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MARGARET RHEA SEDDON
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is May 10, 2011. This interview with Rhea Seddon is being conducted in Murfreesboro, Tennessee, for the Johnson Space Center Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright.

Dr. Seddon begins today by talking about the launch and entry suits.

SEDDON: Getting into those suits was crazy. They had technicians that got you into them prior to launch. You had a lot of help. They suited you up for all the practice runs and all the simulations, so they were part of the team that would wrestle you into these suits and check out everything before a flight. But then you had to get yourself into them for landing. And imagine the middeck, weightlessness, and seven suits floating around down there and fourteen gloves and fourteen boots and cooling garments.

You had to stow them after launch, in what we called the post-insertion timeline, meaning right after you get to orbit. It was always really, really busy, and somebody who might not be feeling well was tasked with stowing all the suits, because different people had different things they had to get done. I had to open the payload bay doors. So you came out of your suit and you just let it float around. Somebody had to stow them all. There were suits, boots, gloves, helmets, parachutes, and seats, and they had to be stuck somewhere. Then you didn't think about them.

Then when you're getting ready for landing, you can't just sort of pull them out and hang them up the night before, like you would if you were on a business trip. You didn't want to pull them out until you had to, because they took up a lot of room and you didn't need to put them on. You didn't want it just floating around. So there was this flail when, "Okay, time to get ready to come home. The commander and the pilot have stuff to do. They have to do the de-orbit burn and all this kind of stuff, with the flight engineer. So let's pull them all out and find where their stuff is, get them in their stuff, and then everybody else can sort things out." Well, it was insane.

SLS [Spacelab Life Sciences]-1 was where I first saw it, because that was the first flight where I had worn a suit. We were saying, "We can't find so-and-so's glove." Well, it can't be anywhere but here. [Laughter]

ROSS-NAZZAL: We didn't do a spacewalk.

SEDDON: It's not like I left it out in the car or somebody carried it off someplace. It's got to be here. When you can't find it, it's just kind of like, well darn. Eventually it turns up because it floats out of somewhere when somebody rummages around back behind the lockers or something. But there's a lot of nooks and crannies where things can get stuffed, and there are a lot of nooks and crannies where things can get lost. I hadn't thought of that in a long time. I think somebody took a picture, and it looked like an ocean of orange down there with all these things floating around. That was interesting to me. I think probably that was in somebody's debrief somewhere, but you hear it and you think, "Oh, yes, well."

Then on my third flight, we planned it out. So-and-so's suit, boots, and helmet and everything are going to be put together and put there. By that time we knew how to solve space motion sickness, so there were fewer people that felt bad and were more useful.

ROSS-NAZZAL: How did you solve that problem?

SEDDON: You know, for a long time we tried a variety of different things. Scopolamine and Dexedrine worked real well here on the ground, but we found in space it solved the problem during the timeframe that you were taking it, but then there was an adaptation after you quit taking it and you got sick then. Then you couldn't really take anything by mouth, so we tried suppositories.

Finally I think it was probably Jim [James P.] Bagian on his first flight tried intramuscular Phenergan, which is an anti-nausea medication that they use postoperatively and for chemo patients. Worked like a charm. Usually you get a big slug of it if you don't feel well. I mean, you get into space and you're thinking, "I don't feel so good." You get a shot, it cures you, and very rarely do you need anything else ever on that flight. A 50-milligram dose is a big dose, and it usually knocks people out on the Earth. It usually makes you so drowsy, but that's okay if you're post-op or on chemo. People on the ground said, "That's too much Phenergan to give somebody that needs to work." We kept saying we don't have any drowsiness up there. There's something different. Either it's the adrenalin or your muscles, where the injection is given, are not being perfused as much or whatever, but we don't seem to have that. It's not an abnormal dose, it's just enough, and it cures it.

They wanted us to do all these tests of, "Well, what we want to do is later in the flight, we'd like to give people 50 milligrams of Phenergan and then check their cognitive abilities." Nope, not going to volunteer. Nobody's going to volunteer and take a chance that you'll spend the day feeling drugged. So we don't know why it works. We just know it works. "Go away. We've solved the problem."

ROSS-NAZZAL: Right. We know it works.

SEDDON: "We know it works and we're going to keep doing it." Can we take a quick break?

[interruption]

ROSS-NAZZAL: I thought we'd start this morning by talking about your CapCom [Capsule Communicator] activities.

SEDDON: Yes, CapCom'ing I must have done between my second and third flights, and it was one of the best jobs that you could have. It really kept you in the loop of what was going on currently with the flying world. I had sort of been out in the science part of the universe and had not been able to keep up with what other people were doing and what the Shuttle was doing and engineering changes and all of that, so it was wonderful to be the CapCom. You had to do shift work again, and it was very busy.

There was a lot going on, and you would do these sims [simulations] that would last all day or have to come in at midnight, so that was somewhat difficult. In the meantime we had

gotten Joann Powell, our live-in nanny, so it was a little easier to have odd hours, and it did, for the most part, keep me at home. There wasn't as much travel as there had been. I wish I'd had that experience early on.

When we first got our job assignments in 1979, some of the people in the '78 class were immediately put as backup CapComs. It really gave you so much experience in understanding what went on during a flight, how the ground supported you. I made a flight or two and I'd worked with people on the ground, but I didn't really fully understand what they did and how they did it. So this was a wonderful experience to get to see that and be part of it, you know, when things went wrong, how people worked on the ground. Of course, I'd been the beneficiary of that because on our first flight the ground had an awful lot of work to do to put together a flyswatter and an unplanned spacewalk and rendezvous. So it was fun to see how that was done in Mission Control and to be a part of it.

As a CapCom, you really got involved. You were representing the crew, and you had to pull in resources. You couldn't do it while you were sitting there as CapCom in Mission Control, so you had to call in people and think about who was the expert and who could help. Then you were in charge of explaining everything to the crew or explaining the evolution of what was going on. So I gained a lot of appreciation for what went on on the ground, and I really enjoyed the job. As I say, I wish I had had it earlier so I'd had more insight.

You know, it's strange. It's like with computers. It's great, but you don't realize the limitations until you have to do it. You would explain something to the crew, and then they would ask you something that would tell you that they didn't really understand what you said. They didn't understand why they were to do something. You realize, oh, yes, we didn't tell them

what we saw that led us to need to fix something, and now we're calling them and they don't even know it's broken.

It was always worrisome during a flight when you would call down to the ground and say, "This is happening," and they would say, "Stand by."

You're going, "You know, I think there's an easy answer to this. Just say yes or no."

And they'd just say, "Stand by." So it kind of got to be a joke. "We are standing by," which was kind of a hint, "Hurry up."

When you're in Mission Control and you realize the analysis and other things that are going on in order to give you the yes or no answer, it gave me some appreciation of how that all worked and why sometimes when you're in flight you don't quite understand what's going on. It gave me a greater appreciation of what went on on my first flight, where they had to do all the re-planning and lots and lots of people had to work on lots and lots of pieces of that. So it was one of the best jobs you could have, in my way of thinking.

ROSS-NAZZAL: Were there any emergencies or malfunctions that you helped work on any of these three flights that you can recall?

SEDDON: There probably were, but I don't recall what they were. I always did the orbit shift. I didn't do ascent or entry. I got to learn a lot about the science that was going on on some of the science flights or smaller payloads. I had to learn about that and interact with the people that were working in the payload world.

Quite frankly, I don't remember any things that happened, but I just remember that there were always things going on. It kept you busy. It kept your mind working. Pull out the

engineering drawings, or who knows how this is all linked up that could have possibly caused the problem. There were just a lot of smart people figuring a lot of things. Someone would get the "aha" moment, "Oh, I know what this is. It's not there. It's back here." It was just fun, just fun.

ROSS-NAZZAL: Yes, it sounds like a fun assignment. I did want to ask you, "Hoot" [Robert L. Gibson] was chief of the Astronaut Office for a while.

SEDDON: Yes.

ROSS-NAZZAL: In the nineties. I was curious, how do you think that impacted your career? Did you ever get any sort of kidding from people in the office that you were getting the good jobs because he was your husband?

SEDDON: [Laughs] Well, you know, I couldn't work for him. That was one of the things that, you know, "Oh, dear, Hoot's now chief of the office and Rhea can't work for him. What shall we do?" Well, no big deal. It was obviously an administrative problem, not a real problem. What I did was I worked for Dave [David C.] Leestma, who was then head of FCOD [Flight Crew Operations Directorate], I think. I just bumped up one, and so that's how we solved that problem. It wasn't any problem at all.

I can't remember whether Hoot assigned me formally to my third flight or not. Do you remember when he was chief of the office?

ROSS-NAZZAL: Yes. I have December of ’92 to September of ’94.

SEDDON: He didn’t assign me to a flight, but there was always sort of this question about things. But I don’t think anybody thought—I mean, Hoot was so clear-cut about who was assigned to flights and why. You went in order. People that needed to be on flights, he put on those flights. He put a tremendous amount of thought into it, and I think everybody thought that he was real fair about it. So I think if he had put me on a flight, they would have said, “Oh, yes, well, that makes sense. It’s time, and she’s the right person,” and so on. So it really wasn’t a problem. We did get a lot of kidding about it, and he would kid me—he was the boss. I told him, “I don’t work for you.” So life went on as normal.

ROSS-NAZZAL: Let’s talk about that third flight. I found it interesting that this was a continuation flight.

