BONNIE DUNBAR

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Interviewers: Rebecca Wright, Carol Butler, Mark Davison

Wright: Today is June 16, 1998. We're talking with Bonnie Dunbar as part the Shuttle-Mir Oral History Project. Rebecca Wright with Carol Butler and Mark Davison.

Good morning, and thank you for speaking with us.

Dunbar: Good morning.

Wright: You've had quite a career with NASA, and most recent years have been spent with the Shuttle-Mir. I know that you were the first American woman to train in Star City, as well as you were part of the first crew to dock with the Mir. I would like for you to start out by telling us now what are you doing? Because those years have quickly gone by and I know that you're busy every day. So if you could just start with telling us what your current roles are.

Dunbar: Well, I just came off of the eighth docking flight to Mir in January of this year [1998], and after a couple of months of post flight debriefing and report-writing and so forth, I've been assigned to a temporary job. Right now I'm filling the shoes of Steve Hawley for about six months as Deputy Director of Flight Crew Operations while he trains for a flight later this year.

Wright: Are all of the past experiences benefiting you in this new job?

Dunbar: Oh, yes. Well, I've rotated through a lot of different technical jobs in my 20-year career here, and this sort of pulls them all together. My primary job is supporting the Director, Dave Leestma, who was a classmate of mine in 1980, as well as filling all of the other roles that our directorate has within the rest of the [Johnson Space] Center.

Wright: I know that you've worked with so many people for so long, and you work with them now day to day. But you spent many months in Russia training in Star City. Would you tell us some of those experiences? And first of all, tell us how you were selected to do that.

Dunbar: Well, why don't I go back, I guess, a little bit further than that. I've been asked about how I accommodated Russia and so forth, and I don't think very many people knew that I was actually in Russia

in 1991, long before this program started. I was invited as a part of an AIAA group to go to Russia and to Tashkent in Uzbekistan for three weeks to participate in the first Joint Conference on Microgravity Research. In fact, I co-chaired a section on the design of space equipment with a Russian scientist in Moscow.

While I was there, I became acquainted with the leader of the microgravity research in Russia, who was also a member of the National Academy of Sciences, Dr. Lea Regel. Dr. Lea Regel had sent many experiments on board the Mir--in fact, on the Salyut--and she was personally acquainted with people at Star City and also cosmonauts, two in particular that she introduced me to. Sasha Serebrov had flown on the Mir--actually, Aleksandr Serebrov--and was also a materials scientist. And that was my background. He was a participant in the conference. And she also knew General Vladimir Genibekov quite well.

She suggested to me one day, "Why don't you go out to Star City with me and we'll have tea with the general and tour the facilities." So I did. I spent almost an entire day out there. We went through all the Mir simulators and so forth, just as we'd done before, and I have pictures. [Laughter] And was very interesting to me. This was before we had a formal joint program, but we'd had interactions with the Russians on the medical area for--well, since Apollo-Soyuz. The person largely responsible for that--well, actually two people--were Dr. Carolyn Huntoon at this Center, and Dr. Arnold Nicogossian (currently at NASA Headquarters as Associate Administrator of Code U, OLMSA), who kept those relationships alive.

So it was not unknown to me what Star City was going to be like, what Moscow was going to be like. In fact, Moscow in 1991 was a very grim place, not many goods on the shelves, not very much traffic because there was no gasoline. They were having all of those tumultuous events that were going to lead up to their internal revolution.

In 1993, I was at NASA Headquarters. I had flown on USML-1 in '92. I'd come back, and I had been asked by Mr. Abbey to participate in the Space Station redesign, and was asked in March of '93 to come up and help with that. Then in June, when we presented our final report to the Vest Committee, he asked me to stay on as an Assistant Associate Deputy Administrator, for Code U, which we had just formed, which was Office Of Life and Microgravity Sciences OLMSA. That was headed by Dr. Harry Holloway. Dr. Nicogossian and I then supported him.

Among the things that we did was look at what we would field in the way of research on Mir as part of this Phase One Program. I remember having many discussions in Washington, D.C., about this program, with members of Congress, within NASA Headquarters, and so forth. At one party I remember someone expressing some reservations about, well, are astronauts going to be willing to go live in Russia? I said, "Certainly. We do our duty in sometimes very extreme circumstances. We've had people who've lived in those kinds of conditions before, one way or another." And I've actually been one of them. I grew

up on a farm which my parents homesteaded in a tent in 1949 through a very cold winter. Pretty limited-income area, some scarce food winters, outhouse etc. I didn't look at that as a particularly—hard life, but we invested much of our family time in survival. [Laughter] I just knew what it was like and I knew that if we were going to send crewmembers there alone, that we had to be very up front about what the conditions were, because we weren't going to send people just to survive; they were going to have to live and study. They were going to have to perform. So we had to make certain that we supported them so they could do that, that they weren't spending all their time just surviving, that they could actually perform.

I came back from NASA Headquarters the first week in December, and I was actually prepared to enjoy Christmas and do other things. And just shortly before Christmas, my boss, Dave [Leestma] called me in and said, "Bonnie, I need to have you go back up Norm [Norman] Thagard, who's going to fly this first increment." And I said, "When?" And he said, "February." And I said, "Well, I don't know if I'm ready." He said, "I need to have you do this." As far as I'm concerned, Dave practically walks on water. And I grew up the daughter of a Marine, so I don't say normally say no when I'm asked to go do something; it's part of my duty. So I talked to him for a long time about it, and I talked to my husband. "This is the right thing to go do."

I didn't feel totally prepared, especially in the area of language. I'd taken some Russian before. In fact, I took Russian classes in 1992, and I could read it, sound out the words. I knew the letters and so forth. I wasn't able to really speak it. So I started crash Russian courses just to try to help me prepare.

