The oral histories placed on this Website are from a few of the many people who worked together to meet the challenges of the Shuttle-Mir Program. The words that you will read are the transcripts from the audio-recorded, personal interviews conducted with each of these individuals.

In order to preserve the integrity of their audio record, these histories are presented with limited revisions and reflect the candid conversational style of the oral history format. Brackets or an ellipsis mark will indicate if the text has been annotated or edited to provide the reader a better understanding of the content.

Enjoy “hearing” these factual accountings from these people who were among those who were involved in the day-to-day activities of this historic partnership between the United States and Russia.

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LISA M. REED

June 19, 1998

Interviewers: Rebecca Wright, Carol Butler, Mark Davison

Wright: Today is June 19, 1998. We're talking with Lisa Reed, as part of the Shuttle-Mir Oral History Project. She's Training Lead with the Johnson Space Center. Rebecca Wright, Carol Butler and Mark Davison.

Thank you, Lisa, for taking time this morning.

Reed: My pleasure.

Wright: I know you have a busy schedule. Let's begin by you telling us what your roles and responsibilities are here at Johnson Space Center, as training lead.

Reed: As a training lead, I sort of am the maestro over a group of instructors. We work predominantly in the simulator to train a Space Shuttle crew for a mission. We get assigned to a specific mission, and we follow that crew from the time they're assigned until the time that they fly. We do all of their training in the simulator.

Also in here, in what we call the single-system trainer, the individual instructors who are responsible for different discipline areas on the Shuttle, like control and propulsion or data processing systems, environmental control and life support systems, they come in with the crew members prior to going to the simulator, and actually train those individual systems. They teach them how they work, just normally, and then we also have classes that throw in malfunctions. So they can come in here and practice malfunctions.

When we take them across the street to the simulator, we actually throw it all together, all the different disciplines, and that's where we practice, actually, flying for the mission.

Wright: How long have you been doing this?

Reed: I joined the Training Division here at the Johnson Space Center in 1987, probably about April or May. I forget now, it's been so long. But I've been doing this for about eleven years now.

Wright: Have you always been in this capacity, or were you doing things before this?

Reed: Actually, I started out as a person who was developing computer-based training programs for the division. Back at that time, in 1987, the PC was becoming more affordable, and it was a new training tool that they wanted to explore. I happened to have training in that with my degree. So they asked me to help

set up that program. But at the same time, they were moving me toward being an instructor. So I became an instructor, what we call here, a systems instructor. That encompasses electrical power systems, environmental control and life support, the mechanical systems, which is things like the big payload bay doors, how those work, how to operate those; the auxiliary power unit and hydraulic systems, which provide our hydraulics for landing gear deployment and for the gimballing and thrusting of the main engines. So they're pretty important. So I did that for many, many years.

About the time STS-71 rolled around, they got this docking system, so I moved into what we call more of a specialty instructor role, and I trained the orbiter docking system for a lot of the Shuttle-Mir flights. Then after that, I got promoted to the job that I'm now in, which is training lead.

Wright: Tell us some of the duties as an instructor for a Shuttle flight. Then explain how those changed or how they evolved when you did for the Shuttle-Mir flights.

Reed: For a Shuttle flight, like I said, there are about five-well, actually four core instructors that teach different disciplines. [A training team is comprised of 5 people: 1 training lead and 4 core discipline instructors.] You try to train the crew on the different system, whatever it may be, and how it works. You will work in the single-system trainers. You'll give them briefings. You'll do what we call tabletops, which is sit down and discuss things with them.

At the same time, you will begin training them in the simulator. It's a stair-step approach. You will take them, I guess, from easiest, lowest level up to the highest level by the time you get to the simulator, where you're not really doing a whole lot of teaching, you're just having them practice what you've taught them over the years and, hopefully, that they've learned it well.

As far as training a docking flight, that encompasses a little more. It's all those same things. You still have the same instructors, but you have more specialty instructors that come in, because trying to bring together orbiting bodies in space is a major task, so you'll need what we call a rendezvous instructor. He will teach the crew how to actually fly the vehicle, in this case, to Mir. Then we had a docking instructor, which is what I did.

Once we get close enough proximity, that's where my job would take over. I would teach them, once we had contact, actual contact, with the Mir docking mechanism and capture, how to bring the two together to create an airtight seal so that we could eventually open the hatches and see all those wonderful welcoming ceremonies and all the work that you've probably seen on TV and everything over the years.

Wright: What kind of instruction did you have to have, or training that you had to go through? Since the docking module was something that was totally new, how did all that come about?

Reed: That's very interesting. We had to learn it any way we could, quite frankly. There were not a whole lot of drawings available to us. The ones that we first saw were in Russian, and none of us spoke Russian or read Russian, so it was kind of interesting trying to learn it.

We would attend testing of the mechanism. We would read anything we could get our hands on, any of the Russian cosmonauts that we knew had flown with this system, because it was a Russian system, and that was kind of unique in itself. They have a totally different design philosophy from the way we design mechanical systems here in America. Not that it's bad or anything, it's just different. So we're used to working one way with electrical buses, and they may have it designed a different way. So we had to go through a lot of learning.

There was a lot of tabletops among the instructors where we would sit down and just try to figure out, "Okay, if you turn this switch on, it [a power source] goes here. We think it's going to do this, but we're not really sure." So we actually didn't have a good idea of how everything would work until after 71 flew and we actually got to see real flight data. So it was an interesting time.

