is just difficult the smaller you are. Basically, you have to have the same amount of stuff hanging off of you when you weigh 120 pounds as when you weight 180 pounds.

They were uncomfortable. They were hot. We had to train in Florida, we had to train in California, and we had to train in Houston. All those places are hot places. The suits were heavy. They were bulky. You had to just muscle them. And there were certain things you had to do. I toughed that out and I could do them.

In an emergency landing where you needed to get out the side hatch, the escape slide had to be lined up, taken loose, opened up and attached to the side hatch while wearing a suit. Drew wanted to help me, which was very nice of him, except that you couldn't fit more than one person in that side hatch, and I understood that I was either going to have to say, "You do it. You climb around the back of my seat and you do it," or I was going to have to say, "Leave me alone. Let me figure this out and let me figure out how to do it." That's what I did. I just felt like it was my responsibility because I was sitting over there near the door. Whatever it was, it was a very difficult thing to do.

There were a couple of times when—I'm trying to remember which flight it was—I had trouble activating the oxygen bottle, because what you do is you grab a ball-type device under your arm and you pull it all the way out. It's that last few inches that activates the thing. Well, my arms are short, and the suit even restricts your movements. I thought I had turned that thing

on and we were running over in the Cape to the slide wires, and I realize I was not getting any air. I had to learn how to get the oxygen on with short arms.

We had to be able to climb out the overhead hatch. "Oh, here, step up on the seat, step up on the back of a seat, and then put your fanny over the edge of the window." That worked fine if you were five-eight. It didn't work at all if you were five-two. So it was kind of like, "Okay, I have to pretend like I can do this, and if it takes somebody shoving me out the overhead in a real emergency, then that's what we'll have to do."

Even climbing from the flight deck to the middeck down the ladder was just incredibly difficult. It was kind of like, "Okay, we're going to practice this and now when you get down to the ground, run over there." I'm going, "Right. I'll be lucky if I can shuffle over there." I felt like we were probably going to hurt more people with that suit than we ever saved.

The heat in Florida was awful, even the heat on launch for SLS-1. They had a fan that would just blow air into the suit. Well, your suit was sealed at the wrists, and so it would try to blow air in. You had to hold the neck ring open so that air could come out, and it was all this humid hot air. At the time I had to wear glasses, so I would pop that neck ring while we're sitting there on the launch pad and it would fog up my glasses. I thought, "Well, okay, I'll try to open the wrist rings." I swear I almost had heat exhaustion when we finally launched. Maybe I'm just a sissy or something, but I hated those things. I truly, truly hated those things. And I was worried whether, with the adrenalin flowing, I could have done what I needed to do in them, but the practice almost killed me.

Later people would ask me, "Do you think John [H.] Glenn is okay to fly in space?"

I said, "If he can make it through the suit training, he's perfectly good to fly in space," because the suit training was one of the most difficult parts about it for me, a little person. So, no, I hated the suits.

ROSS-NAZZAL: And we'll quote you on that.

SEDDON: Those suits were built to be worn by high-altitude pilots, regular-size guys. If they had problems, they ejected. They didn't have to crawl out and run away. They didn't have to rappel down the side of their vehicle. Even sitting on the flight deck, the seats were meant to be for people in little flight suits. Now you've got these big bulky things. Even sitting there, you were scrunched up. You couldn't reach things. They had retrofitted a piece of equipment on there that made it difficult. Even the pilots trying to look up and reach the things overhead, they limited your ability to do that too. So I guess it was something that we needed to do, but it had its own downsides.

ROSS-NAZZAL: What did you think of the crew escape system that was put in after *Challenger*? Did you feel like that added some safety, or was that kind of the same thing with the new suit that you were wearing?

SEDDON: You know, it was just made more complicated by the bulk of the suits. The pole, I guess that would have worked, and certainly it gave you some warm feeling that maybe you could get out if you needed to. Again, you got told if the Shuttle is out of control and you're trying to get out, you may be pinned to the opposite wall, so you have to be able to chin yourself

up on all these seats as you work your way over to the door, to the hatch. I'm thinking, you know, I'm going to have to practice chinning-up a lot more, because now I don't weigh 120 pounds; I weigh over 200 pounds. So I don't know that I'm going to be able to do that, nor was there any way to practice doing that.