Then I met with Mr. Abbey and Dr. Huntoon in a private meeting where we talked about this, and they talked about why they wanted me to go. I expressed my reservations about the language and they felt I could learn the language, that what I brought to the program was my knowledge of the payloads, the science and science operations from my prior 3 flights. I already knew the experiments. I wasn't part of the actual selection committee, but I was part of the planning because we were funding it out of Code U. I knew perfectly well what the program was going to be. And I had some knowledge of these people and had helped advocate cooperate research while I was in NASA Headquarters. So at least I guess they felt comfortable with me going and sticking it out and supporting the program.

Then the other part of it is that I would go with the knowledge that I was there to learn as much as I could technically, so I took lots of notes. I took notes in every class. I have a well-documented three-volume record of my experience there, which I have then used over the years as we've brought our programs together.

So, in February of '94, Norm Thagard and myself and Ken Cameron packed up and went to Star City.

Wright: Felt like a pioneer going off?

Dunbar: Well, I didn't feel like a pioneer so much, because this isn't going into an unknown land. I mean, there were other internationals who had flown before us. Helen Sharman from England. Ulf Merbold was training from Germany. I knew both of those people. I'd trained with Ulf before on a prior flight. He was a backup for my first flight in 1985, which was a German Space Lab flight. So to say I was a pioneer, you know, we were the first maybe from the United States since Apollo-Soyuz to actually live there, but certainly we weren't the first internationals at Star City.

I think it was just really the challenge of learning a new culture, a new language, which was exciting to me, an opportunity to go onto a Space Station sometime in the future, because I had hoped that would happen eventually, and to bring something back to my agency as an engineer. I helped to build the Shuttle, you know, when I was with Rockwell International. I was part of a team, so I understood systems. And just be able to go over and see how do they do things; how do we mesh our two worlds; what are going to be the challenges in the future.

Wright: So I take it the language came at least more quickly when you were surrounded by it constantly.

Dunbar: When people ask me what the largest challenge was, it's not technical. Spacecraft have a lot of common systems. In fact, many of our systems are technically very similar. Some are different. But they're engineering projects. Understanding how they operated and the operations was not the most challenging part of it. It was all language, because you had to learn all of these things in a different language and you had to take oral exams and sit in lectures that were only in Russian, and live only in Russia, learn the basics. It was like being a first-grader in graduate school. You had to learn the vocabulary to be able to function. You might know the answer. They'd sit there and ask you a question, you knew the answer, but you didn't know how to say it in Russian.

So about for six months I felt like a small child. I didn't talk much. And then all of a sudden at six months I started feeling more comfortable. My Russian instructor at that time, Vladimir, who was from Moscow State University, said that was normal, and he was really one of my best confidants, because part of the class--we had four hours of Russian a day for almost three months--part of the class, yes, we'd concentrate on textbook things. We'd concentrate on grammar and we'd concentrate on vocabulary, and then the rest of the class, we'd talk, we'd chat and talk about life here, talk about life in Russia. He'd actually traveled out of Russia as a Russian instructor, told me about his first experience outside the country and how he went to see "Dr. Zhivago," which was banned at that time.

So, language was everything. But after six months, I started understanding much of what was

around me, even though my speaking ability was slower. But by the time I flew, and I was only spending time with my commander, Anatoly Solovyev, and my flight engineer, Nikolai Budarin, I mean, we were it. We understood one another and we functioned. I could read all the checklists, so I felt pretty good. Not like Henry Kissinger, but I did have a language test when I came back, from an instructor from Monterey, and they gave me a 3-plus out of five, which made me feel quite good. I felt quite comfortable. I'm a little more rusty now, but I felt comfortable.

Wright: When we interviewed Salihzan Sahripov, he complimented you and was very much complimentary on your help, because he felt like you had helped him with his English because you understood Russian so well. He made a comment during that interview about how helpful you were. So I'm sure it was quite a relief to them to know that they could speak a language with you that you understood and it helped.

Dunbar: Well, I tried to do for Salihzan what I didn't necessarily feel I had at the beginning, and that was an opportunity not to always be performing a language, you know, just have some one-on-one help. At the very beginning I didn't have that and then I did have it, and it was such a tremendous help. I had it from a young woman by the name of Larissa, who became an extremely good friend, who had come to my apartment. We'd go down to Moscow and see the sights and so forth. She would help me through the training materials sometimes, the konspects. She was an official translator there at Star City, had grown up at Star City. Her father had been an official translator, not necessarily an interpreter, and he had helped put in the centrifuge that's there. He had gone to--I think it's possibly Finland, but he was the translator that went with the Star City personnel as the engineering was being done, and went back and forth. So she was a tremendous help.

I had this little support group there at Star City. [Laughter] Olga, whose husband was an instructor at Star City, technical system, she taught technical English at an institute in downtown Moscow. They were probably both in their sixties. She had actually been to the United States at one time. Tremendously warm, nice woman. I had lunch in her apartment. She took me on tours of Star City before we ever had maps, and showed me where everything was, all the little nooks and crannies to buy food.

And Galena, who was an engineer in Building 2, who, if I was by myself, particularly if I was by myself, she'd open the door to the hall and pull me inside. It was like disappearing into the bowels of the building. And we'd have tea with her colleagues there.

Wright: Those are some of the benefits that came with the job--meeting all these wonderful people over there.

Dunbar: Yes. That little support group, which were all Russian, was really important to me, and primarily Russian women.

Wright: How did they accept you as an American woman? Was there any question or were the differences such that it took a while to build a trust?

Dunbar: I knew when I went over there in '91 that with respect to women, Russia was not very progressive. I knew that from Dr. Regel. She's a woman and she was Dr. Regel, Academy of Sciences, in some respects very much an exception, and she talked to me about it. I was going to train at a military base. Although General Genibekov was very supportive and warm, he was a little bit unique in his sphere. I saw no women military officers, for instance, at Star City. There were no female military lecturers.