SEDDON: Yes.

ROSS-NAZZAL: But yet you were the only member who continued to fly.

SEDDON: Well, actually, it was odd, and there was some controversy about my being on the next flight, because I was subject number something on the SLS-1 flight, and they wanted four other subjects. They had gotten data on me, and a lot of the experiments continued. They wanted to get eight subjects altogether, and if I flew, they were only going to get seven subjects, because I was a repeat. They already had data on me. They weighed the pros and cons of that, but I had

been following SLS-2 as long as I'd been following SLS-1 and continued to follow it after the first flight.

I think the other kicker in there was that I had had a baby in 1989, close to when it was supposed to be SLS-1 time, and they weren't sure I wasn't going to have another one in the interim, so they wrote it into the—"Here's what we want, the qualifications we want." Preferably an M.D. or Ph.D. in life sciences, normal physiology, willingness to do all the experiments, and not get pregnant. It just sort of ran on and on and on, and there's this little thing in there, "Can't be pregnant."

So, anyway, I think I had such a good relationship with the investigators, I had so much experience from flying that I was folding back in. The scientists were saying, "We need to do this or that next time. We need to plan this next time. We need to do the timeline better this next time." There were just so many things that came out of SLS-1 that they wanted to capture, and I think they knew that if I wasn't on SLS-2, I would probably be busy with another flight and not be able to help them as much as they liked.

Many of the experiments were different on SLS-2. They were a continuation, but they were slightly different. Once we had a flight crew, John [E.] Blaha said, "You know, we are there to get the science," which was kind of unusual. The commanders always thought, "We're there to get you to space and get you home." And his take on it was, "No, we're all there to get good science out of this mission. It's an important mission." So we got the flight crew to say that they would participate in some of the experiments. They had to do the "non-provocative" ones. In other words, they wouldn't do anything that would make them sick or weak, because they might have to fly us home at any point in time.

We looked at it really hard, and we spent a long time on the timeline. The investigators were a bit concerned because we looked at it and we said, "If we try to timeline four people doing all the experiments, we're going to impact the other experiments, or we're going to get poor data. So we will guarantee that on these days we will get you three people. If all the equipment works well and we have the time and things run efficiently, we will get you the fourth. We'll timeline things in." It was very complex to do it. "We'll timeline things in so that that fourth person will have time to do the experiment if we have time with the hardware. On days when we have things that look like they might run well, we'll get the Orbiter crew." We had an Orbiter crew member that would do each of the experiments. We said, "We'll get you that person too." It was kind of like, "Hmm." It was a tradeoff. They were having to agree that all we would guarantee was three people, and we would write the timeline that way, but we would have penciled in our notes that we could call the pilot or the flight engineer on a moment's notice to come back and do this experiment.

Everything went well. I think they told us we got 115 percent of the data that we were supposed to get, because the hardware worked well, we had timelined it right, we had a great crew, and we worked really well and we worked really hard and we were willing to stay a little bit late at night. And we did a lot of what I call preplanning. In other words, we took a little bit of time at the end of the day to say, "How can we get ready for tomorrow?"

I think the experience I had on SLS-1 was really valuable in helping things to work so smoothly on SLS-2. I was the payload commander, and that really helped because I could make decisions. I certainly listened to everybody else. We hashed things out, and it didn't very often come down to saying, "I've heard what you said, but we're going to do it this way."

And again, having a good relationship with almost all of the investigators, we could persuade them too, and they had seen the problems we'd had on SLS-1. They could see the value in doing it the way that we were going to do it. They cooperated with each other. And because we had gotten a lot of really good data on SLS-1, they realized that the crew was very, very invested in doing everything possible. There wasn't a push-pull controversial-type relationship. It was very cooperative and collaborative, and they trusted us to do it. As I say, when all of your equipment works well and you don't have to spend time banging on the gas analyzer or turning the freezers off or on, or worrying about something that doesn't look right, you can fly, literally and figuratively, and that's what we did.

I think the animal dissections were the most difficult, the most unknown, and the most controversial of the things that we did. We practiced that a lot. We thought a lot about that. We spent an inordinate amount of time at Ames [Research Center, Moffett Field, California] training. I had to make a decision about who was going to do what. One of the payload crew, the science crew, felt like everybody ought to do everything. We worked on that, and there came a point in time when it just wasn't efficient for everybody to do everything. We couldn't specialize, we couldn't get really good at anything, and that was one of the things with the animals. We had a number of different things we had to do with the animals, and we all practiced all of them. It became obvious that some people were better at some parts of it than others. It was either going to be that we had to spend three times as much time training, and we had already spent a huge amount of time, or we were going to have to specialize. "You take this part, you take this part, you take this part, and you take this part."

Because most of the activities were done in pairs, it also came down to we need to pair up. These two people do these things, and these two people do these things. I think there was

maybe some difficult feelings about stuff, but I talked John Blaha at length about it. I said, "John, you're the commander, and if certain people come to you and say this isn't fair, this isn't right, I need you to understand why I'm making this decision."

He said, "I'll back you. You're the payload commander. You know more about this than I do. You've seen this happen."

So we divvied up and I just said, "Here's how we're going to do it," and that's the way we did it. It worked out really, really well, because each pair of us could spend our time now focusing on half of those experiments, so we could get really good at them.

Marty [Martin J. Fettman] and I did the dissection part, and Dave [David A. Wolf] and Shannon [W. Lucid] did all of the metabolic blood draws on the rats. The metabolic stuff, you had to be able to essentially start an IV in the tail vein of a rat, and it was very, very difficult. I always had trouble with it. Quite frankly, I didn't think I was going to be very good at it. With the stress of being in orbit, the time constraints and everything, I didn't think I was going to be very good at it. I guess maybe to a certain extent because of my surgery training, I didn't have any trouble with the dissection parts. So that's the way we divvied things up. Everything went well.

Marty and I spent a lot of time, extra time, both at Ames and JSC, working with the trainers from Ames on the dissections. The dissections were very interesting. There were a number of experiments that were proposed for the animal dissections. We had practiced those, and we had gotten pretty good at it. Before the flight somebody looked at the end results, and we would be taking, I don't know, a dozen pieces and parts out of each rat that we dissected, and then the rest got thrown away.

So they sent out a research announcement, with our permission, to ask if anybody else wanted other organs, and it became known as the Parts Program. There were lots and lots of people who wanted different things, like eyeballs and lungs. It wasn't that much more difficult to remove them and save them, but you had to have fixatives for them. Each little organ had its own little bag of fixative. Some had to be frozen, and some of them had to be refrigerated, and some of them just needed to be put in the fixatives. So, you know, it got more and more and more complex.

I think that we understood that there were the primary things, there were those ones that had been proposed at the outset that were our primary responsibility, and there were time constraints on some of those. The inner ears had to be in the fixatives within two minutes of decapitating the animal, and the inner ear is buried way down in the skull. Then the leg muscles had to be on their muscle clamps and into the fixative by ten minutes. There were several little teeny muscles that you had to stretch out and put on the clamps and everything and then get them in their assigned bags; it was just this choreography that was incredible. Of course, Marty was a vet, and Marty was just terrific at this stuff, so we just worked out this complex choreography.

Then once you got really good on the ground you'd think, "Okay, I can do that in the time allotted," and you'd begin to worry about what it was going to be like when everything was floating and we were floating. So we went on the zero-G plane and scared ourselves really bad, because the zero-G plane is not really zero-G. Even on a smooth day, there are little ups and downs so that if you've got stuff that's not floating or that is floating it goes in different directions. Marty and I were bouncing a little bit. They had put a workbench on the zero-G plane, and we did all the stuff we were going to do to the rats. Everybody on the plane is going by, going, "Ew! Ew!" And people would come and look, the curious would come and look, and

the other people would avert their eyes. It was bumpy. We got it done, but we looked at each other and said, "Oh, shoot, you know, have we bitten off more than we can chew?" We told the investigators, "We don't know how this is going to work. There's a chance that we may not get it done or done well or done on time, and we may mess things up."

They said, "Well, you're the best we've got. We're going to send you anyway."

"Let us practice some more," Mary and I said.

We did practice down at the Cape [Canaveral, Florida] before launch. When we were down there two days before launch, we had it written into our schedule, "animal dissection practice." Marty and I wanted it to keep our hands good, because the animal dissection didn't take place until day thirteen of the flight. We're thinking, "Do we remember how to do this? Are our hands in good shape?" So we had to worry about it the whole flight. Marty and I would look at each other with "here's hoping" expressions.

There was no way to practice it up there, only think about it, and hope that we remembered all the things and had all the parts and we could put them in the right place. We had all this stuff. We had choreographed where to put all the fixative bags within the workbench and where to put our stands and where to put our equipment and where to put ourselves. I had special magnifying glasses so I could see the little pieces and parts well. So it was pretty exciting.

Once we got going, Marty and I'd be standing at 90 degrees to each other, we'd smile because, yes, we got it done, so that was nice. They called us the Benihanas of the Space Program because we were just going a mile a minute. Luckily, we could do one and then we'd clean up. We'd make sure everything was away, debrief, and then do another. We had a certain amount of time. I think we were going to guarantee to do four, they wanted us to do six, and we

did one and it went okay. Then we looked at our watch and thought, "Okay, we could do another." So we just went through it and we got better and better and it got smoother and smoother, smoother and smoother. But even on the last one did, we had to think really hard, we had to work really hard, and everything had to go right.