Hoot [Robert L.] Gibson and Greg [Gregory J.] Harbaugh, who actually worked the docking mechanism on 71, we would laugh sometimes that we were all learning this together, because normally the instructors come in, they already know. But whoever found out some new information, we'd pass it along to everybody else.

Wright: Real teamwork, I imagine, had to be involved and communication between each member.

Reed: Yes, and I think everybody realized that. With the teamwork, we also realized that there's no holding of information. This was a dangerous feat we were trying to pull off, if you really think about it. So the crew had to be well trained. We also had to understand how the mechanism worked so that we could figure out how to break it in simulations. So if we didn't know how it worked, we couldn't give them realistic scenarios and teach them how to potentially get out of a hairy situation should it arise. That didn't actually happen.

Wright: Is that part of your job duty to come up with these scenarios with the situations to get them to figure out how to survive?

Reed: Yes. A lot of people chuckle, a lot of my friends chuckle at my job, and I said, "Well, I actually have a really great job. I don't have a whole lot of stress, because I can take it out on the poor astronauts." [Laughter] Actually, the astronauts like to joke that we give them a really hard time, but I think they knew we're their biggest cheerleaders. We're sitting down there, and we try to throw things in, and as they go

through the training flow it will get a little more difficult and a little more difficult. We're actually down there going, "Yeah!" when they get it right, when they figure out what we've done to them and actually get themselves out of a sticky situation.

Wright: Maybe you can go into creating thousand-piece puzzles when you get through with this job.

Reed: [Laughter] That's right. I might need to do that, actually. My brain's full at this point in time.

Wright: Did you experience any differences in training the astronauts compared to the cosmonauts?

Reed: Oh, yes. I think the biggest thing that was an obstacle in training the cosmonauts that first came here was language, obviously. I actually worked on STS-60, which was, I guess, the precursor to the actual Mir Phase One flights. They sent over Sergei [K.] Krikalev and Vladimir [G.] Titov, who have subsequently flown on either Shuttle and docked with Mir. They've both flown now. But at the time, this was November of 1992, and I had just completed training my first crew, which was STS-47, and had been assigned my next task, which was going to be STS-60. STS-60, as it turns out, came about just after they [the Clinton Administration] had made the agreement that we would work with the Russians. The first step was going to be, "We'll fly a Russian cosmonaut on the Space Shuttle." So they sent over two, because one would fly and one would be a backup. That was not decided right up front. So we had to train them both.

I remember we were all laughing, because they came downstairs and they said, "Well, these two cosmonauts will be joining the training astronauts real soon. The actual STS-60 crew will be training in February. We need to get these guys very smart on the Shuttle from November to February."

We were all going, "Oh, my goodness." [Laughter] We said, "Well, do they speak the language?"

They said, "Well, one of them speaks some, and one of them doesn't speak quite as well, but he speaks some English."

When they got over here, I remember they brought us all in to introduce us to these two cosmonauts. Everybody was feeling a little weird, because we had never done anything [like this]. We've always worked with Americans and we speak the language. Everybody is at a certain level when they come here, of knowledge, when they come down for training. I remember everybody being very quiet. They didn't know what to say to us, and we didn't know what to say to them. We couldn't speak the language. There were these translators. So the normal icebreakers and jokes you try to use, they had to go through this translation. And that was our first experience of many to come in working with translators in training some of the cosmonauts. I think the neatest thing about that over time was they evolved and we all become really great friends. Sergei eventually was chosen to fly and he flew on STS-60.

But leading up to that, in order to get those guys trained by February, so they could join the rest of the crew in the training flow for the simulator, we, the instructors, spent eight hours a day with them. For example, Monday on their schedule would be electrical power day. I would start in the morning with a briefing for two hours. I'd have a translator sitting with me, and Sergei and Vlodya sitting across— Vlodya was his nickname for Vladimir-sitting across from me and we would talk about the electrical power system. It was difficult, because, as you can see, I can just roll on talking here in English, but you have to pause with the translators. If it took an hour to teach it to an American, it took three hours because you had to translate everything. So, by the time we would get out of the briefing, we would go right into a single-system trainer class or we would go right into a simulator session demonstrating what we had just learned. I actually felt sorry for those guys, because they were getting a lot. It must have been like drinking from a fire hose for them. [Laughter] Because we were just every day, it was a different system. But they rose to the task and did very well. It was fun.

We ran into a lot of problems with slang. We Americans like our slang. We don't realize we use it as much as we do. So they would stop us. I remember one day, I was in here teaching Sergei about the hydraulic system. I was explaining to him that when we come back from orbit, they'll start one prior to the de-orbit burn. It's basically just to make everybody feel good that you have one running, because you don't really need it. Just so everybody knows you have at least one of these hydraulic systems running. The term that all of the instructors here use is "warm fuzzy." I remember he stopped, and he looked at me, and he goes, "What is this 'warm fuzzy'?" [Laughter] And I couldn't explain it to him, because I tried to separate the words. "Warm," to him, was like "near hot." Then "fuzzy," we got off into talking about teddy bears and fur and it just degraded from there. I don't think that he ever quite understood what a "warm fuzzy" was. [Laughter] Maybe he does now. He's been over here for a while.