There were things said to me that I hadn't heard for 20 years, but weren't totally new. I was well prepared for this. When I started engineering in 1967, only 1 percent of the engineers in this country were female. Now, I really didn't know that. My physics teacher, who happened to be a man, is the one that suggested that I be an engineer because of what I'd done in physics and math, and I went off to the university, and all of a sudden I found myself 1 of 9 women in a class of over 1,000 men, and quite a few professors who really didn't think I belonged there--very overtly. Put me in the back, you know, so I wouldn't distract the "real" engineers. Well, when you're in that environment, politics don't play a real big part in grades. You either solve the problem or you don't. So I solved the problems. [Laughter] It was hard to argue with my grades. I went through engineering and graduated, and those people didn't really bother me as long as I could perform.

So I knew I was going to see some of that, and I had seen some of that in the early part of my career as well. That was just part of the life. My job was to do my job and to perform and to do it in such a way that NASA would be proud of me. I knew that I was going to expect some of this difference in culture, the difference in progression and how they accept women.

Wright: Your actual training that you went through, were you treated any differently or were you treated as an astronaut/cosmonaut, or were you treated as a female astronaut/cosmonaut?

Dunbar: That's a very difficult question to answer, because if you were to look at just everything on paper, you'd say treated exactly the same. But I'm certain Norm didn't get all the aside comments. [Laughter] Or, you know, occasionally I would go to parties with Anatoly and Nick, who were very protective of me, really just a wonderful crew, and that's what a crew ought to do, is bond. But, you know, there are some jokes, especially at women's expense, it was kind of interesting. I had a good crew and I was real proud of

the fact that we finally went through our final exams and we were evaluated by a psychologist, the psychologist who actually wrote a book on psychology of crews, said we "operated like a symphony."

Wright: What a compliment.

Dunbar: Yes, I felt very good about that.

Wright: Very harmonic. That's wonderful. Tell us about those gentlemen. You spent how many months with them?

Dunbar: Well, we were officially a crew all through training, 13 months, but we really didn't start training together, except for science. We did our tours here on science training together, but actually in the simulator didn't start training until about four months before flight. Our lectures were different. Norm and I spent our time together, just the two of us, in lectures, separate from our crews. It wasn't until about four months before flight that he started training with his crew and I started training with my crew. We had started partying probably together at about launch minus six months, something like that. And it was good. It was very easy.

Anatoly is a strong commander, but very clear, and I appreciated that, and very supportive. His wife is a mathematician there at Star City, and they lived one floor below me in our apartment building, so I frequently went down for dinner. So that was a good bond.

Nikolai lived in a different building, but it was also his first flight, so he was trying very hard to do well. He's very easy to get along with. He's up in orbit right now, and Andy [Thomas] confirmed that he was very, very smart and very easy to get along with.

Wright: Would you explain the differences of how you and Norm trained together and then how different it was to train with your crew?

Dunbar: Well, it was a difference in the whole training philosophy at Star City. Star City has established itself more like a university environment, because they try to bring everybody up to the same speed. I'm talking about really cosmonauts. I asked an instructor once what was the rationale behind the methodology of how they trained, and he said, well, we went through this very university-type structure, basics in aeronautics, basic in chemistry. We didn't have that, but they do have like basics in chemistry and so forth, because their pilots for many years were coming out of the military, but without a university education. They typically go through an equivalent of our high school, which was very good, but they might go right into flight school, whereas their flight engineers--or they call them bort engineers--typically came from

Energia, which was the company that built the spacecraft, and very often they had engineering degrees or advanced degrees. And then they also had medical doctors that they occasionally flew, and of course they had medical degrees.

So the intent of this lecture-intensive beginning training was to make sure they all had a common base, to bring those pilots up to a certain technical level as well. Then once they did that, once they graduated them--and that's essentially what you did, you went through these oral exams in all these different systems--then you were allowed to actually get into the simulator.

That's somewhat different than our program, because in our selection process the academics, the basic academics, are already done. That's part of the competitive selection process. So we put people through an astronaut candidate class, lectures and so forth, but very quickly we'll start integrating them together as a team into a simulator. That's the difference between the two systems.

Wright: Did you find any part of the training more difficult than others when you were in Russia?

Dunbar: Strictly the language. I told somebody, we went to do winter survival out in the woods there by Star City, and they said, "Is this hard? How was it?" I said, "This is the most comfortable thing I've done," because I grew up in the Northwest. My dad was a World War II Marine, and he used to teach us survival. You know, the snow's on the ground, you're out with your horse. You're checking the fence and it gets foggy and you lose your way. How do you survive? I learned survival from the time I was a kid. So being out there in the woods in the snow and taking care of the fire actually was kind of fun.

Wright: You were home. [Laughter]

Dunbar: Yes. We used to do that for fun. On the weekends we'd pack the horses up and go into the Cascade Mountains and we'd call that fun. [Laughter]

Wright: Wow. You were in pre-training. [Laughter]

Dunbar: So I actually enjoyed winter survival.

Wright: That sounds great. You had a chance to be on the first group and, of course, you got to fly with your crew. So tell us how exciting that was for you to be able to be there at the Mir.

Dunbar: Well, it was very exciting to be part of that first flight. As you probably know, Anatoly Solovyev and Nikolai Budarin also went up on the Shuttle, so they were my crew. And sat on the mid-deck. I sat with them on ascent. I also acted as an interpreter, too, because they were only with us for about three

months in training. We transferred them after docking. It was very exciting to see the Mir, to actually get on there. Although there was a lot of extra hardware there, it was still somewhat familiar. I recognized all the panels and so forth.

The hardest part was leaving them and not staying with them, and I realized how tightly we had started to bond as a crew when we got ready to close that hatch and I was going to be on one side and they were going to be on the other. That was probably the hardest time.

Wright: I can imagine. And then as you slowly leave and see them in the rear-view mirror, I'm sure that part of you wanted to be there, and I'm sure part of you was.

Dunbar: Well, it's like any job. I had that sense, as we were closing the hatch. Then immediately my brain's back in the time line, so then I think about it after the flight. But there was just that period there. I think even Hoot [Gibson] noticed it. I mean, Hoot was feeling it. It's just kind of, "Well, it would have been nice to stay."