The fact that we practiced and the investigators and trainers spent a long time with us and made it successful. We were reporting to the ground, because they obviously couldn't see us, and we couldn't videotape any of this. One of the caveats on this flight was no videotaping of *anything* to do with the rats. Really, we even had to minimize the amount of conversation about it, because somebody would hear, "The decapitation went well," and people would get excited. So all we would say was, "Number one subject is done. Everything went well. Everything's in the bag." You could hear the cheering from the payload ops people, "Yay!" Then, of course, I didn't know until we got back whether we'd gotten things in the right amount of time to have good tissue for analysis.

The fixative bags were really interesting. They were double-clamped. They were small rectangular plastic bags with double clamps, two clamps up the thing. The fixative was down below the lower clamp. What we had to do was take off the upper clamp, put the piece of tissue in, push it down and put that upper clamp back on, and then take the lower clamp off, force the liquid and the tissue to mix. Then we had to try to squeeze out as much air as we could, pushing the liquid and tissue to the bottom of the bag, because we didn't want the tissue to be in an air bubble, and then put the lower clamp back on above the liquid. It was a complex procedure, and we knew that if we didn't get the fixative mixed well with the tissue, that it might not be very well preserved.

We didn't know until we got back whether or not the specimens were good, whether they could get their data, and as the data began to come in—it was just fascinating stuff. One of the most fascinating, I think, was about the inner ears, the gravity receptors in the rats. They found that in weightlessness the gravity receptors rewire themselves. We had always thought that the nervous system was just there and permanent. What they found was different: more of this one kind of nerve grew, and fewer of these kinds of nerves grew into the receptors. So they would show here's ground-based animal; here's space-based. Oh, it's different. In fourteen days, different nerves had grown into the inner ear of the rats. They were beginning back there then to understand the concept of neuroplasticity, that the nervous system can rewire itself. Scientists used to think as you got older, you just lost brain tissue and that was too bad. Now they're finding that you can re-grow brain tissue as you get older. That's neuroplasticity.

I think we saw it, too, with reflexes. A lot of our reflexes would get out of shape. We had an experiment where we held on to an overhead bar and got dropped to the floor. We had suspenders on, and our legs would have to catch us. Well, there's a reflex that sends a message from your inner ear down to your legs that says "you're falling." It doesn't go through the thinking part of your brain. It's a reflex, and your legs stiffen to catch you. That reflex got out of shape as we were in space. The muscle action of your leg that they measured was slower.

Blood pressure reflexes were the same way. As you're not lying down and standing up, the reflex that helps your heart speed up a little bit when you come upright, when your blood pressure drops, just slowed down. It began to forget how to do that.

There were a lot of very interesting things that were found. All rats continue to grow. They're not like us, where you get to an adult stage and humans quit quite growing. We brought back bone specimens of the rats, and what they found was that there was less growth when you

didn't have gravity, but there was some. The structure of the bone that was laid down in space was different, which says, "Hmm." So if we take people into space and we give them something that helps them to grow bone, rather than continuing to lose it, maybe it's not going to be as good a bone as what you would have had here on the ground. It's not going to be lined up the same way, and it's not going to be able to handle the stresses of gravity when you get back. So it was things like that, that we wouldn't have known if we hadn't been able to dissect the rats.

People don't want you to do bone biopsies on them. Even getting people to sign up for muscle biopsies where you stick a needle in your leg and biopsy the muscle, that was difficult to get people to sign up for that. But in the rats, we could bring all of these things and look. You have to decide whether rats are good models of humans or humans are different, but it does give you some interesting thoughts about how living things react and the things that we need to worry about when humans go into space. Then how do we get people back to normal, or can we get them back to normal when they come back home.

I think it was some of the most sophisticated science that we had ever done in space, and we figured out how to do it. We figured out we could do it. It opened up all kinds of new ideas about what you could test next. And then we quit doing it. Neurolab [STS-90] had some pretty sophisticated life sciences on board with animals, but after that, we quit. We had a workbench. We had animal cages. We had the capability to do stuff. We had Spacelab that allowed us to take live animals in space reliably, and we quit doing it. There was always this thought that, "Oh, we'll have all those capabilities on Space Station and more."

Of course, Space Station was, it seemed like then, a long ways away, and everyone knew that NASA timelines always stretch longer. There were always surprises or funding difficulties or one thing or another. To me, it was just sad that we didn't continue the science on Spacelab

until we got science capability on Station, but they wouldn't fund both. So we quit doing complex life science studies, and we've never gotten to the point in Space Station where we could do it. We don't have animal cages. Until recently, we haven't had enough crewmembers. We don't have a carrier to take live animals up.

We just quit doing that, and it's kind of sad when you look back on the capability that was designed, built, tested, which brought back good information, and that was that. So, in a way it was sad, but at least I did my part. I had fun doing it, and I think the flight itself was a great success.

ROSS-NAZZAL: You had mentioned that the first flight was so hectic, so how did you decide to balance things as payload commander to give your crew the opportunity to relax and not be working eighteen-, twelve-hour days every single day? Did you work with the flight activities officer?

SEDDON: Yes. It was the timelining thing. When you're getting things planned, as I said before, you learn how to work with the crew, the investigators, the NASA people who are working the flight and administration-type people, and engineers. What will the hardware do? You have to come to compromises about things. I think sometimes the investigators, who would have given everything they had to have gone into space and they would have worked twenty-four hours a day for fourteen days, didn't quite understand when we said, "We can only fit this much stuff in here, because then begins our pre-sleep activities," which included dinner and getting ready for bed and having a little time off, and that's three hours.

They sort of thought, "Three hours? This is such valuable time. Three hours? And you get two hours when you get up? Why do you need two hours to get up?"

And you're going, "You're going to kill us." The excuse on the life science flights, of course, was, "Well, you know, if we're starved and sleep deprived, what kind of data are you going to get back?" And to a certain extent, that made a good argument.

Then the NASA managers say, "This is the way it has to be done."

And we would say, "We would like to get up fifteen minutes early on this day to get set up for the metabolic experiments."

And the NASA managers would say, "No, we don't want to set that kind of precedent."

And the timeliners would say, "No, I'm required to give you this much time."

We sort of had to work things out so that we didn't promise the timeline was the way that we can guarantee we would do it, and that's the conclusion we came to. If we wanted to get up fifteen minutes early, we could set our watches and we could pretend like we weren't in the lab. Of course, they can tell the minute that you turn the light on back there. "They're up." Often the payload officer would say—I'm sure when I worked in Mission Control someone would say—"The crew's awake." They knew. But when you were there, you would do it your way.

Ahead of time, we said, "We're going to go by the rules. We're going to guarantee that we'll do this, and if things are working, if we got good sleep the night before, then we may be able to get up a little early. Or if somebody else will take care of making breakfast, we'll go set that up and then go have breakfast."

So that's the way we did it. I think the fact that we didn't have to work late to fix equipment, it just went well, at least to my way of thinking. Maybe it was because of our realistic planning; also, we just didn't have the problems on SLS-2 and had the benefit of having

experienced crewmembers on the flight. Especially if you're going to do two missions that are very similar, you understand what the problems are, what they could be, you think about that and you plan around it and you don't over-promise. I think that's the worst thing that you could do during a flight, I've seen it on a couple of flights where they were so tightly timelined.

The other thing that we always dealt with was that the investigators would say, "Well, when we do this in training, you can do it in thirty minutes."

And we said, "Yes, but we need to add some zero-G time on that." They would frequently get really upset that something that took thirty minutes on the ground, we timelined for forty, but that was a wise thing to do. Because if you tell them, "Well, if it takes each of thirty minutes, then we can do four people in 120 minutes," well, it just won't work that way. There's time in between. There's time of getting out of equipment. You just can't do it as rapidly, especially the first time. We made rules about that. The first time we do it, it's an unknown, it's in zero-G; there's no way we can practice it here on the ground. You have to allow us one and as much time.

They would go, "Oh, man, we're not going to get anything done."

We said, "But, remember, we've timelined it. We've planned it that if we get everybody done, if everything goes a lot smoother, we'll get you that fourth subject, but we're not going to promise." And so we didn't. We promised what we thought we could get done, and then we got more, so they were very pleased. That became pretty obvious early on in the flight, that we were getting sometimes five subjects because we got payload crewmembers. We did the three primary people, then I would do it, then we'd call John or Rick [Richard A. Searfoss] or Bill [William S. McArthur, Jr.] to come back and help us with another run.

They were just great. It was great to have people who were not afraid to do some of the life sciences things and who took the time to learn how to do it. You had to learn how to do the experiment, how to be the operator and subject for the experiment, and we helped them out. They didn't have to learn it to the depth that we learned it, but they had to learn what they needed to do. We had great crewmembers that would come back and help us out. So it worked and worked well.

ROSS-NAZZAL: Would you tell us the reasoning and benefits of having a payload commander? Because you didn't have one on that first flight.

SEDDON: It's like having a named leader at anything. Why do you have a commander on the Space Shuttle flight? It's just the person that takes the responsibility for making some of the decisions about how you're going to do things. I had learned on SLS-1 that if you try to do everything by vote or by getting everybody to agree with how you're going to do things and everybody wanted to be nice about it because you didn't want to have a bad relationship with the other people, it just didn't seem to work very well.