But, you know, there were a lot of sort of urban myths, I guess, for the Shuttle early on. There was this myth that you could land it in the water, and we had procedures. You could go and land the thing in the water. Well, what they didn't tell you was that the payload, whatever you had in the back, as you hit the water, was going to come forward and smash you. None of us really believed that we were going to be able to do that, but you practice the procedure. "Now, line up with the waves and do this and now climb out the overhead hatch." Kind of like, "Yeah, right."

I always kind of felt like a lot of the escape modes in flight with the suits on were urban myths. It gave us—what was it the pilots say—gave you something to do so you didn't stress or you didn't tighten up. It gave you things to do while you were diving at the ground. I don't know. I'm glad we never had to use them, and whether or not they would have been any use to the *Challenger* crew, I don't know, but it was one of those things that changed after *Challenger*, and we had to deal with it.

ROSS-NAZZAL: Do you think that there was more interest in your mission because of the possibilities for a future Space Station and showing what was possible or feasible to do in space, with an actual lab?

SEDDON: I guess to a certain extent on my two life sciences flights, I think we did enough interesting things that it gave people more ideas about other things that were possible to do, and it also pointed out that it's very inefficient to get all of this stuff together, to spend all of this time training people. They go and they do great science for a week, ten days, two weeks. Then they come back to Earth, and we take it all apart again. Then a couple years later, we put it all together again. It was just an inefficient way of doing science. Plus, it only gave you a very short window to gather data. SLS-1 was nine days and SLS-2 was fourteen, and, yes, you can see what happens over that period of time, and a lot of the systems sort of equilibrate over that time and you reach your new space normal. But there were a number of things that hadn't equilibrated yet or that you thought might take longer to readapt after you got back if you'd been there longer.

We didn't have any control animals. You didn't have a centrifuge for the animals in space to have 1-G controls, so what's due to the space environment and what's due to weightlessness? It said now we could do more sophisticated science, but we can't do all the things that we want to do with this vehicle. I think everybody was excited about having Station and having additional capabilities and more time and a lab that was up there and usable most of the time.

I think that, at least for us in '89 and '91, Space Station was still far away. We didn't know what it was going to be like and how long it was going to stay up and what the capabilities were going to be and what equipment would be on board and what would be the focus. It was the next step, but beyond what we were doing at the time.

ROSS-NAZZAL: Now, at the end of this mission, you guys spent about a week at Edwards [Air Force Base, California] doing some additional tests. Would you tell us about those?

SEDDON: That was very interesting. It drove some other things, let's say. People ask, "Usually Shuttles go at 28 degrees inclination. How come yours went to 39?" Well, it was because, number one, we wanted to keep our sleep and wake cycles the same, because changing circadian rhythms can change your physiology. So we want to be able to go to bed and get up sort of at the same time every day.

And when we looked at how much equipment we had to have for the post-flight testing, we really only had one set of equipment, so that said we needed to plan to go to the landing site that was the most predictable. And the answer was, yes, we need to go to Edwards. NASA had to bite the bullet on that, because it cost extra money to get the Orbiter back to Florida, but it's more chancy to fly into the Cape. So they said, "Okay, we'll land at Edwards, and we have to go at 39 degrees to keep your sleep/wake cycles the same, and land you early on landing day so that we can still have time for tests on landing day." The early post-flight testing was very important. That very first day they had to land us so that they had enough hours at the end of that day to complete the day's post-flight testing. So it was all again parts of this puzzle that had to be put together.

We said, "Okay, we're going to land at Edwards, and will we get to see our families?"

"Well, yes, for a little while."

"Well, then what?"

"Well, then you're going to go over to the officers' quarters and sleep and then we'll have you back for more tests the next seven days."

We said, "How about you put us up in someplace nice, and our families can stay there, and we can see our families in the evenings." When they looked at it, it made sense, and it didn't cost a whole lot of money. So we went to a nice resort called the Silver Saddles, and our families got to be there. That was wonderful. I mean, that was just absolutely wonderful. We were relaxed. We could eat with our families. We could be with the kids, and we could talk about the flight. It took something that was going to be very onerous and made it something that was very nice. The investigators could come and stay there, and we could have a beer with them as long as we recorded it on our food log and we didn't have any caffeine before the exercise testing. There were all these restrictions, but at least it was in a nice place and not in the rather sterile environment of Edwards Air Force Base.