Wright: Would you tell us some of the things that you were doing during that time that you were all together? Did you help them transition or were you just part of the whole crew doing an assortment of duties?

Dunbar: You mean on--

Wright: During the docking.

Dunbar: During the docking flight, all the duties are very well laid out. As soon as we took over Norm's seat, his so-called Lojement seat, and put it in to the Soyuz, he and Anatoly and Nick became the Mir crew. So that happened not long after docking. We picked up Norm. We brought Norm back. We brought Norm, Vladimir, and Gennady [Strekalov] back. They became part of our crew. Then Anatoly and Nick became the Mir crew. I didn't see much of them except for pre-planned events after that, because their job was then to receive control of the Mir and to work with their Mission Control Center, the TsUP.

Our job in the Space Lab, for Ellen Baker and I, was to start the medical analysis on Norm and Vladimir and Gennady, and that's what we did. We had a whole suite of experiments, everything from blood work to cardiopulmonary work, to lower-body negative-pressure work, cardiovascular type of work. We had to do that on orbit to get the Zero-G data. That took much of our time for the dock time.

Wright: How were your experiences different this last time when you were up visiting [STS-89] and your

duties that were there on this last flight?

Dunbar: The duties were very similar except that we only brought one person home, but we didn't do as much medical evaluation. It was very limited. Our primary duty was to transfer cargo, including Andy, and bring Dave back. Then we had a double module SpaceHab with this, which not only carried logistics, but we had 23 science and technology experiments on board as well. So we were able to do some of that.

Some of those experiments, which were actually technology demonstrations, were equipment going to the International Space Station. They included life-support systems to evaluate the quality of air and water, and some radiation detection equipments, one from Japan, which was called the Real Time Radiation Monitor, and it flew again recently, and the other was equipment a set of metal spheres with detectors in them to help us evaluate what kinds of materials we would build future spacecraft out of if they were going to Mars, to be able to protect people inside.

Wright: Did you have different feelings this time, knowing that it was just going to be a short visit for you? You weren't leaving your crew behind this time. You were just there for a different mission.

Dunbar: Well, the thing is that Anatoly was there again. [Laughter] When we opened the hatch, it was Anatoly and Pavel Vinogradov. It was really fun to see Anatoly. So one of the things we did before we closed the hatch and left is, I went in on the other side of the hatch and they took a picture of Anatoly and I inside the Mir before I came back over, and when Mission Control in Moscow called us after undocking, they asked me what side of the hatch I was on. [Laughter] I told them, unfortunately, I was on the Shuttle side.

Wright: [Laughter] That had to be fun. You all had a good visit?

Dunbar: Yes, we had a good visit. He had been working very hard on this particular increment. I think history shows the systems were starting to degrade, a lot of maintenance required. He told me he had been working very hard and hadn't had much sleep.

Wright: Had you visited with him through other communication means up in the Mir, or was this the first time you had seen--

Dunbar: I talked to him once on the ham radio when I had called up to talk to Andy. So we had talked once on the ham radio.

Wright: He'll be home soon and maybe you'll get a chance to visit with him.

Dunbar: Yes.

Wright: Tell us about some of the equipments that you have helped put together, if you have some specific ones that you have helped design or that you feel are very important, that have gone through with the Shuttle-Mir Project.

Dunbar: Interesting. I have contributed to designs as an operational person, but I have to put the credit on the hundreds of other people who actually put that hardware on board and also went through the scientific peer review process to put the science on board.

I think, if anything, where I feel I've made some difference has to go back to 1987. After the Challenger accident, I was asked by the NASA Administrator to lead a task force to look at what our posture was in terms of research flights and research hardware to prepare ourselves for Space Station at that time. In looking at that, we determined that we really weren't in a very good posture at all, because we only were flying pallet flights, not pressurized module flights. Space Station was a pressurized module flight. There were different sets of experiments, different things we had to learn, different ways of training people, and that the only people at that point that were flying module flights were the Europeans and the Germans. We said, "This is not going to put our scientists, our researchers, our crews in a posture of really incrementally preparing for Space Station."

So we put on the Manifest, the USML series of flights, and I was very pleased to eventually become payload commander for that first one, USML-1. We then put up USML-2. They were at that time supposed to be U.S. flights. Then we started internationalizing them, so MSL came along. But we were able to design new furnaces, new levitation devices. A whole suite of hardware flew for the first time on USML-1 and then USML-2, and is actually, you could say, the parents of what we're flying on the International Space Station. So I feel very good about what we did as a team on that task force to prepare for the Space Station, and some of that hardware also flew on Mir as part of that incremental development.

Wright: It's nice that you've been able to watch the progression of it moving and then, of course, hopefully it will go on into the next phase.

Dunbar: Absolutely. If you take a look at the Space Station furnace as it started out on USML-1 and that design, as well as the acoustical levitation device and the glovebox which first flew in 1985, it is all incremental buildups. We actually did some interactive work on protein crystal growth and with microscopes that had never been done before on STS-50/USML-1. Much of the protein crystal growth had been automated pretty much to that point but not always successful. We actually took it to a laboratory

level and demonstrated some concepts that we're going to be able to fly to the International Space Station.

Wright: Is there an area in your career that you have enjoyed more than the other? It seems to be so diverse and certainly has evolved over the last years. If you could spend your time in space, is that what you would be doing, or do you enjoy putting things together on the ground?

Dunbar: I love flying. I feel very comfortable in space and I like being part of a team. I like being part of the crew. I like being part of a crew with Mission Control, because I used to work in Mission Control. And I like being part of a team as the research team. That's very broad, whether it be bringing back a long-duration exposure facility, which we did on STS-32, using a robotic arm, to actually doing protein crystal growth or basic research, you're part of a much larger team, and it's not an individual success. When you finally achieve your objective, there's just a tremendous amount of satisfaction and reward in that.