On SLS-1 Jim Bagian and I, of course, were the two mission specialists, and we were sort of the de facto co-payload commanders from the beginning. After *Challenger* [STS 51-L], NASA said on the Spacelab missions, on big science missions, we'd have a payload commander. Jim and I had been working this flight for a long time together, and it was going to be a little difficult to figure out who got the job. I guess I could have pulled rank and said, "I'm more senior. I got here before you did. It's mine." But I didn't really want to do that. We were working fine together. We didn't have any major problems. We each worked on different

things, and things were a little uncoordinated at times, I would say, not to the point that it impacted anything, but it was like, "Well, I know Jim wants to do it this way. I'll just defer to him on this one, and then I'll try to get him to defer to me on that one." It was just like having two presidents or two flight commanders. It just sometimes got a little awkward. So I was happy when they decided they would make me the payload commander on SLS-2.

Dave Wolf was a very junior member. He was the other mission specialist, so I don't think there were any really bad feelings with Dave that he didn't get named. It didn't make sense to make him payload commander. Shannon and I were certainly of the same class that came in, so we had been with NASA the same amount of time, but the fact that I had flown SLS-1 and she was a mission specialist/payload specialist, it just sort of made more sense. The investigators got to decide and NASA got to decide, "Who are we going to make payload commander?" We didn't vote on it. We didn't elect a payload commander. Somebody made the decision, and they decided it made more sense for me to be the payload commander. That helped. I felt like if we couldn't all go to a meeting that needed a decision, that I could go and represent the payload. The crewmembers knew about the payload commander decision early on, and I made reasonable decisions on our behalf.

ROSS-NAZZAL: What did you get to do during your free time, if you had much at all on this flight?

SEDDON: I spent an awful lot of time looking out the window. On my first two flights, things had been so wildly busy, that looking out the windows was like, "Oh, that's pretty. Go back to work. Oh, look at that. What is that? Go back to work."

On this one, I decided that I was going to focus more when I had the time, having certain things that I wanted to see, seeing as much as I could. I slept by the overhead window in the flight deck on several occasions. The thing about it with our inclination, we were always over the same part of the world during sleep time. I saw the Himalayas night after night after night, and pretty soon it's kind of like, "Oh, I wish I had time to see other things."

And sometimes I would mark my timeline to remember there was a good pass over Tennessee at that time. I would say, "Can I take a break? I want to go up."

Rick Searfoss, who was our pilot, was really focused on Earth observation. He would call back and say, "Rhea, we're coming over southeast U.S. in about five minutes, so scurry up here if you have time."

I'm not terribly good at taking pictures, but at least seeing things with my own eyeballs and understanding a little bit more about where everything was and what it looked like from space, and what you could see and what you could pick out was wonderful. You learn what landmarks you can see that will lead you to seeing what you want to see. You have to spend a little time doing that. You can see runways at airports, but you have to know that those runways are in the configuration that that's Nashville [Tennessee] or that's Houston [Texas]. So you have to learn a little bit about what you're going to be looking at. Then you have to be able to really see it, because a lot of the things are quite small. Runways, you can just barely see them. You can, but if you don't know to look for them, you miss them.

Then you learn how big is something that I can see. Yes, I can see the Astrodome. If I know that's Houston and there's Intercontinental [Airport], oh, there's the Astrodome. But you didn't have much time to do that. It's there for twenty seconds and then it's gone. So you really had to plan out a little bit what you wanted to look at, what you wanted to look for.

I spent a lot of time trying to look for internal waves and seamounts, and I had trouble with that. I'm not sure I ever really saw that in the ocean. But there were beautiful atolls out in the Pacific that just looked like little jewels dropped along the way. I enjoyed seeing that. With our 39 degree inclination we could see all the way up to Long Island as we were coming across the eastern coast. We could see it in the distance. On a clear day we'd be coming over the Atlantic somewhere in Virginia or someplace, and if I really looked hard and knew what to look for, it was a clear day, I could see Long Island and Cape Cod, because that's a pretty distinctive place. So that was a focus for me.

I felt like that might be my last flight, so I wanted to put that in my memory banks and say, "Oh, yes, I did look out the window, and I did see some of those things." Very hard to get a picture of Murfreesboro, I learned. You can pick out the Cumberland River in Nashville because it's curvaceous. It's curvy, curvy. There's two parallel highways, I-24 and the Murfreesboro Road (or Nashville Highway), that run down that way, but everything else is just green trees, so it was a little hard to actually find the town. I took pictures, and I've got one that is supposed to be where we are. You can see the airport in Smyrna. You can see the runways and you can see the parallel highways, but can't see a whole lot of little town. But I looked anyway.

ROSS-NAZZAL: Did you prepare before you flew in space, so you knew what you were looking for?

SEDDON: Yes, I did in the time that I had. Again, Rick really wanted to focus on that. He didn't have an awful lot of other things that he needed to do, other than managing the Orbiter and doing some things in the front, and when we asked, he would come back and do some experiments for

us. He was really our specialist, and he knew what we wanted to get pictures of, so he got some really great pictures on that flight. There's some really nice shots of different places, so the montage of our flight, we put some Earth observation pictures on there. But he really wanted to focus on that.

Life sciences flights are not popular for the Orbiter crew. If you've read Mike [Richard M.] Mullane's book [*Riding Rockets: The Outrageous Tales of a Space Shuttle Astronaut*], his fear in life was that he was going to get assigned to a life sciences Spacelab mission. He said, "Those are to be avoided at all costs," because really there's a lot of stuff going on in the back, but not an awful lot of stuff going on in the front. So you have to sort of find your own entertainment, I guess.

John Blaha said, "I'll take care of the videotaping. I'll be the photographer." A lot of the video when we got back has his toes in the bottom corners. Bless his heart. But he got some nice video and he got some nice still pictures. We appreciated it, because when you're busy working, it's hard to remember to take pictures. When you get back, people say, "Okay, show us a video of what you did," and you don't have any, or you don't have any stills to put in your photo album, or the pictures are all of the people that you took pictures of, but they didn't take any pictures of you it's disappointing. People said, "Were you on that mission?" So you have to plan that out too.

ROSS-NAZZAL: Were you present when John Blaha was having the conversation with the cosmonauts on Mir? Was that something that he called you all up for?

SEDDON: Yes. Yes, he called us all up to look for it, and it was kind of like, "Where? It's supposed to be right—oh, maybe that's it." Yes, I remember that, now that you mention it. I hadn't thought about that in a long time. It took all of us to find it, and we could see this little dot getting close. Yes, I vaguely remember him talking to the cosmonauts.

ROSS-NAZZAL: I thought that was an interesting event to occur on flight.

I understand you were taken off the flight on stretchers this time, instead of actually walking onto the crew transport vehicle.

SEDDON: Yes. Well, actually, on both of the life sciences missions.

[interruption]

ROSS-NAZZAL: I had asked you about the stretchers but it sounds like you came off on stretchers on both.

SEDDON: We had agreed after the flight to move into what they call a people mover; in other words, not to move around very much after we landed, because the investigators really wanted to see how quickly we readapted and what we were like immediately after spaceflight. So we didn't move around too much after we landed, and then they came to get us out and they moved us pretty rapidly, helped us off the Shuttle and over to recliners in the people mover, this big van that hooked up right to the white room of the Orbiter. We didn't even come down the steps. So

they took us over there, let us out, and took us back to the labs, where we started all of the post-flight testing.

On SLS-1, I felt fine. I got off, was taken back to the test area, and stood up and did all the post-flight tests, and everything worked pretty well. Then on SLS-2, we did what they call a tilt test. In other words, they did some heart testing and lung testing of you lying down and then they tilted you to upright and tested you again. You could hear your heart rate beeping, "beep, beep, beep, beep." When they tilted me, I could hear my heart rate, "beep, beep, beep, beep, beep, beep, beep." Even before I could feel it, I could hear that I was having a hard time keeping my blood pressure up, and indeed I began to feel woozy and they had to put me back down flat.

I had more of what they call post-flight orthostasis after the second flight. The flight was five days longer. I don't know whether there's a lot of variability in people, but that first day was a little rockier for me on the second flight than it was on the first. So maybe staying in space longer changed my reflexes a little bit more.

Then, again, we stayed at the Silver Saddles Resort for a week after landing. They completed all their testing, and they got more good data. I think several people that first day, after fourteen days in space, had trouble getting some of the tests done, just because they couldn't stand up. They would feel faint when they tried to stand up.

That first day data-take for some of the investigators wasn't good data, because they couldn't do it the way they wanted to do it. I can remember in particular the lung functions, because they needed you upright, because, again, gravity was working on the blood in your lungs, but if you couldn't stay upright, you couldn't complete the test. So it was interesting.

ROSS-NAZZAL: And this was the longest Shuttle flight to date at that point.

SEDDON: It was. It was the longest to date, and so that's why the tests were interesting. And the fact that they could compare, you know, at least one of us they could compare here's what this person was like after nine days, and they were different at fourteen days. One data point doesn't give you anything you can publish, but it was interesting.

That reminds me. One of the things that we had to get a special dispensation for—the Shuttle has a rule that you will take salt and water before reentry to build up your blood volume so that you're in better shape when you land, so you're not relatively dehydrated when you get back to Earth. That's because if the Shuttle should crash, you've got to be able to get up and run away. There's a requirement for a certain number of salt tablets and a certain number of ounces of water, I guess right after the de-orbit burn or sometime in that timeframe, and so it was a rule, a flight rule. So the investigators said, "You know, that's going to mess up our data."