Our training team lead at the time was a guy name Henry Lampazzi, who is just a jovial person. He's very nice and he greets everybody walking in the hall. One day, I walked in to teach Sergei and Vlodya a class, and they had had their English class prior to that. Their English instructor had been up there. You would go in, and things would be written on the wall, on the white board. You could tell what they were covering in the lessons that day. I saw the word, "Howdy," phonetically spelled out on the white board. I kind of chuckled, because I knew that Henry's greeting to everybody walking down the hall is, "Howdy." He would see them, and he would go, "Howdy." They never learned that. They probably learned the formal English greetings, "Hi. How are you?" They did not know what this "Howdy" was. [Laughter] They would ask their instructor to explain all these things. So I'm sure we confused them thoroughly. We eventually got to a point where we tried to watch our slang. But it was fun.

Wright: They were, I imagine, good troopers for having to learn as much as they did in such a short amount of time.

Reed: They were. One of the nice things about it is that the STS-60 crew, it was just one of those really kind of magical moments where the crew got along tremendously well. The training team got along tremendously well. We all got along really well together, so we had a whole lot of fun while we were training this. Probably ought not say that, because people are going to go, "Oh, you're getting paid to do this." But we would laugh and we would cut up.

I remember Charlie Bolden [Commander for STS-60] would come in. We only have four seats in the simulator. For a while, until they decided who was the prime for STS-60, prime cosmonaut, he would have to kind of flip a coin. He walked in one day, and he goes, "Headskys or tailskys." [Laughter] Sergei just laughed at him. To see who would get that fourth seat.

Wright: The trust that build up between y'all, did it take a long time to do that? You mentioned at the beginning that you had a little while before that awkwardness stopped. So was the trust something that came naturally between all of y'all as y'all worked together as a team for a length?

Wright: I wouldn't say it came naturally. It was real interesting, because actually all of us had been born and grown up in the era of the Cold War. So here we were, Sergei was an engineer, Vlodya was a military pilot. He had a military background. On the 60 crew we had, obviously, military commander and military pilot. That was their background. Then we had MS's, who were engineers. So it was weird to think you're actually working with these people that you kind of been brought up all your life, and especially those with a military background, this was the enemy. I think the biggest lesson I learned out of that is that we're not all terribly different, no matter where we're born. I think they learned that, too. But there was a little apprehension up front just because it's ingrained in you. Over time, I think it was more that when we would go out and socialize, where you actually get to talk and meet everybody's family, that the trust was built up. Then you'd come back and that would be reinforced in training. The more we got to know each other, it just built over time.

Wright: That was 60. But how did it evolve between 60 and, of course, 91? Different missions that you trained.

Reed: Well, the next mission after 60 that we got was STS-71. They come and tell us, "Well, here's what we're going to try to do on this mission. We're going to dock to the Space Station Mir." We were like,

"Wow, that sounds really cool." But we didn't think about how to get there. The more we got to thinking about it, it was going to be a really difficult task. The first thing was, where are we going to get this docking system?

Then the other thing that they informed us was, "Well, we're going to take some cosmonauts up with us over these next few flights." I think they actually started out with five flights, and then it went to seven, and then it became nine. So at the time it was just five flights. Since the docking mechanism was a mechanical system, it fell under the area that I taught. Mechanical systems was one of the things. So it was left to myself and one of the other instructors to go off and learn about this. So, again, we worked with a crew.

Well, they would assign a prime and a backup Mir crew, obviously, that was going to be flying. During the time that the 71 mission occurred, and all the subsequent missions, they had a prime and a backup Mir crew. At some point during the training they would bring those cosmonauts over, and we would have to train them. It was a little bit different than 60. They weren't actual active participants on the Shuttle, like Sergei and Vlodya were. They were visitors. They would be visitors. Once the hatch was open, the two vehicles were connected, and they could come over on our side.

We have to plan for contingencies, if something should happen, like a cabin leak. Realizing that they can't read all of our warning signs, they wouldn't, maybe, understand the master alarms and the caution and warning tones that we might get. So we had to bring them in. I actually taught many of them in here, and sort of made up a special class just on how do you recognize the sound for fire, for cabin depressurization, any other alerts that might say you need to get back to Mir in case we have to do an expedited undocking to separate the two vehicles.

That was kind of interesting, because I didn't spend as much time with those cosmonauts, actually day to day, but they would come in with the translators, and usually three or four at a time. I think my fondest memory was they came in here and they all came in with cameras. [Laughter] They wanted to take pictures. They were talking to the translator, "Can they get a picture with you?" I'd be standing there with like three cosmonauts, and we'd all have our arms around each other, taking pictures. Then while I was instructing, one of them would hop up and want to be taking pictures of his buddy getting training in the Shuttle simulator. I thought that was kind of cute. [Laughter]

Wright: It had to be exciting for you that they were so excited about being here and learning from the whole experience.

Reed: Yes. The other thing that amazed me is, once I would explain to them, for example, rapid cabin

depressurization and I'd show them on our CRT displays where that might occur, once they knew what it looked like here, they could go pick it out. They would point, "Oh, yeah"-once I'd put the malfunction in-"that's where it's dropping." You could see that these people were just as smart as our astronauts.