So, my goals. Well, I've always been very flexible in life. I feel very fortunate to have had five flights, and I could stop here and life would be happy, but I'd love to have a long flight, and if I lived long enough, I would love to go to Mars. That was what I dreamed of as a kid; commanding a spaceship to Mars.

Wright: You could see all the planets, I imagine, where you grew up in the Northwest.

Dunbar: My parents homesteaded in 1948, and my mother lived in a tent partly while she was pregnant with me. My first house after I was born was two "sheep herder" cookhouses moved together. We had no indoor plumbing. They hauled water. We had a small oil stove until I was about three or four and an outhouse beyond that. Nothing around us. At night, no lights to the north, absolutely no lights to the north, and at night the Milky Way was a big white band across the sky. That's how I saw Sputnik. That was my first introduction to real space flight, was watching it go over.

Wright: It must have been thrilling for you to get to see the stars from the other side.

Dunbar: Well, they don't twinkle out there. [Laughter] No, it is, there are a lot more. What is it Carl Sagan said--billions and billions. It's a much different picture, no less spectacular than what we used to see.

Wright: And Earth, when you're looking down on it.

Dunbar: Earth. We have no sensors that really do justice to what you see from space, no artificial sensors, except the human eye--the depth, the colors, the motion. We see still pictures, but in space you're

moving 17,500 miles per hour, once every ninety minutes, orbits slightly precessing, so you're covering a different part of the planet. I'd always wanted at least one orbit at the window, ninety minutes. I never got it. There's just never enough time to really do that. But I've seen some pretty spectacular things that will stay with me my entire life.

Wright: And I'm sure it's never the same.

Dunbar: It's never the same. The Earth is a dynamic planet; it's always changing.

Wright: The successes of Shuttle-Mir, of Phase One.

Dunbar: The successes of Phase One. Number one, we elevated our interactions as a people. I think it's been said many times before, we've spent many years and billions of dollars as adversaries. In the course of this interaction, we have forced many diverse groups to work together, not just the flight crews. I think flight crews are probably the easiest to integrate across the board—because they share a common goal. They're like pilots. This is your work and you enjoy it. But we integrated researchers, we integrated flight controllers, we integrated managers, and it was a necessary thing to do before we actually started the International Space Station.

The International Space Station is probably the most challenging civil engineering project ever undertaken. If we had to compound that with all of the other language and cultural and technical issues that we've learned about in Phase One, I think we would have put it at risk, higher risk. It's already challenging enough. Now we can go into this assembly not having solved every problem, but solving a large number of them.

Wright: Looking back over the few years, is there a high point that's in your mind that you see as maybe the greatest contribution that's been made either from you or from the program as a whole?

Dunbar: I think I'd just really mention the real contribution of Phase One, it was that it intended to do this. It intended to forge these interactions and to mitigate the risk due to the management, safety, and engineering processes, and, at the same time, to contribute to the research base by extending what we've done on short flights to equipments that need the longer period of time. We've learned a lot from that.

It's not the same environment as we'll have on the International Space Station. The Mir was limited by the fact that you can't do telescience on it, where the investigator is really involved in telemetry and data and commanding. But we've learned about how to better design equipment. We've learned a little bit about scheduling, some of that. We're integrating what we've learned off of Mir and Sky Lab, and

putting those together and within our cultural framework, and extrapolating them on to the International Space Station. So those are all high points.

Wright: Any low that you wish would have been done different? Or were all lows basically learning experiences?

Dunbar: No real lows. I think if you look at lessons learned, even though we had established a collaborative medical research effort with the Russians over the years, and it had its high points and low points, it probably would have benefited our research and researchers had we forged some tighter agreements to begin with. We flew microgravity equipments which were not always located in a microgravity environment, but we knew that was going to be a problem from the Russian researchers who don't enjoy a close relationship with the companies, like Energia and so forth. They're not always a prime player. It's a difference in our definition of who the customer is.

So, knowing that the Russian investigators themselves were having some problems, probably it should have alerted us that we might as well, but I think we've taught the Russians something about the importance of research and controlling the variables, understanding the environment, being able to document it, and how we treat our customers and researchers. So while I feel for some of our researchers who didn't get their data, what they went through was a contributing lesson to how we can improve that cultural attitude for the International Space Station.

Wright: Hundreds of people were involved, but at the same time so much was done in such a little bit of time. Do you see more and more being able to be accomplished in the next few years for Phase Two?

Dunbar: With the Russians?

Wright: Yes.

Dunbar: I think that's going to depend entirely on the Russian economic system. I think that's probably what the Russians will tell you and have told me. They are right now in a position of really determining what their funding's going to be for their space program and for their companies. That will affect how we do business in the future. Their researchers right now are very tight on funds. We are helping to fund joint research such as medical research in Russia, but they're going to have to eventually do that themselves. Phase Two, they will have to develop the processes for peer review equipment selection, manifesting, and operations on the Space Station.

Wright: And during Phase One, you felt that the sharing of information between the two international partners, it flowed? Was it fair?

Dunbar: Well, it was very dependent on the circumstances and spotty. And I wouldn't have expected anything else. We're talking about a country that was under Communism for 70 years. It would have been very naive to think, well, we'll sign an agreement and you can change an entire mental outlook on people and life and politics overnight. It just wasn't going to happen. We were told that in our cultural training classes. I was told that by my friends in Star City. One of them would always say, "Now, Bonnie." [Russian phrase] Okay. This is how it really is. And this is why it is. We couldn't just take our motives and lay them over like a template on the Russians. We had to understand what was making them think this way, what historically motivated them.

So, no, we didn't always get the information we need. We didn't always ask the right question. That's one of the things that I learned: you have to ask the right question if you expect even close to the right answer. It doesn't mean they were hiding anything intentionally, but that's how it worked. So those are the kinds of things that we're learning, the cultural differences, how to read each other, what's really intended, and how to share a common outcome and understand what that means in terms of the program.