And NASA said, "Tough. They've got to get up and run away."

Again, you look at the reality of things. What's the chance they're going to crash on the runway and have to run away from a burning up Orbiter? At the time, we weren't entirely sure that the fluid loading was really working, because there were a lot of people that still got dizzy when they stood up, even after fluid loading. So it was kind of like how do we make this argument?

I'm not sure how we completely resolved it, but it wasn't an issue. Probably one of those things I ought to remember and don't. Seems like we got them to buy off on our not fluid loading, because it was important data to have, and the question had always been how much good does fluid loading do. Well, if they really wanted to run a scientific test, they'd have some

people that fluid loaded and some people that didn't, but for safety reasons they didn't feel like they could tell people, "Well, you're part of the group that doesn't fluid load."

"Oh, well, are you committing me to certain death if we crash?"

I think this was just one of those things that they let us make sure that we were well hydrated, but we didn't have to use the salt tablets, because you dump all this salt in people, the people that are looking at salt balance, now what? What does this mean? So as I recall, they let us promise to eat well at breakfast that day and drink plenty of liquids, but we didn't have to do the salt loading. But I could be wrong on that.

ROSS-NAZZAL: So much was made of your flight and how much science you brought back, and so much good science. What benefits have you seen come out of that flight in terms of research?

SEDDON: It's really kind of hard for me to know because I haven't followed the research afterwards. I think it probably informed some of the work that was done on Space Station, certainly some of the calcium-balance studies. It showed us that you really lose a fair amount of calcium, and that we need to do something about it. I'm trying to think. It put certain things to rest: lung functions pretty normal; vestibular functions, there were a few changes but you couldn't convince me that there was anything that limited our abilities to fly in space longer. The vestibular stuff—everybody knows you're ataxic when you get back. You stumble around and your balance is a little bit off. So there were certain things that I think helped guide future investments in what do we need to know, what do we need to study further, and what can we just say, "That's not a high priority. It may be interesting, but as far as future space travel, that's not at the top of our list. We'll put our money on the things that seem to be a problem."

What can I say? I think it told us a lot about flying in space. I think it gave us some interesting information about gravity's role. How that's been practically applied, I don't know. I think some of the equipment that was designed for the flight, I think that engineering-wise there were probably some things that went on to be useful.

There's one small experiment that we took that was putting drops of blood on filter paper and then just storing them at room temperature—there was a special kind of paper that it was put on—to see what kind of information you could get just from that. So they didn't have to draw big blood samples and you didn't have to centrifuge them and you didn't have to store them in the freezer. What could you do? With this very simple piece of equipment, what could that give you? It was designed that it separated the white blood cells from red blood cells and then you bring them home. What could you tell from that? And the serum was separated from those.

Indeed, I think they found that you could get information. I know that the investigator who put that together, Vaughan Clift, took that to Africa and they could use that out where you didn't have blood-draw equipment and centrifuges and refrigerators. There were things that you could get, and I can't tell you exactly what things, but they could look for malaria or AIDS [Acquired Immune Deficiency Syndrome] or something with this very simple kind of equipment. And it had its usefulness. It was funded by NASA because it had usefulness for testing astronauts, that you didn't have all that equipment on a flight. You could use something simple like this.

A lot of the hardware, you'd like to think that the technology drives the technology here on the ground, and certainly in many respects things NASA has designed have found usefulness in the public arena, but the hardware that was designed for the life sciences mission, a lot of it

was designed back in the eighties. By the time we flew, it was pretty outdated stuff. Technology had gone on beyond what we had in flight.

I'm trying to think if there were any pieces of equipment that people said, "Oh, this is brand-new technology that we can put to use on Earth." I'm not sure you could say that about our stuff, because it took so long to fly the missions. That was one of the problems with having flights that slipped so far into the future. The hardware was outdated. Frequently, you couldn't get replacement parts. I know the echocardiograph was one of those. "Oh, man, that's a 1983 version of the echo machine. We don't make those anymore." This is eight or ten years later. We have a whole lot more advanced equipment now. So that was one of the problems with the science hardware, is it was not driving technology anymore, because things had moved so rapidly. Even the computers, there had been a tremendous growth in capability from the early eighties to the early nineties.

I think the other problem with the slipping so badly was that the way it was supposed to work was you proposed your experiment, you spent two years getting it ready, and it flew. Then you got your data. Then you could hire a grad student who will focus on that. You've proposed it, you get a grad student excited about working on it, two years he'll get his data, he can publish his paper and his thesis, and everybody's happy. But the grad students grew old with us, because it took so long to get things off the ground, and that was one of the problems with the science. It was getting hard to excite people about proposing something if you were going to have to work on it for ten years.

ROSS-NAZZAL: I can imagine. You said that that was going to be your last flight, and it turned out to be.

SEDDON: Yes.

ROSS-NAZZAL: Had you been approached about flying a fourth mission, or did you turn that opportunity down?

SEDDON: I had not been approached. When I got back, I helped work on Neurolab, because it was going to fly fairly soon. Before they had their crew, they wanted somebody that could help with the astronaut perspective. So I worked on that for a while.

I worked on the NASA-Mir payloads for a while. They were going to put some stuff together for Norm [Norman E.] Thagard to do on Mir, and so I helped work on that. It was interesting to work with the Russians, they have a very different perspective on things. So I was working life sciences issues and things.

We wanted to have a third baby, so I was kind of working on that too. I don't know whether I ever told them not to assign me to any missions.

They made it clear to the mission specialists that if you wanted to hang around, you were going to have to be willing to get an assignment to Russia for flight. That meant you needed to learn fluent Russian and you had to be willing to uproot your family and go live there for two years. It became clear to me that I really didn't want to do that, especially if I had a third child, and with Hoot's fifth mission. They just sort of left me alone, I guess, because I didn't express any desire to do any of the things that were coming up. I was doing what I considered to be useful work for the office.

Then got pregnant with Emilee and so I was off flight status for that, and then let it be known that I was interested in leaving in '96. So that's what I did.

ROSS-NAZZAL: Tell us about working with the Russians and then Hoot was flying on that Shuttle Mir mission [STS-71]. How did that all come together?

SEDDON: Well, as we were preparing for Norm's flight [Mir 18], I'd tried to be a liaison with Norm and Bonnie [J. Dunbar] and got to hear about the difficulties of going to live in Russia, especially living out in Star City. The food was different; the daily life was different. They had no washer and dryer when they got there. They scrubbed things in the sink. The electrical connections were not good, so that they'd blow up your computers. They had trouble with the phone lines.

It was like sending people into a very different environment, and I think I was kind of angry about that. How can you just tell people to go tough it out? "Go do it. Now that you know how to fly in space, go do it in a foreign language." I don't know how we got there. I felt so bad for Bonnie because she got sent over there at the last minute, and it was tough on her.

I did what I thought would be useful. Norm had to have some things to take with him to do. The higher ups said, "Oh, well, let's see. Since he's a physician, let's do life sciences." Everything was backward. In other words, people didn't propose experiments, get selected, and be put on a mission. It was like, "Go out and see what we can pull together, who's interested, and who's got stuff we can send." It was backward. It was just really backward.

Once we got those things pulled together, then we needed to train the Russians to do some of the experiments. When they came over, they had to have baseline data done: what was

their normal physiology. We put together a big training program for them; we designed it to be like the training that we give astronauts. You come in and you explain the science and you explain the hardware and you let them play with the hardware, and then you let them ask questions.

The Russians came over, and, of course, it was difficult because it all had to be translated, so you go through that. They nodded and paid attention, seemed to be understanding. We showed them the hardware and the checklist and explained everything. "Okay now, questions, discussion?" "*Nyet*." It was kind of like, "What?" Astronauts take full responsibility, and what we hadn't really learned yet was what the Russians do. They get trained, and then you hand them a checklist and it's their responsibility to carry out every step on the checklist. They don't have to understand it. They don't have to go beyond following the steps. They don't have to help you develop. They don't have to make their inputs. They just need to do what the checklist says.

So we had to learn to work with that. Again, you had to make sure that the checklist was very good and very understandable, because if they came to something and they said, "Don't know where that is. Don't know how to do that," they would just quit. So that's what we had to work with.

We also had to work with the fact that the Russians frequently would come over here, and they would be given money for per diem to go eat, and they would save the money to go to the electronics store when they went home, so they didn't eat right. So if you've got human physiology experiments where your blood sugar has to be normal, we found out we had to feed them too. So there would be breakfast when they arrived in the morning and lunch would be

served. We had to give them the per diem also. So it was odd, and you had this funny feeling. I had this funny feeling about do I want to go fly on this?

I think we found out that there were a lot of differences. Mike [C. Michael] Foale and Jerry [M.] Linenger, who eventually flew with the Russians, had some surprises about the command structure. The Russians got a bonus for doing what they were supposed to do when they flew, and if they did something they weren't supposed to do, their bonus got cut. So they were told, "If this happens, you must get permission from the ground before your proceed."

There was an electrical problem on Mike Foale's Mir 23 flight, when they were out of touch with Moscow. The crew knew what steps they should take but the Russians wouldn't take them without permission. Mike said, "We could lose this mission before we could talk to the ground again." But the cosmonauts were not going to do stuff that they knew was the right without asking the ground.