It's really funny, Bill Cosby once, I remember him saying, trying to talk to foreigners, people tend to shout at them. [Laughter] He's like, "They're not deaf; they just don't speak the language." You had to be very careful, because you would find yourself, if you couldn't get a point across, you'd just say it louder. And it doesn't get across any different. It's the language; it's not the level of the volume. [Laughter]

I realized at that time that these folks were the best of their best, just like our astronauts here are. Now that we have some of our astronauts that have gone over there and trained, I imagine it's the same feeling for them. It's got to be frustrating to be a highly intelligent individual and outstanding in your field, and then to be constrained by language and not be able to get your points across. So we tried very hard to help alleviate that for them. But it was fun. We had some fun moments. They were all really good folks.

Wright: What other missions have you worked on, other than 71?

Reed: Let's see. I worked 71, 76, 79 for a little while, and then I left and went to another job and then came back. I did STS-84 and STS-89, and 86 was in between there, too. I lose track. But I did all of those missions for docking. In some cases I was also their systems instructor at the same time.

Wright: You've been up close and personal with Shuttle-Mir?

Reed: Yes, from day one.

Wright: Since the beginning.

Reed: Yes. I have to admit, when STS-71 actually docked, we have what we call a sim control area over in the Mission Control Center, which during our integrated simulations is where we hook up the simulator with the flight control team in the Mission Control Center and they actually practice, like we're on orbit, we sit in this room and we monitor, and they actually put in malfunctions for the flight controllers to see, so we can develop that teamwork. That's sort of the last step in the training flow. Before a crew flies, we do these integrated simulations.

Well, during missions, that room is still there and we can go see actual mission data. I remember sitting there the day that Hoot maneuvered the docking system in and called down, "Contact and capture." I had a lump in my throat for the rest of the day. I really did. It was just like, this is so historical. The last time we actually docked Apollo-Soyuz, it was a different time, it was a different place, and we weren't

necessarily friendly. This time it just had an overwhelming impact on me. I was amazed at my emotional response at the time. To this day I can still remember. The rest of the day, the training team, we just walked around. We were all kind of in a daze, because we had trained these people to do this, and they had gone up and done it perfectly. I mean, it was truly amazing. All of the hard work and everything paid off. We did grumble a little bit as it was going on, because some of the things were hard to do. It's like, "What are we going to do?" We had to actually develop procedures. There weren't any procedures.

All of the subsequent dockings that I watched, every one of them has amazed me, that they're bringing these two huge vehicles together at a slow rate, basically bumping them into each other, and then actually having people work together, from two different countries, in space. That's really amazing.

Wright: How do you feel when you watch that hatch come open and the people that were once in this room now are traveling back and forth from one vehicle to the other?

Reed: It's really hard to describe, because it's almost surreal. You've trained all this for so long. We actually train the hatch openings and the welcome ceremonies. They're not as official, of course, in the simulator. But we go through the flight plans. We almost know step by step what they're going to be doing. After months and months of training it, it's almost ingrained in our memory. To actually watch it, you almost feel like, "Wait a minute, we're not in the simulator. I'm not there. We're not talking to them. It's these other people talking to them. What's going on?"

But at the same time you realize these folks are actually hundreds of miles up in outer space, and we trained them to do this. It's an emotional response. It's hard to describe it. When the hatch opened on 71, I teared up. I mean, I really did. I've kind of gotten control over myself for the other flights, but that one was just-I guess, there was never a question in my mind, if there was any crew that could dock, I knew that that crew could do it. But just that we hadn't done it, so it was a first. So there was always that little bit of apprehension. Then when they do it, and they do it so well, you're just really proud of them. I guess it's a little bit, probably, like being a parent and seeing your kids do really well, because here we try to give them the tools and teach them things that will help them do their tasks. Then we also try to give them the tools that if something goes wrong, to save themselves and the vehicle and get home safely. Then when you actually wave bye to them after that last simulator session, it's kind of like, I guess, kids going away to college for parents. You hope you gave them what they needed to be able to do the job right.

Wright: Then you start on your next group, right?

Reed: We get a two-week break. Actually, the training teams are chosen for the missions way in advance.

So a lot of times we'll know what mission we're working before a crew is assigned. But usually it will be a couple of months before the crew actually hits the training flow where you're working with them a lot. So you get a couple months' break in a lot of cases [a break from flight specific training, that is –the instructors still train non-assigned astronauts during this "down time" to give them proficiency until they are assigned]. But for me with the Mir docking flights, they were kind of coming one after the other. For a while it got interesting trying to juggle the schedule, because I'd have, let's see, the 84 crew training in the simulator that day, and I would have the 86 crew training in-we have another trainer that actually does docking systems. It's equivalent of our single-system trainer. Then I'd have another crew member that was doing a JIS [Joint Integrated Simulation], which was, they were working with Moscow and the Mission Control Center and all this other stuff. So you'd have three things you were trying to juggle going on. Working my schedule during that time was really interesting.

One of the reasons is because when we did do integrated simulations with Russia, we would pick a time where people across the ocean were on part night and part day, and people on this side of the ocean were on part night and part day. Sometimes we were coming in at 1 a.m. in the morning, and we would do a simulation until 1 p.m. the next day. It got humorous after a while, because at a certain point, especially if you've been working a normal day, and then all of a sudden the next day you've got to come in at 1:00, you'll get really sleepy about 3:00 or 4:00 in the morning. We'd all be sitting in there kind of trying to wake up. We had to be, well, as we'd say, "Not stupid." [Laughter] You get dumb when you get sleepy.