Wright: Are you planning a trip back soon to visit?

Dunbar: Well, whatever my management decides to do.

Wright: Whatever your future is planned for you.

Dunbar: I believe Salihzan is right now planning a trip for the entire crew to come to Uzbekistan, and I know he's working that with General [Yuri] Glazkov at Star City.

Wright: I hope it's an enjoyable one for you. At least you won't have to go and train, and you'll already have the language. I think about how much you've accomplished in just two years for this one project.

Dunbar: Well, it's actually four years. Four years. Yes, and again I think there are some unsung heroes here. There was a lot of behind-the-scenes work prior to 1993 or it wouldn't have happened. Some of the people that were involved were Mr. Abbey and Dr. Arnold Nicogossian and Dr. Huntoon and some of the other people in the medical area that are here, that, despite the Cold War, were still having dialogue with fairly influential people within the Russian establishment.

Wright: I know you must be very fulfilled. I would use the word "proud," but you seem very humble. So

I know that you've got to be very proud and very fulfilled by the things you've been able to do. I know your future is going to have a whole lot more planned for you. Thanks for sharing what you have. Is there anything else that you'd like to add from your viewpoint that you'd like as part of the whole project?

Dunbar: Well, the focus tends to be on the crew members, and in particular that have flown or had backup roles. But we've had crew members who have served in Russia, the deputy of operations. I don't know if you're going to interview them. But I think they're an important part of the program.

We had a tremendous number of the science people who were in Russia with us, and we talked to some of those. An astronaut now, but a former researcher, Dr. Peggy Whitson, spent a lot of long hours with us and made it work for Norm and I. Without her and her people, we would have had a much harder time with procedures and just equipment training and development. So there were a lot of people that made it work.

Flight Director Bob Castle and the work that he did in developing relationships with Victor Blagov, I think is very important. My boss, Dave Leestma, who is a very quiet guy, but just ensuring that we would have astronauts there, I mean, he was pretty persuasive with me. [Laughter] So there are a lot of good people that help make these programs work.

Wright: It doesn't sound like you have too many regrets.

Dunbar: Oh, I have no regrets except that I have not flown on the Station yet. [Laughter]

Wright: Yet. [Laughter]

Dunbar: And that I'm still in the process of sharing what I learned. I have all this wonderful information on systems and designs and so forth, and I'm trying my best to ensure we have good dialogue.

Davison: I have a couple of questions, one that I can't avoid asking since you worked with foot restraints and other things on earlier missions. Can you talk about how the Russians viewed restraints and how the Shuttle and then what we'll evolve to in Station?

Dunbar: We used a lot of foot restraints, primarily because we have a floor. The Russians also have a floor and base block where they have metal actually removable foot restraints and handholds. So in principle we have the same approach: handholds and foot loops. But in many of their modules there's no longer any wall space or handholds or foot loops; there are just things bungeed across. So they run bungees down the length right not in the center, but close to it so that you can pull yourself back and forth.

The bottom line is, to work in Zero-G, you need to have stability, and if you need two hands, then that stability is to be gained through your feet, so you have to have a place to anchor to. The laws of physics are the same for Russia as they are for the United States. The question is, how do you design them to facilitate what you're doing. Designs may differ based on what you're doing and where you're doing it. The important thing, though, is to involve the crew and particularly crews that have flown. You get a whole new mental picture of how you'll do something once you've flown.

Just as an example, this hasn't so much to do with a restraint, but just how something is oriented, which has to do with restraints. We were getting ready to fly on {STS-} 89 and I was down at the Cape because we were doing a close-out on some equipments, and they were having a problem with astroculture, which was going to be transferred over during the flight. They couldn't get it in the locker properly because of a foam problem in the door. So I looked at it and I wasn't trying to be brilliant here--it just dawned on me. I said, "Well, why don't you just turn it upside down. It will still fit in and the door will close." And he looked at me and said, "We can't do that. How will you read it?" I said, "I'll turn upside down." [Laughter] When I get up there, it really doesn't matter to me. You end up doing something and then finding out you're sideways, kitty-cornered, whatever. And since it was on the back face of Space Hab and it was going to be launched anyway on its back, it didn't really matter what other orientation.

So it went through the engineering analysis and they said, "Yeah, hey, if you'll launch with it that way, that's fine with us. Then we don't have to incur the cost of redesign." They said, "I'll sign off on that." They signed off on that and so we solved it just simply by turning it around. And that's just a Zero-G mind-set. We apply those principles to restraints, handholds, footholds, and whatever you need as well. Does that answer your question?

Davison: Yes. I have a follow-on. As you compare the Mir volume and hatch size to the Space Station, the International Space Station is quite a bit bigger. Do you think that's going to present a problem or give more room to work?

Dunbar: The International Space Station is more similar to Space Lab, and I've flown three Space Lab flights. Those are not overly big volumes. In fact, they're still significantly smaller than the Skylab work volumes. Those are very comfortable volumes to work in, and I think that that's not going to be a problem for the Russians either, because that was something Gennady commented on. When we brought him over to do the physical testing in Spacelab, we had one rack missing and we just put some foot loops in there, so he went in. He put on a headset, listened to music, said, "Tell me when you're ready to test me." He said, "I really like it in here. It's light, it's roomy. This is very comfortable. In fact, I will sleep until you're

ready for me." So he put on his headset and slept, and when we got ready to do a medical test, I would tap him on the shoulder.

I think that the room is an advantage, it's not a disadvantage. Of course, the hatches need to be as big as they are to move our racks back and forth, and that's what's going to make our station a real research laboratory, is the ability to move things back and forth.

Davison: What advice would you give the young boy and girl students that are in school today to help them prepare for the future?

Dunbar: Well, the bottom-line advice for preparing for the future is, our world runs on people doing a lot of different things, but the future is going to require that they be very well grounded in the sciences and in computers and math. It doesn't matter what you're doing, whether you're tuning a car with an electronic tuner at the shop or you're a secretary at a word processor typing a document, or you're going to the polls to actually vote on some type of method of environmental change. If you don't understand the underlying principles of all of those, you're not going to understand the world around you. Then, of course, you need all those things to be an astronaut.