So that was the difference in command structure. The Space Shuttle commander is the final authority on everything. If he wants to do something in flight because he thinks that needs to be done and it needs to be done now. Before talking to the ground, he's had enough training, he has enough sense, he has people on board that can advise him, and he'll do it. And up there, it was just very different with the Russians.

I worked when I was at NASA on what we call the Bioethics Task Force, and we found that there were differences in the cultures of the people that we were flying with, the people from other countries. Things were very different culturally in willingness to do life sciences experiments, and so we had to factor that in as we wrote the NASA rules about informed consent. Flying with the Russians and eventually flying on the International Space Station opened up a lot of other issues and questions and how are we going to ethically perform human

experiments. It wouldn't necessarily be the way we would do it in our country, but the way other countries insist upon doing it.

The Russians had to be paid to be subjects, and that's against the law in the U.S. You had to work those things out. The Japanese, bless their hearts, it would not occur to them to refuse to do anything. You could have proposed all kinds of horrible things, because in their culture you bow to authority. They didn't care about informed consent. It was their duty. Of course they would just sign up. It was part of what they did for the good of the mission and the group, the team.

Again, that was my real exposure to working with different cultures, and certainly if we were going to continue to have an international space program, people had to deal with those sorts of things as they came up, and I'm sure they have since I left NASA. But working with the Russians for the Mir Program was my first introduction to international relations. Since I was working bioethics and issues of informed consent, it surprised me about the different ways different cultures addressed doing experiments on humans.

ROSS-NAZZAL: What about Hoot's flight? He flew a Shuttle-Mir flight. How involved were you? You were pregnant at the time.

SEDDON: Right. Yes, that was interesting.

ROSS-NAZZAL: I think you gave birth a few weeks before he flew.

SEDDON: A few weeks before. We weren't sure what was going to happen first. There was a time when the launch was going to happen and then the baby was going to be born, and then the landing was going to happen. Then we were getting really close to launching the flight and having the baby on the same day. That part of it was interesting. As it worked out, I had a scheduled C-section, and so we could pick a date within reason. We waited until we found out when Hoot's flight was probably going to be, and then we decided we could have the baby a couple weeks ahead of that.

But pregnancy—especially when you're—I was forty-seven at the time—itself is a little emotional and a little stressful. When you're working, it's more so, but we decided to do it. We were delighted when we found out it was a little girl. So it all worked out. Emilee was born about two weeks before we left for Florida.

I went to Cape, kind of as the camp follower with babe in arms. She was a good baby, and everybody adored having her down there. She could be in quarantine because babies don't carry all those infectious diseases that other kids do. So they allowed her to be in quarantine with us.

It was interesting to see Hoot approach a flight. I was just utterly amazed that he learned to speak as much Russian as he did, because he's an engineer and he didn't ever take much language. He didn't take any more than he had to in school, because he didn't really enjoy language study. But he would come home at night before STS-71 and he would spend hours down in his little airplane room, practicing Russian.

He always seems to have fun with languages. When Franklin [R.] Chang-Diaz was on his flight [STS-61C], his only Spanish needed to be something like, "Hello, Mr. President, here's Franklin Chang-Diaz." I mean, he had to learn a sentence. But he managed to mess it all up

when they practiced so that Franklin was afraid he was going to not say it right when they got there.

Then when he flew on the Japanese Spacelab mission [STS-47], they learned a little Japanese so that they could harass Chiaki Mukai, who was the backup payload specialist, and Takao Doi and Mamoru Mohri. So he learned enough so that he could say foolish and somewhat nasty things in Japanese.

But he had never really had to learn a language, and he learned quite a bit of Russian. Then he enjoyed being able to talk to the Russians that were flying with him, and he took them flying. I know he took Anatoly [Y. Solovyev] flying in the T-38 and enjoyed showing him our little airplane. Of course, it was nothing compared to what Anatoly had flown or what Hoot had flown in the military, but they had fun going up and mixing it up in the sky.

We had never met the Russian wives before. We got to meet them in quarantine, and there was very little interaction. They came to the beach house to party, and everything had to be translated, so it was difficult. I thought they were very reserved. I mean, we had something to talk about; there was a baby. They were polite and nice, but, again, very reserved and not wanting to chitchat, or maybe it was just too difficult to chitchat, so that it was just a little awkward.

We met their children, and it was interesting, Julie, our daughter, and Anatoly's very handsome son were just about the same age, and the son had taken English in school. Julie, of course, didn't know any Russian at all, but they managed to communicate. I guess she was nineteen at the time. So as teenagers do, they were able to talk about space and teenage things.

The launch got delayed and then eventually launched a couple days late. I know Hoot had worried a lot about the docking because it was quite a piloting feat to get to where you

needed to be at the right speed, so he had stressed about that. We went to Mission Control and watched it and heard the numbers, and it was like, "Oh, thank you, Lord." I don't know whether he stressed about the animal dissections when I was in flight or not, but I stressed about his Mir docking. But it all went very well and everything worked out. The flight went smoothly and, as usual, he made a really, really great landing. We were there for landing, me and my babe in arms. So it was nice to get him back home.

Of course, post-flight, especially for that one with this Russian mission, he was gone all the time. The baby slept in the bed with me. The other children never did, but Emilee got to sleep in bed because Hoot wasn't there a lot of the time. They were doing their post-flight stuff. Then he became Deputy Chief of Flight Crew Operations, and that meant that he had to go to all the launches and big meetings and things like that, so he was gone a lot. But I had a relatively stable in town job at the time, and we had Joann, so it worked out really well. Crazy time, as usual. The whole NASA experience was a crazy time.

ROSS-NAZZAL: At some point I guess you decided you wanted to move back to Tennessee, and you somehow had a relationship with Vanderbilt [University, Nashville, Tennessee].

SEDDON: Yes.

ROSS-NAZZAL: Can you talk about that decision to move back and the relationship?

SEDDON: Well, you know, I was ready to move after Hoot's last flight. I said, "Why don't we go back this summer."

He says, "No, I've got too much stuff to catch up on and get done," and he was going to be too busy. So I talked him into the next year, going back.

So we wanted to go back in '96, and it was pointed out to me that I needed one more year with NASA to qualify for a pension. They were offering early outs, so I needed to be fifty and have twenty years with the government. Luckily, I had some time in the V.A. [Veterans Affairs] Hospital system when I was a resident, so I had a little extra time, but I needed to be fifty, and that was in 1997. So I thought, "How am I going to work this?"

Luckily, the folks at NASA said, "Well, you know, if you could work for NASA at a different place, like somewhere in Tennessee, then you could fulfill that last-year requirement." Luckily, Vanderbilt had been working with the Neurolab people, and there was a Neurolab experiment coming out of Vanderbilt, so I negotiated a part-time job there, and came to Vanderbilt.

Luckily, Drew [F. Andrew] Gaffney, who had flown with me on SLS-1, was a professor at Vanderbilt at the time. I said to him, "I'd really like to come back to Tennessee, and one of the places that I think I'd like to work would be Vanderbilt, the Medical Center. Can you make some introductions?" And luckily, he did, with the vice chancellor at the time and his deputy, and they sent me around to talk to a bunch of people. I also talked to people at other hospitals in Nashville and looked around here. I was going to be working part-time in one of the Vanderbilt research labs two days a week for NASA. I let the Vanderbilt Hospital people know I could work for them three days a week until my NASA commitment was up in a year.

Luckily, Dr. John [S.] Sergent, who had recently become the Chief Medical Officer, saw some value in what background I had. He said, "You probably would be the only person here that understands systems thinking and how processes work, and we really need to smooth things

out now that the Vanderbilt Medical Group had been formed," meaning all the departments now belonged to the same group. They needed to have someone help work on smoothing the processes that the physicians had to deal with. So he offered me a part-time job. That gave me a chance to look at Vanderbilt and have Vanderbilt look at me. It was a good partnership, and so I was given a job at Vanderbilt.

Hoot had decided, when it became clear that I was fairly serious about moving back here and I had some job opportunities and things, he didn't really want to work at a desk someplace, and so he decided that he would get his air transport pilot's license and fly with Southwest. He had a number of friends who encouraged him to do that; they were having a good life with Southwest. So he made moves to get the right credentials and get on with Southwest. So that's how we managed to get back to Tennessee and how we sort of reinvented ourselves for the next stage of our lives.

ROSS-NAZZAL: Did you go on then after that year of part-time work to work then full-time for Vanderbilt?

SEDDON: Yes, I did, as soon as my commitment was up and my birthday was over, Vanderbilt offered me a full-time position, because I'd really been working almost full-time anyway and got involved in a number of different projects and things.

Dr. Sergent was just a terrific boss. That's what I really wanted for my next job was to have a really great boss, because I'd had a variety of bosses at NASA and had learned that that's probably one of the things that can make you happy or make you not happy in a job. So I came back to Tennessee looking for a good boss, and Dr. Sergeant was a good boss.

ROSS-NAZZAL: Were you practicing medicine at all or were you working in a different field?

SEDDON: That was a question when I came back here. My goal during my surgery training was to do enough general surgery that I could go on to a plastic surgery residency program. I wanted to do plastic surgery, and got interested in nutrition and might have been going in the direction of getting a Ph.D. in nutrition instead and doing some pretty fancy nutritional stuff with surgery patients that had come down the road. So I had not done my senior year of residency in general surgery when I went to NASA. I'd completed all that I needed to do in general surgery so that if the job at NASA hadn't worked out, I could have gone on to either of the two fields that I wanted to go into after that.