It would be very critical. There was a lot of coordination that had to be done with the instructors in Moscow, along with the instructors on this side, to come up with the cases that we would run. What we would try to pick were things that got both crews involved. So typically it was, "We'll throw in a cabin leak. They'll dock, and there will be a leak in the seal between the two vehicles." We'd do things like that. Or we would have-one of the vehicles, there was a jet or something failed on, or they had a leak and they had to expedite and then dock. So you kind of had to be awake for that to make it all happen in the simulator. But it was not uncommon to see some of these instructors kind of trotting up and down the hall outside the instructor station, just trying to wake up before we got into the really heavy part of the simulations.

Wright: Did your job take you to Russia, as well?

Reed: It's really funny, I don't know how I've managed to avoid going to Russia. I think they needed me here most of the time training. But a lot of my friends, over the years, as we began to establish a presence with U.S. astronauts on board Mir, people were beginning to have to go over there. A lot of our simulation

supervisors would have to go over and work with their equivalents in Russia to come up with these cases.

There's a whole method to doing simulation, and you don't just walk in and go, "Oh, well, I think I'll put in a cabin leak." You have to plan it all out. In other words, we don't want it [the simulation] to go in a direction that we haven't thought about. Okay, we can put in this malfunction and here are the four possible ways it can go. So we have a plan, because there's a lot of money involved, and a lot of time, and a lot of people involved, especially when you're connecting two control centers, Moscow and Houston.

To me, that was actually a pretty amazing technological feat that we were able to do that, and even more on their part. The Russians don't have, I guess, a control center like we do, where you can split it up. We can simulate while we're running a mission in another area. Their guys are running it out of the same-this is my understanding-out of the same control center where they were actually being controllers for the Mir that was up there. So it was pretty amazing. That was where the simulation supervisors were, so a lot of them would go over and spend weeks coming up prior to any of these sims, coming up with cases. "Does this work for you?" They would call us sometimes.

Occasionally, the Russians would call here and we would do teleconferences. I would be in on those, and they would come up with some great idea of what they wanted to do on the docking system, and we would see if that was all right. We would discuss it and come up with a really good case. That was kind of fun.

Wright: Most people, I believe, when they think training, they think of something like where we are today. But I'm not quite sure they would have ever thought about you having to train them in protocol, what you do when you cross to the Mir. Tell us how that all evolved, and why that was so important that they know what to do when they opened the hatch.

Reed: Are you talking about our American astronauts?

Wright: Yes.

Reed: Well, actually they pretty much get trained on the protocol from, I imagine, the protocol office here at JSC. But we would practice it. They had been told what they needed to do, so over in the simulations we would practice it. The reason being is, it's going to happen one time and everybody's going to be watching, so it's kind of like a dress rehearsal, if you will. I know that they talked about it a lot, every crew that I ever trained for a Shuttle-Mir mission, because there were things that they would do. Obviously, the commanders would be the first to the hatch. But there would have to be somebody-you have to understand this little airlock that they're in is not very big. I'll tell you a story about that in a minute. But they have to

position somebody down there with a camera. Then they've got another person who's got this 100-foot cable that's going back, it's a TV and microphone cable for a handheld microphone. It's 100 feet long, so if you see any of the pictures of them going through the Mir and dragging this microphone so they can talk to Houston, that's it.

So you've got somebody down there with 100 feet of floating cable. These are what you don't see on TV. Prior to the commander actually opening the hatch, there's the docking targets that are actually planted on the hatch on the Mir, and somebody would have to go up there and put those. You need it for undocking, so they've got to make sure that they put it somewhere where you can find it later. There's two lights [used during the rendezvous and docking to illuminate docking targets on the Mir] that would come across the hatch on our side that they had to pull a pin and take those out. Otherwise, you couldn't get through. So it was a lot of coordination just to get to the point where the commander could go, "Hi." A lot of things that had to be done. Obviously you had somebody with a still camera, somebody with a videocamera, somebody with a cable, somebody getting the targets and the lights.

I was referring to the airlock. The airlock is probably-well, gosh, I want to say maybe six feet in diameter. It's around the whole thing. It's very tight quarters. I guess the only blessing for them is in zero-G they got to use all of the volume. I did have occasion to go down to the Kennedy Space Center to actually train the crews. This was one of the things about the docking system. We didn't have any mock-ups here at the time that we could train with. So a lot of times the crew's first look at the hardware with an instructor would be at what we call the crew equipment interface test, which is about a month before flight.

I guess the funniest one, I went down with the 84 crew one of the times. They wanted some training on all of the duct work [the airlock contained air ducting that would provide air circulation from the shuttle to the Spacehab and will docked, to the Mir as well]. In addition to having to put these two vehicles together, you're bringing together two atmospheres, two different pressures, and different volumes of oxygen and nitrogen and carbon dioxide, based on how well their carbon dioxide scrubber may be working versus ours. There was a big duct that we had to connect and drag across-this was another coordination thing, for the greeting ceremony-and connect to the Mir air revitalization system. So we had to train them on that. We had nowhere here at JSC really to do that. So I used a lot of pictures and described and we went through procedures and did lots of those tabletops.