So I would say now is the time, between grades one and twelve, to learn it, to take as much math as you can, through calculus. Take chemistry and physics. Take biology and botany and learn about the world around us. You'll be a better prepared adult.

Butler: You mentioned that on the last mission, the eighth docking mission, that you had an equipment that was preparing a little bit for future Mars flights.

Dunbar: For radiation detection, yes.

Butler: Can you talk about that a little bit and how that might be applied, if at all, to International Space Station?

Dunbar: We're talking about Phase One providing us with some information and data that builds the International Space Station. The International Space Station itself is not an end. The International Space Station will provide us a technology base to prepare for Mars. The question might be, why? How? Well, the Earth is 1G. We've said it's 1 because we live here. Then we compare everything to it. The moon is about a 6th. Mars is about a 3rd, and the International Space Station is going to be not quite zero, but real close to it.

We know that when we go to Mars, we have to have life-support systems that are very reliable and

they will work in Zero-G for a long period of time. We can't test them on the ground. That's why we were testing some Space Station equipment on SpaceHab--water loops, air loops. Will they work in zero gravity first? I suspect that we will be testing most of our Mars life-support systems for long periods of time on the Space Station before we ever venture out in a long mission like a Mars mission with crews. We'll have to. Everything from growing plants for closed loop systems, to recycling urine, to purifying water. All of these things we'll test very thoroughly before we send them out on a Mars mission. So it is a platform for space exploration.

The other part of that is the people component. We know that if we go on a long mission in space, the two primary effects on people are going to be the weightless effect on calcium loss or osteoporosis, and how do we counteract that, and the other is once we leave the Earth, the protective radiation belts of the Earth, how do we protect people to the high doses of radiation on the way to Mars.

So the equipment that we flew with respect to radiation was one in designing materials to protect people, but on Mir and on the Space Shuttle, we also evaluate people for their calcium metabolism and trying to understand the basics of how it works and then why we lose it, so we can protect people in the future.

Butler: Speculating a little bit, various tests will be done on Space Station. How long do you foresee it might be before a series Mars mission is mounted?

Dunbar: I can only speculate based on information I have and when the opportunities are. I think that I saw one chart that said based on where the planets are, that the first opportunity would be like 2011 at the earliest, which means we need to start within the next couple of years seriously planning it and then determining how we test equipment on the Space Station. It would almost have to be early testing if we plan to complete 2002, 2004 for all the final modules. So we need to be thinking about it now if we want to make that window.

Wright: And you get your chance to get there. [Laughter]

Dunbar: I will probably be too old to go. [Laughter]

Wright: We don't know now what's going to happen between now and then, you know.

Dunbar: I had volunteered to go as an elderly postmenopausal woman. [Laughter]

Wright: And you might be the only one on that list.

Dunbar: I've even offered to take a one-way ticket. [Laughter] Many of the early explorers didn't expect to come back, although I'm sure that Lewis and Clark expected to come back. They were gone quite a long time. People that went out into the middle of Africa, I'm not sure ever expected to return to England.

Wright: Speaking of trips, I guess I have to ask, have you had a chance to be back home in those fields of the Northwest?

Dunbar: Oh, yes. My parents still ranch, and I go back pretty frequently, as much as I can. We still have cattle and we brand about once a year.

Wright: Still look up at the stars?

Dunbar: Oh, absolutely, although it's getting harder. We now have in the Yakima Valley a lot of xenon lights at night, and it gets a little harder to see the stars. Civilization encroaching.

Wright: And what does your Marine father feel about you being up? Does he go out when you're up in the Shuttle and look for you?

Dunbar: They come to the launches. Oh, yes, they've always supported me and my brothers and sister in anything that we did. My parents have a very interesting attitude about life. They measure people by their character, and as long as we tried hard at what we were doing as good citizens, they didn't compare us. They're proud of what I do. They're proud of my sister, who's a teacher. And they're proud of my brothers. They love space, but there are other things that they measure us by.

Wright: At least when you're floating above, they know where you are.

Dunbar: Absolutely. [Laughter]

Wright: They can keep an eye out on you. We thank you for your time.

Dunbar: Thank you.

Wright: Appreciate it. Thanks.

[Tape recorder turned off, then on again.]

Dunbar: ... and I think, for me, made the difference about my opinions of my future interaction. You asked about the Russian opinion towards women. Obviously when I first came in there, I heard the little

jokes, the little remarks, what the Russian women were telling me, even if the Russian men weren't.

But there were some turning points in all of that. In October of '94, while I was undergoing a medical examination here, I had a reaction which was also compounded by some efinephron and I stayed here for some medical evaluations. There were some people in the Russian medical establishment that were going to use that as an excuse to remove me from the program, and there were some people in the American establishment who were going to use that as an excuse, very conservatively, to remove me from the program.

But I was restored to training by the Aerospace Medical Board. I wanted to go back to Russia. I was asked, "Do you want to go back?" I said, "Absolutely. I don't quit. I know that I feel good. This was a blip, and I'm going to be able to fly, despite--" I had the whole spectrum of medical opinions, you know, "You're going to die tomorrow." And I knew where I was.

Well, I went back, and I went back into training. I had 100 percent support from Anatoly and Nick, and there were a couple of the Russian medical doctors that said, "You can't even get in the simulator because of this, until the board's put you back on flight status." A simulator is not a stressful environment. I said, "You're going to cause more stress if you keep me out of the simulator than letting me in."

But the training schedule for that week came out saying I would sit at the instructor's station. I had to make these simulator sessions to stay on track, to graduate with my crew. So Anatoly said, "Well, look. We're going to go to the simulator and we'll talk there." So we walked up to the simulator and the instructor came out from the instructor station and said, "Well, Cosmonaut Bonnie Dunbar must sit with us," and Anatoly said, "No. We either train as a crew or we don't." And in that country, the commander carries some weight, and so I went into the simulator, and I went from that point on. He took a stand and said, "We're going to stay as a crew. This is not a rational thing to do." And we did.