When I came back to Vanderbilt, I wasn't board-certified in anything, and that was one of the requirements of the faculty. I had forgotten all the surgery I had ever learned, and I had been practicing emergency medicine on the weekends when I was in Houston, but I'd never really been trained in emergency medicine. So I didn't really feel like I could come and work in the emergency room or teach or do anything like that at Vanderbilt. I just didn't have what I felt was sufficient training and expertise.

When I talked to Dr. Sergent and we looked at that, he said, "Well, you know, it probably would be best if you could practice, because you'll get a better feel for what's happening."

I said, "Well, here's the problem."

And he said, "Well, okay."

I said, "But that allows me to devote all of my time to helping figure out what the doctors need and want, should have, whatever." So that was the agreement, that I would work on

process improvement and eventually worked on quality and safety. It worked out well. Again, when you have a good boss who has confidence in you, who can see areas that need to be improved and will support you with all the other physicians, it works out well. So he set me to work on a variety of different problem areas. There were things that weren't working smoothly, and areas in which regulations changed and we had to change the way we did things.

It was essentially the same way that I had worked at NASA. You're given a payload or you're given a group of people that you have to get together and figure out how you're going to do stuff. So my payload commander experience—where I had to get the engineers and the crew and the investigators and the managers and the administrators all to compromise on how we're going to do this, what's the best way to do this for everybody concerned—that's what the job really was with Vanderbilt. So I enjoyed it.

I began to put together some interesting things like checklists, what we called at Vanderbilt "malfunction procedures," that were really decision trees. If this is, then do this; if not, do that, and map it out. People are going, "Wow, that's interesting." You get this kind of patient in and if they have this, you do this, this, and this, and if the answer is yes, you go here; if the answer is no do something else.

We were getting people to agree to do things in a standardized way. Yes, you're the emergency-room physician and, yes, you're the surgeon that might admit this patient. What do you want the emergency room doctors to do before they call you? And what do the emergency-room doctors want you to do once they call you? It's just working out those agreements about how we're going to work together. So it was using the experience that I had from NASA in a different way, and, luckily, John Sergent saw that that was going to be a good thing.

I think we've now realized, much more in healthcare and the work I'm doing now, how standardization of processes can really help prevent error and provide better care in medicine. It's taken a long time to convince people. They say, "I'm not practicing cookbook medicine."

We're saying, "You don't have to, but it would really be nice if you'd do all the things you're supposed to do for this patient and not forget them, because now it's not the standard of care to do it your way; it's the standard of care that these certain things have to be done or your payers are not going to pay you if you have a bad outcome." Also, you are not doing right by your patients. So it's been an evolution of trying to figure out what aviation can give to healthcare, and, luckily, I got in on the beginning of that.

ROSS-NAZZAL: How fascinating. So what are you working on now? You're no longer working at Vanderbilt.

SEDDON: Right. One of the things that happened when I was at Vanderbilt was a couple of pilots from Memphis [Tennessee] came to talk to Dr. Sergent and said, "We are a company, Crew Training International. We are a company that provides Crew Resource Management training to military and commercial pilots, and it is a program that aviation developed to help flight crews work better together to prevent error and prevent accidents."

Everybody says, "Oh, here's a horrible plane crash, nothing wrong with the airplane. The pilot just made a mistake, and the co-pilot didn't speak up because he was afraid to offend the pilot." There was a lot of that going on, and that's why aviation developed this program. It had gone through several iterations of development from just being nice to each other, to having specific skills, to doing things a certain way. It had become fairly sophisticated.

This was in 2003. Dr. Sergent said, "Hmm. I have a couple of astronauts here who need to look at this."

And the pilots out of Memphis go, "Cool. They'll understand what we're talking about."

John Sergent called Drew Gaffney and me in and said, "What do you think of this?" And we recognized it. We learned it at NASA. They had done some of the original research on what this ought to look like at NASA. So, it was interesting. The program itself, they had tried to adapt to healthcare, but they were pilots and it was a lot of aviation examples that Drew and I could draw the analogy. Oh, yes, this plane crashed because nobody said anything about this dangerous pilot. Or this airplane crashed because when someone spoke up, they said it in a nice way but it was not listened to. The co-pilot says, "That looks funny." What he meant was, "There's a mountain up there." And you have the cockpit voice recorder, so you can hear those errors.

So Drew and I thought, "Well, this might work in healthcare. Let's get together a group of people, our opinion leaders, some department chairs and some people that we had a lot of faith in, and the rest of the world did too. Let's put a group of people together and have the pilots come and teach the class." We did a survey afterwards, "What do you think about it?"

Well, it got higher grades than anything that Drew and I had ever seen, like 98 percent of the people thought this was terrific, and everybody else needed to hear the message.

Dr. Sergent said, "Well, why don't you go talk to the people in Risk Management." The Risk Management Department is the group that looks at errors and how much money we have to pay for errors. Vanderbilt is self-insured, so we have an insurance trust. Risk Management has an interest in avoiding error. And they thought, "That's great. Let's train some people in this." They provided the cash for it, so we were off and running.

The pilots in Memphis agreed to give us a good deal if we would help them adapt this whole program for healthcare, make it what healthcare needed. As we went along, it was much more than just a training class. Pilots can get the concept with a training class, because they lay it on top of a very standardized way of doing things. Well, in healthcare, there aren't any standardized ways, so we had to begin to work on that. For instance, "There's a new regulation that we have to do a time-out before we operate on people, so we don't operate on the wrong patient, the wrong side, or the wrong procedure. Let's look at that. How would you make that a checklist so our doctors can just run the checklist before they operate?"

"Oh, okay, we can do that."

That's very much like the takeoff pre-brief before you fly an airplane. Here are the steps we have to do to make sure we're ready to go fly. A lot of the regulatory agencies in healthcare began to look at, "Here are much safer organizations, like nuclear power and aviation and European trains. What are some of the things they do that we could bring into healthcare?" Well, the timeout was one of those first things. "We're not going to tell you you have to be like pilots, but we're going to put something into healthcare that's what pilots do to make sure that they're reliably ready to go."

So we began to work with Crew Training International and developed not only a training class but what we call tools to help you take those skills and apply them to patients and healthcare. Then when we wanted to train more people, the Vanderbilt bosses said, "What are the results?" So we had to figure out what could we measure to show whether this is doing any good. So we had to put together a measurement plan.

Then we wanted more money, and we realized that we should have told the leaders of the hospital what we were doing rather than just the people we were training, because the

administrators and departmental leaders had the money that would let us continue. So we put together a leadership program to educate them.

Vanderbilt was a great customer. We trained, I think, over five thousand people at Vanderbilt. Crew Training International said, "Whoa. This is great." It became obvious that they needed to do this at other hospitals, so they began to market this concept and began to get interest in it. They spun off a healthcare subsidiary called LifeWings Partners and invited Drew and me to be partners with them.

As it turns out, Vanderbilt faculty (I'd become a faculty member somewhere along the line) are allowed to do so several days a year of consulting work. You can take time off from your work as long as it's pertinent to healthcare, and this certainly was. So Drew and I could take our consulting days and go help talk about the plan. We had to go through the conflict of interest and all that kind of stuff, but it met all the requirements.

So we began to help other hospitals, and it took off. A lot of people had had errors. There was an Institute of Medicine study around 1999 that said—and this was kind of the eye-opener and maybe the reason for doing all of this—that there are somewhere around 100,000 patients in U.S. hospitals that die from preventable error every year. A lot of people have what they called sentinel events, which means a bad error that harmed a patient, and hospitals feel bad about that. I mean, they hate doing that. Doctors feel terrible about it. It costs lots of money malpractice-wise for hospitals and physicians, and it can ruin healthcare workers' careers. They feel so bad about it, they don't want to practice medicine anymore. The nurse that gave the wrong medicine because the doctor ordered the wrong medicine, I mean, that nurse may never want to practice medicine again if a patient was hurt.

So, there was a lot of interest in preventing error in healthcare. Again, there was a lot of realization that some of the errors are what you call slips or lapses. You do the wrong thing or you forget to do the right thing for this particular patient, because you're doing it all from memory, and maybe you ought to have a checklist. There's a new book out called *The Checklist Manifesto: [How to Get Things Right]*, written by a Harvard surgeon [Atul Gawande], and it's kind of like it's his "aha" moment. He talks about the fact that if you want to get something critical done right, then you ought to have a standardized way of doing it.

For a long time, we haven't required physicians to do that. Now there are a lot of peer-reviewed journals that are publishing things that show that if you train people to work as a team, if you do things in a standardized way, and if you give people feedback that what they're doing is getting results, which is exactly what our program has been teaching since 2003, that you get better results, 50 percent fewer infections, 70 percent fewer deaths in some cases. It's now coming out in the literature.

So about four years ago I decided that I didn't really like the commute to Nashville and that I would prefer just working with LifeWings. It's not full-time, it's part-time, but I enjoy it, getting to help other hospitals do what we've been doing for while.

ROSS-NAZZAL: With the new healthcare debate, I'm curious, have you been involved at all in using this as a process to decrease the cost of healthcare?

SEDDON: Well, I think that people haven't quite figured out what the new healthcare reform law is going to do and what they need to do. But, for instance, Medicare and Medicaid have what they call "never" events. These things should never happen, and if they do happen, they're not

going to pay for them. They are saying, "It's a complication that we know how to prevent. Why should we pay you for operating on the wrong limb? Why should we pay you if someone gets a blood clot? We know how to prevent that. There's a best-practice of ways to do certain things. We're not going to pay you if you don't do things correctly."