I went down with the 84 crew. I'll never forget sitting in this little six-foot-diameter airlock on the floor. I mean, we were all sitting with our knees up like this [bent up to our chests], every one of us. There was about five of us in there. I was pointing out, this is what they're talking about when they say "disconnect this clamp and connect it to this duct," and actually pointing the stuff out to them. They all had their procedures and they were making notes, because they do that.

At one point in time somebody didn't have a pencil. I remember Charlie [Charles J.] Precourt [Commander of STS-84] saying, "Has anybody got a pencil?" It's like Eileen Collins [STS-84 Pilot] kind of did this contorted thing, because we were all in there just kind of crammed like this. She pulls out this pencil like, "Here, I've got one." We were just amazed that she was even able to move in there. But trying to fit five people on the floor of that little airlock and try to do some training was rather interesting. In zero-G it would have been much easier. I kept trying to get them to take me with them, but they wouldn't do it.

Wright: Not that trip.

Reed: Not that trip.

Wright: Well, that's a feat in itself, is for you to train them, but yet knowing that that's not their actual environment that they're going to be training in.

Reed: Right.

Wright: Does that pose a challenge to you and to them?

Reed: I think it's always a challenge, because if you think about it, we practice launches over here. But I can't imagine going from our simulator, which I hear is fairly realistic, to actually knowing that you're sitting on top of all of this rocket fuel and it just lit. That's got to kind of make you leave your brain back on the launch pad for just a moment.

I think they have similar problems. But one of the nice things about having so many flights to do, that after every flight, I would talk to the crew members. We have what we call a training debriefing. "What could we have done better? What did you notice that was different? Was there any-we call them gotchas-any gotchas that you ran into? How can we change the procedures to make them better?

Actually, all of the docking procedures and all of this duct work and what we call tunnel ops, tunnel operations, because that whole area back to the docking system we called the tunnel, we revised that for every flight. It got better every time. By the last three flights we pretty much had it down. We're actually going to be using this docking mechanism for our International Space Station flights. I think we've learned a tremendous amount of lessons from the Shuttle-Mir Program and will use that in the ISS flights that are going to be coming up in the future.

Wright: But I have to assume that not one flight is the same as the one before it. Each had its own unique

characteristics for you?

Reed: They did, and sometimes it was what we were doing. I guess 71, it was a first. It was a "Let's see if we can do this" kind of thing. Also trying to learn this new system that we had very little information on. I think with 76 there was an EVA involved. Now we're getting a little more fancy. They actually went outside and were practicing some, I guess, ISS assembly-type tasks while docked to the Mir.

Then on 84 it was just the crew. I think what I remember most about that crew was they were sort of representative of the change in the astronaut office, the multicultural backgrounds that we were getting in, because we had Charlie Precourt as the commander; we had Eileen Collins as the pilot; we had Ed Lu, who is of Chinese descent; we had Carlos Noriega, who is of Hispanic descent; we had Jean-Francois Clervoy, who is from France. So it was not uncommon to be sitting around the table and hear Russian, French, Spanish and English going on between all these guys. I remember that was a really, really neat group, as far as that aspect was involved.

Charlie is an amazing person. He's one of these very talented linguists. He just picks languages up. He would be in the cockpit and he might explain something-oh, we also had a Russian, Elena Kondakova. He would speak to her in Russian. He might say something to Jean-Francois, who we called "Billy Bob." That was a nickname he got on a previous flight. But we called him "Billy Bob." He might say something to him in French. And he might be talking with Carlos in Spanish. It was really amazing. It was kind of fun.

Wright: You've been here since '87. Those first years, I'm sure, were so instructive to you. You just learned and learned every day. But the last few years with Shuttle-Mir, would you have imagined when you stepped in here in '87 that ten years later you would have worked with so many international partners?

Reed: Not at all. It was amazing to me when it first happened on STS-60, and to this day it still-I'm amazed at what we're doing now and the direction that we're going. I think it is really interesting. I've trained and worked with every astronaut candidate class that has come in since 1990, and they have evolved. Went from being all Americans, to now we're bringing in international astronauts from the international space agencies. So we're seeing a change and a moving in that direction. I just couldn't have imagined that a few years ago, because you kind of grow up with NASA as all fighter pilot types and they go and they sit on top of rockets and they go into space and do wonderful things. But you don't think about anybody from another country joining NASA, it was such an American icon. I think it just speaks to the direction that we're moving as a whole for human space flight. That's the next step, is the cooperative, international cooperation.

Wright: How long are they in this trainer?

Reed: In this trainer? Classes in here are typically two hours long. Classes in the simulator are four hours, five hours, eight hours, ten hours, all the way up to thirty-six hours. Just prior to a flight, they'll do what we call a long simulation, which will take thirty-six hours, usually whatever the critical objective is on the flight. For example, on a docking flight, we take the window just prior to docking and after docking, and we will work all the way through that time line and practice doing everything that they're going to do. It's the big dress rehearsal. All of those things tend to happen in the last twelve weeks of training.

Wright: What is your time period that you're with, when you said you're assigned to the team?

Reed: It can be anywhere from a year and a half to flight, or nine months to flight, depending on what the objectives are. I guess for most of the Mir crews, I worked with them about a year. We'd be assigned with them for a year.

Wright: Did you train them more?