So, yes, we stayed for a week. We got really, really tired of doing those experiments over and over and over again. We began to look like drug addicts, because they kept drawing blood from us. We completed it. They got the data that they wanted, and they were happy. I think all of us were really invested in that flight. We had spent so much time planning it, working on it, fighting about it, trying to understand how to do it. You come back from a flight knowing we've got good in-flight data, and you realize that if you didn't have the post-flight data, you're going to be missing an important part. How do you readapt? We were willing to do it. The flight had been successful, so I think that made it a happy time too. Post-flight is always a good time when you come back and you've done what you meant to do.

It was nice to have the investigators there, because they were all happy about the data, and as they were pummeling us with this data take or that, they would chat about, "I remember on this day when this happened." We had a lot of fun and excitement, talking about what they did on the ground. They'd ask us, "How did you do this? How did that work?" So it was fun.

ROSS-NAZZAL: You and Jim Bagian actually received an award after this flight, the Melbourne Boynton Award.

SEDDON: Yes.

ROSS-NAZZAL: Will you talk about that? And you had previously won it yourself in 1986.

SEDDON: Had I?

ROSS-NAZZAL: According to the research we have.

SEDDON: Yes. I think there was recognition that at least for the world of life sciences and aviation and space medicine, that this was an important flight, and it was nice to get the recognition that we had contributed to it.

It's strange when you do experiments in flight. It's somebody else's research, and you don't get your name on the published papers. So you are subject two in that data. Here it all is, all of this work that you did and all of this suffering that you went through, and your name's not on the paper. You are a subject number. It's absolutely important that you are de-identified. In other words, they didn't say, "This is Rhea's data." People needed to know that if they looked really strange physiologically, that it wasn't going to impact anything or that people weren't going to worry about being assigned to another flight or something.

Some of the investigators were very nice. They put at the end, "Special thanks go to these people who were both subjects and operators. We really appreciate their help." That was nice. But it was nice to get an award or two from eminent scientists and others that said, "We appreciated what you did, and what you did really was important to what we are interested in." You got different kinds of awards for different things, but I think they were very much appreciated.

ROSS-NAZZAL: One of the things that I saw, looking through the research that we pulled, was that you had given some testimony after this flight. One of the committees that I thought was interesting was the Committee on Budget. You had testified in front of the Committee on Science, Space, and Technology. But that one just struck a chord with me. I thought that that was rather unusual for an astronaut. Is that the case?

SEDDON: It probably was. You know, we didn't control that. We didn't request it. We didn't say, "I want to talk to these people." NASA decided which committees and which people we talked to post-flight. We always did post-flight, what they called a Hill visit, and they frequently asked us to go and talk to our own congressional delegations. I'm from Tennessee; I went and talked to the Tennessee delegations. You took them a montage of pictures and told them how much their support meant, and I think they were pleased with that. They had something to hang on their wall that said they were space supporters. So that was a good thing for us to do.

We were frequently, depending on what was going on at the time, were asked to go to speak to different congressional committees. We worked it out and spoke wherever we needed to at the time. Obviously, there was probably budgetary considerations going on at the time,

probably for Space Station or for Shuttle funding or for science funding, and it was very helpful to go and bring the excitement of spaceflight to committee members and tell them what you had done and why it was important.

Frequently, even when you went and talked to congressional people, they had their aide there that really followed NASA. The members of Congress didn't know very much about space, and it was the aide that asked the questions and wanted to know certain things about what you did. So when we went and talked to a committee, we would tell them, "Here's what we did, here's what it means, and here's what the future of that is." So I think that was helpful. Again, we did that depending on what the issues were at the time and what NASA felt like we ought to go and talk about. We tried to make it understandable and exciting. Whether we changed people's minds, I don't know, but that was part of our responsibility.

ROSS-NAZZAL: Is there anything you don't think we covered about this second flight? I'm trying to be pretty thorough.

SEDDON: You covered more stuff than I ever remembered. I'm glad you did your homework. It was very helpful to remember those things.

ROSS-NAZZAL: Yes, I think that was it.

SEDDON: Okay.

ROSS-NAZZAL: We thank you for your time today.

[End of interview]