Now, when we finally graduated, a couple of special things, very special to me. When I say "graduated," it was a party there in one of the classrooms in Star City, with good drink and food. [Laughter] The head of training there, Yuri Kargapolov, got up and I thought he was just going to give one of the usual toasts, and he looked at me and he gave me a toast. Now, he had been the gentleman that had been hardest on me for the prior 12 months, and basically it was a toast for perseverance. General Genibeckov came up to me afterwards and said, "You know, you American women are tough." [Laughter] And we come back and we get certificates, and I really appreciate that and so forth, but I think if you have to ask me what were the most significant events of my tour, it would be Kargapolov's toast and Genibeckov's follow-on statement that, "We would like to have you fly a long flight with us anytime." See, up until that point I had been given all the reasons why women shouldn't fly long flights. So I felt good. I felt that regardless of anything else, I had done what I had set out to do, which was to finish my job,

graduate with--

Wright: With toast. [Laughter]

Dunbar: With toast. And establish some relationships with the people there, and maybe they would think a little bit differently about women in their program.

Wright: I know you mentioned earlier you were asked to be the backup. Was there any chance or any talk at all that you would have a chance to fly after Norm?

Dunbar: Yes, there was. In fact, I was asked if I wanted to fly the second flight. I was asked by the Director's office. I really would have wanted to, but at that time, because of the rapidity of leaving and so forth, there were some family strains involved in that, so I said yes the first time. I said, "I need to defer the second flight because I need to be back in the United States." But then I told them that I'd really consider the third flight, the third increment. Well, about the time they got ready to make that decision was when I was still under a medical consideration. So, I was willing to do it, I was asked to do it, but circumstances precluded it. So I've come back and flown two Shuttle flights.

Wright: I guess you had your own near-Mir experience. [Laughter]

Dunbar: Near-Mir. [Laughter] I was very fortunate to have been on the first docking mission and the eighth docking mission, especially with Salihzan. I've had wonderful crews. Hoot Gibson was extraordinary as a commander. Terry Wilcutt was extraordinary as a commander. I really enjoyed working for both of them and the crews.

Wright: It must give you a good feeling when you see Kargapolov and all these folks when you're in those International Space Station meetings and you see them, knowing what they think of you.

Dunbar: It feels good. Their head medical doctor now kisses my hand. I used to have that happen in Germany. [Laughter]

Wright: Now we're moving on to the Russians.

Dunbar: Now moving on to the Russians. I don't even consider it sexist, because I know what it means.

Wright: Very respectful, isn't it.

Dunbar: I know what it means.

Wright: Especially to you. That was neat. I'm glad you shared that with us. Even in America, when the cosmonauts were here, were there experiences or times that you--

Dunbar: You did talk to Salihzan. I really enjoyed my time with him. He's a very unique individual. He was alone without his wife for a while, so I took him out to dinner a couple of times and we've had a chance to talk about his country. What I found so interesting that Salihzan and I shared, and I don't know if he told you, he grew up in a very rural area of Kyrgyzstan, and he was sitting out in the middle of the fields watching the airplanes go over and wanted to become a cosmonaut. My mind was really solidified the day I was doing some sort of manual labor and I looked up and saw this contrail. I knew it was following an airplane into the Yakima TACAN on its way to Seattle. I'd never been in an airplane. I was in high school. I said, "There's just something else for me," you know. "I want to be in that contrail." And we shared that together.

Wright: That was a nice connection.

Dunbar: It was a very good connection.

Wright: No matter what language it is.

Dunbar: What culture, what language, what gender. We had a common motivator that brought us to the same place at the same time.

Wright: Is there more that you want to do with the space? You've looked at all the experiments, your microgravity, it's the physics, all these different components. Is there something else that you want to do? Can you see an experiment or a function that would go on the International Space Station that you feel will benefit those folks, just based on all your experiences?

Dunbar: Well, nothing that hasn't probably already been addressed. I have the opportunity through a lot of different groups to make inputs. Some of them may not be so good. [Laughter] Some of them may be something someone hasn't thought about. Just having the opportunity to interact with them is good. I'll say, "Well, I saw this on this flight. Maybe this would help," or, "Did you know this group is doing this?" So maybe one of the benefits of the breadth of what I've done is being able to identify connections that can be made, that maybe haven't been made. I enjoy doing that.

Wright: Since we've talked off and on about women's issues while we've chatted with you, do you feel that that's something, now that the Russians have declared you a tough woman, that you'll be able to help at least other people see the issues that shouldn't affect women?

Dunbar: Well, it's very interesting. I mentioned when I went to the University of Washington in 1967 and some of the things that happened. I didn't talk about those things for 20 years. I've recounted some of those experiences to some of my male colleagues, many who don't believe it happened, and I find it kind of interesting. And for my own organization here, for my boss, we are a part of a team. There is no distinction. There are probably still men at this Center who believe not only did it not happen in 1967 here in this country, that it didn't happen at Star City. That's a little unfortunate, because all you have to do is ask even some of the cosmonauts or ask the women in Russia, and they will confirm that there's still a real cultural challenge integrating women into their society equally. That's been noticed, I think, by a lot of senior management.

Our challenge is to not change the way we do business for fear of offending the Russians. If we believe the way we're doing is right--and it is--the opportunity for individuals to achieve in this country regardless of race or gender, that all people are equal, then we must stand up for it. It's why my father fought in World War II. It's why my brother died in Vietnam. There was no gender-related clause in the constitution any more. If we believe in that, we must stand up for it, which means the men in this Center need to stand up for the women if they're challenged by the Russians.

Wright: Sounds good. I think we're going to end on that one. Thank you so much.

[End of interview]