Reed: Well, I guess as an instructor, you can always say you can always train them more. But most of the people that we have chosen in our astronaut program are just phenomenal folks. We set out our objectives, what we want to teach, almost at the beginning, and we go after that, and they learn it very well. It's really amazing. You can always go deeper. This is such a complex mechanical system and flight machine, the Shuttle. Then you can add all the other complexities of the docking system and using the arm to put the docking module on top of the docking mechanism, and then docking it with Mir. So it's pretty complex stuff.

Wright: Any other thing that you would have liked to have done other than this, now you've done it? Or are there other things you'd like to move to?

Reed: I hadn't really thought about that, I mean, other than just going into space. [Laughter] If they could just take me with them. I think I, as an instructor, have been very blessed, or very lucky, I'm not really sure which. I've just sort of got some really good assignments. I got to work on a lot of missions that were considered firsts. Even now I'm on a first, which is a first female commander. So I consider myself very, very lucky. I don't have too many regrets, things I didn't get to do.

I probably would still like to go to Russia, but at the time I was just too busy training them here, so I couldn't go there. I couldn't necessarily cut me loose from the schedule.

Wright: I'm going to ask Carol or Mark if they have some questions for you. Before we let you go on back to your other job duties, would like for you just to kind of tell us about what's here and how you walk people through that.

Reed: Okay. Well, again, this is what we call the single-system trainer and it is a mock-up. It is a mock-up of the cockpit, or what we call the flight deck of the Space Shuttle. We bring crew members in here in either pairs or alone, and they will work with a single instructor. The instructor will train them on different systems.

Some of the systems that, if I kind of take it from the left all the way to the right, that are over here on the left side of the cockpit where the commander sits. We have a lot of our environmental control and life support; so, fans, pumps, cooling, what we call the active thermal cooling system. A lot of the switches are there. Our fire-suppression system should a fire occur is located right there.

On this panel we have some heaters. We have cabin vent and relief valves, which enable us to isolate leaks, or try to isolate leaks, should they occur. We also have things like nose wheel steering for when they land. The commander has got some of the important switches over here.

Then down on the bottom what we call the PCS, or the pressure control system, which is actually the combination of oxygen and nitrogen to keep them at a 14.7 psi cabin, much like we breathe here on earth. Because once they get on orbit, you don't have that; the atmosphere is much less. It's microgravity and not like the gravity that we have here on Earth and the atmosphere that we have here on Earth.

Some of the other big things that the commander has over here are right above his or her head, they have the GPC switches, which is general purpose computer. That is all of our flight software, which runs and flies the vehicle and controls the vehicle. So those are pretty important things.

You can see much like a standard airplane cockpit, there are a lot of meters and gauges that help them monitor things like oxygen flows, hydraulic pressures, quantities of water that they might have in cooling tanks and things like that. So they use that a lot.

In the middle here we have our CRT screens. These are sort of the direct interface from the computers that are on board, where they can actually call up different displays and things like that.

Here we have a standard what we call a launch trajectory, but they also have different systems pages, like this one, that they can call up and get information. This is where if something were to go wrong, it might be notated on this page, as well, because they might get an alarm. They also have caution warning lights-we call them bells and whistles-that will light up to let them know. What I'm doing here is just testing all the lights. Individual lights there may light up, if something were to occur, to let them know which system is having a problem.

As you go across this console, here in the center we have the keypads. This allows the commander and the pilot to actually talk to these computer displays and pull up different displays that they might need. For example, I could pull up a systems summary, and that would give them some information on smoke, if they had a fire/smoke indication. It gives them cabin pressure information and also a bunch of electrical information on the right side.

As you go on over here, we have our digital autopilot buttons that help them choose how they're going to let the vehicle fly when it's on orbit and what jets it might be flying and firing. Those kind of things.

As you go to the other side, that gets more into the pilot's world on the right side. So he's going to have a lot of things like main engines, which are really big, help boost us to orbit. Also the auxiliary power units, hydraulic system, and then all the electrical power system against that wall right there, perpendicular to that.

Reed: Then the rest of these things overhead. They have navigational aids, inertial measurement units, all of these that help, I guess, come up with a state vector and also help them land when actually do de-orbit and come back. We also have tons of circuit breakers that actually power a lot of these other things here.

In the aft flight deck, we have the controls that open the payload bay doors, that help set up the KU band antenna system, so that we can communicate with the ground and provide TV downlink. We have our windows that enable them to look outside, deploy payloads, work the robot arm, things like that.

All of those things can be taught in here one at a time. We typically don't throw them all together. That's pretty much the SST. They spend a lot of hours in here, from the time they're in ASCAN [phonetic] until the time they fly.

Wright: Because it needs to be a home away from home?

Reed: Yes.

Wright: They need to feel comfortable.

Reed: Yes. I guess the one thing about this is, imagine if you took that whole back wall and moved it up to about right there, that's actually how small the vehicle is in real life. So this is kind of spread out a little bit. There's a lot more room in here than there is on the Shuttle.

Wright: Carol, did you have a question?

Butler: You mentioned there were a lot of lessons learned from the Shuttle-Mir Program that will be beneficial to the International Space Station. I know one of those probably dealt a lot with the docking. Are there any others, in particular, that really stand out?

Reed: Actually, I think one of the things that we learned was the language thing, not only Russian, but we now have Japanese, French, Spanish, German international astronauts in residence. Most of them speak English. But a lot of our folks, our instructors, who are having to, I guess, work training issues with these different agencies are having to travel now. So we've got people learning Japanese. We've got people learning French. I guess it's something we didn't have to worry about in the days of us just flying Americans. You come in, you already speak the language, it's no problem. This throws an extra complexity in it that you have to take into account.