So I think the government is beginning to look at how can to cut costs and make hospitals more responsible to do the right things for patients and not do the wrong things. If you have, "Here's what we do for patients with this kind of disease process," and if you've done 50 percent more, then we can't be responsible for paying for that.

I think that a lot of the things that we teach are applicable to practicing medicine better, and it's better for everybody. It's better for doctors. It's better for the teamwork of doctors and nurses working together. Doctors don't have to take the full responsibility. They've got somebody that's watching over their shoulder to make sure, "Oh, Doctor, you booked this case as a right inguinal hernia, and the patient signed the permit for a left inguinal hernia." The nurse can say it in a certain straightforward way, and the doctor can listen to it in a way, that, "Oh, we need to figure out what's the right thing here." Or the nurse says, "The chart says this patient is allergic to the medicine you just prescribed."

Well, that all goes back to aviation and the co-pilot being willing to speak up to the captain to avoid the error. So I think in the new healthcare regime, what we're teaching is going to be applicable. Whether people figure out other ways to do it or just can do it on their own, I don't know, but business is good.

ROSS-NAZZAL: I can imagine. We have two general questions that we like to ask everybody. What do you think was your greatest accomplishment while working for NASA?

SEDDON: For me, personally or for NASA?

ROSS-NAZZAL: For you personally.

SEDDON: That I had a normal life, and that's true, my greatest accomplishment. When I went into NASA, I thought, if I choose this important and fascinating career am I ruining all of my chances for ever getting married? If I'm an astronaut and I decided to have a baby without being married, what would be the consequences of that? Is there something that's going to happen to me that will make it difficult for me to have kids? Will I ever meet somebody whose life will mesh with this insane life I'm about to undertake?

So it was one of those unknowns, and one of the things that I hoped to accomplish at NASA was to come out on the other end with what I considered to be a normal life, the kind of life that I wanted to have. I was able to do that. I don't know if it was fate or the good Lord looking out for me or the right person coming along or a combination of all those, but I'm happy that I didn't have to give up those other parts of life in order to do my work at NASA.

Was I the world's best astronaut? Probably not. Was I the world's best wife and mother? Probably not. But I got to do all of those things, and that was very important to me. I wanted to look back when I got to the age where I am now and say, "I was able to do all of those things."

When they were handing out flight assignments and Hoot and I had just gotten married, there was the decision of whether to wait to have children or to go ahead and try. I considered when I'm sixty and I look back, would I rather have an early flight and no children or children and maybe no flights or maybe later flights? The children were a higher priority. So I was glad

to be able to look back when I turned sixty and say, "It all worked out. It worked out just fine." I think some other people had to choose one or the other, and I was lucky that I didn't.

ROSS-NAZZAL: What do you think was your biggest challenge while working at NASA?

SEDDON: Probably some of the physical aspects of training and doing the work. The scuba training was hard for me. It was physically hard for me. I doubted whether I was going to be able to do it. The suit work that we had to do, there were times when I thought, "I'm not sure that I'm going to be able to do this, and if I'm even able to do it, would I be able to do it in an emergency and do it well and quickly?" So I think the most difficult part for me was the challenge of being small, because NASA, even though they broadened the height requirements so that they could take more women, and bless them for that, I don't think they had really planned or thought about what it would be like for a really small person to do the things that larger men found pretty easy.

There were things along the way that I had to accommodate to. Getting into the T-38 was always a struggle. Certainly there were the physical aspects of being pregnant and wanting to continue to work when I'd rather be home with my feet up. I was just determined to work through my pregnancies and come back healthy and ready to go again, and to have good care for my children. So that was part of it, just the strength-type things. I wish I could say something more wonderful about challenges that I overcame.

You know, people say, "Wasn't it difficult to fit into an all-men's world?" I just ignored that part of it. If they didn't want me there, that was their tough luck. And so what if I didn't fit the mold, I wasn't a test pilot, I didn't get much credit for what I did on my flights. Everybody

else got a lot of glorification for doing spacewalks and rendezvous and being commanders of things, and life sciences got kind of short shrift. I didn't care. That didn't bother me. I was there to do what I wanted to do and what needed doing. Nobody else wanted life sciences flights, but that's what I wanted. I felt like I had accomplished good things in being on those flights.

ROSS-NAZZAL: How did the office change over time? When you started in '78, my understanding is that it was very much a test pilot's office. Did it change significantly by the time you left?

SEDDON: Absolutely. In fact, NASA changed a lot. When I went there, it was like being a surgery resident; you go there, and it's all men. I had gotten used to that. I was in a man's world, I felt fortunate to have been given a chance, and I wanted to do a good job.

Yes, at first the Shuttle Program was a test pilot world and you had to, to a certain extent, be humble about the fact that you weren't a test pilot and didn't want to be a test pilot. You had to be willing to learn a lot of the stuff that pilots needed to know. I never quite understood why we needed to know everything about the Space Shuttle. I wasn't ever going to mess with the switches that turned on the propulsion stuff, the computer stuff. And yet it was a good thing to learn. It helped put together how those pieces and parts were connected.

But I think, over time, the question about whether women could do a good job was answered as women began to do all the jobs that had been reserved for men. I mean, when women began to do spacewalks, EVAs [Extravehicular Activities], when women began to come in as pilots, as women began to be represented in the hierarchy of NASA, as women began to be

flight directors in Mission Control, to be instructor pilots out at Ellington [Field, Houston, Texas], women just began to have the credentials to be respected. We all felt a responsibility to do a good job, and it was just kind of like, okay, being female was not an issue anymore. Women don't have to fight for those positions; you just have to have the credentials, do a good job, and compete with the other people. So a lot of those things got put to rest, and we began to see women in all roles that we wouldn't have thought of before. But why not?

By the time I left NASA, I thought the whole world had changed, because NASA certainly had. We had all kinds of minority people. We had handicapped people doing jobs at NASA that they were perfectly capable of doing. NASA was very good about taking a lead in all of that. So I sort of had this picture that the world had changed.

Then I went back to healthcare at a very conservative university where things had not changed. Once again, I was the only woman in the room. But it's changing slowly. It's still not at the level that NASA was, but we're getting there.

ROSS-NAZZAL: Are there more women now who are physicians than men? Is that the case?

SEDDON: There are more women in medical school classes than there are men. I don't think they are as well represented in medical leadership. I guess people have always said, "Well, women don't want to do that." I don't think that's quite right. So I think it's just taking some time for women to make inroads into leadership positions in healthcare.

It's always interesting to me to go now to many hospitals all over the country, some of them academic centers and some of them community hospitals, and to be surprised that there are many more women physicians as leaders. We invite the leaders in for a "boot camp" for two

days, and we go in the room and there are more women there. It's kind of like, "Neat. This is good." They are department chairs or chief medical officers or the CEOs [Chief Executive Officers]. They're women, and that's neat. So the world is changing in healthcare too.

ROSS-NAZZAL: I'm sure I could keep asking you questions. I'm going to ask Rebecca if she has any for you.

WRIGHT: No.

SEDDON: Anything written down?

WRIGHT: No. I was just going through. It was very interesting.

SEDDON: I feel like I'm prattling on and on.

ROSS-NAZZAL: No, no, no, that's the whole idea. It's not for us to talk.

SEDDON: You're good listeners. You're both very good listeners.

ROSS-NAZZAL: I had one more question, but I think you've really talked about it. You had talked in the first interview about how you were pulled aside during the interview with NASA. You were told that the newspaper would be interested in covering one of the women, because this was the first time we were having women. You mentioned the myth that women's hormonal

cycles make them much more emotional than men, and that you wanted to study in space, you know, would you be more emotional than men, would it be dangerous in space for women, and I thought maybe you'd want to address that. But I think you did a nice job here of exploring how things have changed.

SEDDON: Yes. There were no physiologic problems with women. When we brought back all the data from SLS-1 and –2, you couldn't really tell the difference between men and women, except the size. That's why it's really hard to blind data when I'm involved, because I'm little. Everybody else is tall. There's four subjects, and one of them is this tall and the other three are this tall. Well, guess who is subject number two?

I don't think women got emotional about anything. It was another one of those things that was put to rest. Physiologically we're the same. Emotionally we're the same. Work-wise, women worked just as hard as men.

I think the women in the program to a certain extent have perhaps lived their lives a little bit differently because they had children. One of my bosses was a little perturbed with me because I wanted to take three months' maternity leave with my second and third baby, but I had enough sick leave saved up and it was legal for me to do so. I had to buck the system, but that was definitely a difference. Some people took a little bit more time off with their children, but that was their decision. So, hopefully, people don't consider that a problem anymore.

Certainly we answered that question when we came to NASA. At least I did. If I had gotten emotional during my menstrual cycle or I took to my bed several days a month or things going wrong upset me a whole lot, I wouldn't be a surgery resident, and Sally [K. Ride] wouldn't

have been an astrophysicist and Judy [Judith A. Resnik] wouldn't have been an engineer. We're not weaklings; we're strong people. And I think we proved that to NASA in the long run.

ROSS-NAZZAL: I think that's a good note to end on.

SEDDON: Okay, good.

ROSS-NAZZAL: Thank you very much.

[End of interview]