Also there's a lot of cultural difference. I think one of the things that we learned with the Russians is they tend to be very-I guess it's the personal space. Maybe you've heard about this. They tend to be closer than Americans are. So, getting used to that. Also, they tend to talk louder. It might sound like they're shouting, and they're not. So there's a lot of little things that we've learned. They are training folks in cultural differences. I've had a class on Japanese cultural diversity. I also understand that they're getting the same for Americans [a class for the foreigners on American culture] so they understand us.

Wright: That might be interesting for us to take.

Reed: Yes. It's real interesting. I took the Japanese course a while back. You don't realize, you just kind of think everybody's like you, and really they're not. I think that's probably some of the biggest lessons.

Then the other one is learning to work with translators. There are some technical things that we learned from Shuttle-Mir. But I think overall, it was more the people stuff that we learned, in trying to bring together all these different nations to work together on this common program. We learned a lot of lessons from Shuttle-Mir doing that.

Wright: Mark?

Davison: I'd like to stop the [video] camera and take out the tripod and then kind of go through a docking through a window.

Reed: Okay. They actually don't have the control panels in here. But I can tell you what they would do.

For docking system operations, I typically train to the crew in what we call the aft station, because

most of what would be going on during a rendezvous and docking was taking place back here. This was the hub of activity. There were lots of people on the flight deck, if you can imagine, usually four or five. That gets pretty crowded, because there's not a lot of room there.

The commander is typically in this position looking out the window, looking for Mir. Also there are overhead windows, so they're spotting Mir and actually flying, using pulses of jets with this hand controller. They also have a whole bunch of other information from our personal computers that are on board, that can track out where they're going, where they need to be. They have handheld lasers that they can actually fire at Mir to get a distance, so they know how far away from Mir they are. Also, via the KU band, they have a rendezvous radar. Several different inputs on how far we are from Mir, and slowly we move toward Mir.

Meanwhile, you have whoever is working the docking system itself trying to get the docking system ready for actually contacting and capturing Mir and bringing the two vehicles together. That panel is typically right here. There's actually two. There's one here and one here. It has a bunch of lights on it. They would power it up and check out the whole system about an hour and a half prior to docking.

Then about thirty minutes prior to docking, there's a second, I guess, power-on that they would do with a push button and get the system actually ready. We had to wait thirty minutes prior to docking, and this is where the differences in design issues came about with the Russian and the American stuff. The way they had designed their avionics boxes, all of the smart boxes that ran the docking system, they couldn't be powered up for a long time, or they might overheat, just given the way that they were encased in foam and everything. So we were very careful not to power it on too early.

So the crew would come here, power it on, and basically just wait once they had agreed that everything was okay. Of course, if anything out of the ordinary had happened during that time, they would work through malfunction procedures, and everybody in Mission Control would try to come up with a contingency plan. But they would sit here and work with the commander and the pilot and the other MS's. As we got closer and closer, they would be watching out the window. Then somebody would be usually up front looking at our CRT display of the docking system status. It has a bunch of different data telling you about different status points on this system. They would be hawking that display. You'd have somebody actually looking at the system in the lights making sure everything was going okay.

When they would see a light here come on, it says "initial contact," and they would call out, "Contact." At contact, the commander would then do what we call PCT, which is post contact thrusting, to actually sort of push the Shuttle a little harder to ensure that we get capture into the Mir. Then a light over here says "capture," would light up, and they will call down "Contact and capture."

What that would do would trigger an automatic sequence in the docking system. If everything went okay, it would go on its own and basically pull the Mir very, very slowly. It was extremely slow, like watching grass grow. But when you've got that much weight coming together, you don't want to be moving very fast. It took about nine, nine and a half minutes, for the whole sequence to run. The capture was actually a temporary capture, where little latches would grab Mir, and then we had to pull the two together.

Around each of the docking mechanisms there was a structural ring on each side. On our side we had hooks. Actually, they did, too, but they didn't really use them, because that was for a contingency. They would get these two structural rings, pull them together, our side would just pull Mir in very, very slowly. When those two structural rings met, they would trigger a sensor that said we have a good interface seal. In other words, we have a good seal between the two. Because you're very concerned in space about getting any kind of leaks. I mean, fire and leaks are probably the two scariest things that can happen to you on orbit.

As soon as you get the good interface seal, then that would trigger the hooks to begin closing. All of these, we had different indicator lights, so they would come up and let the person know that the hooks were moving. The same thing was up front, the person watching the CRT screen would say, "Okay, I see that." They would sort of have a cross-check of everything was working fine.

Finally, once the hooks were closed, they would get, I guess everything would clear out and they would see "docking complete." Then they would go downstairs and get ready to open the hatch. That's pretty much it.

There was also a manual phase, if for some reason the automatic sequence, they had to stop it. It would then become a manual sequence. There were push buttons on this panel where they could do all of those things, like close the hooks and open the hooks and drive the rings in and out to pull the two vehicles together. We had, I guess, redundancy there in case the auto system didn't work. I think they only had to use that once during the Shuttle-Mir Program, and that was on STS-76.

Wright: Thank you.

Reed: You're welcome. I hope that was what you wanted.

[End of interview]