

The oral histories placed on this CD 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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[Go to Oral History](#)

SAM POOL

August 3, 1998

Interviewers: Rebecca Wright, Kevin Rusnak, Franklin Tarazona

Wright: Today is August 3, 1998. We're visiting with Dr. Sam *Pool* as part of the Shuttle-Mir Oral History Project. Thank you again, sir, for making time out of your busy schedule to visit with us.

Pool: Sure. You're welcome.

Wright: We'd like to begin by you explaining your roles and responsibilities that you've had with the Shuttle-Mir Program.

Pool: Perhaps I should start by mentioning the fact that we had a long working association with the Russians going back to the early 1970s, so most of the people who we interfaced with during the Shuttle-Mir Project we knew. The United States Government and at that time the Soviet Government had an agreement enabling cooperate in the area of Space Medicine and Biomedical Research. During the [Ronald] Reagan era, as you know, many cooperative efforts were curtailed or stopped; but, the cooperation in this area continued, so it was not very difficult for us to begin to work on a new project with our Russian counterparts.

Our primary effort is to provide medical support for the astronauts, and the people we dealt with in Russia have the same mission, provide medical support. The two systems are quite different, and one of the things we discovered as we began to work with them on Shuttle-Mir Project was that some of the people who worked in the program were new to us. Principally those in the military who had been restricted in what they could do during the earlier cooperation were now in evidence and working with us, primarily people at Star City. While several of us had been to Star City, we hadn't really worked with the people there very much, so we were introduced to a new group of people in this process.

Just to describe to you briefly some of the differences in our roles and responsibilities on each side, the American system, the system we developed, follows the military model in that we provide health care services to the astronauts as well as to their families, and we provide health care pre-flight, in-flight, and post-flight. We also organize emergency medical services that may be required. We provide medical certifications for selection as an astronaut and each space mission to which they are assigned. We've worked with the Russians over the years to develop a somewhat similar set of medical standards; however the standards are not exactly the same.

The Russians, on the other hand, have really developed separate and almost autonomous systems. There are people who are involved in training the cosmonauts and preparing them for a mission, and a

different group of people are responsible during the mission. At the time of recovery of the spacecraft, representatives of both groups are frequently there to assist.

We found, in working with them, that they didn't have, as best we could tell, a single physician, a flight surgeon, who had worked the entire process end to end from pre-flight training, to in-flight operations, to post-flight rehabilitation. They didn't have anyone who had that sort of experience, because their efforts were more focused and limited. So that is a fairly big difference in the two systems.

Another difference in our approach involves the basis on which we practice medicine. To the extent possible, we follow an "evidence-based" mode in the practice of medicine. We tend to do certain tests because we know that the yield from those tests, medically speaking, is fairly high, whereas our Russian counterparts do many tests we no longer think are necessary or, for that matter, valid. And their access to and use of various medical technologies is still very much different. We wouldn't think of doing all of the X-rays they do because of the radiation exposure, for example. We don't do centrifuge runs routinely on our crew members prior to missions, but they do. They have some justification for that, because in the centrifuge arena, at least, a reentry ride on the Soyuz is going to expose you to some fairly strong G forces, whereas in the Shuttle, we really don't experience that much anymore. They do certain types of altitude runs and stress tests which we no longer do. They use rotating chairs to expose people to a provocative environment and see if they can train them not to be sick on orbit, but we know from our studies that we certainly were unable to use similar techniques with good results in terms of being able to protect people from being motion sick on orbit. It didn't work. They continue to do it. We have a difference of opinion. Their medical standards reflect what we would say is a more aggressive approach to training and to medical studies, whereas we tend to focus on those kinds of tests and exams that give us a fairly high yield in terms of understanding the individual.

One of the things we realized fairly quickly was that we were going to exchange people, and that we were going to have astronauts living in Star City, and they were going to have cosmonauts living in Houston. We decided we were going to send a flight surgeon with the astronauts to Star City, so we trained some of the flight surgeons to speak Russian. We had several flight surgeons who volunteered and we have had NASA flight surgeons in Star City from the very onset of the program.

We wanted the Russians to send flight surgeons to work with us as well, and after some negotiations on the subject, we started that part of the exchange, and they sent one physician at a time, usually for six months to a year. So we put their physicians into our process and let them assist with taking care of the cosmonauts, and trained them in our system. Similar training took place in Russia for our physicians. We took care of our astronauts in Russia and we got involved in Russian training.

We also put a physician in the control center in Kolograd, representing our interests and our

crewmembers. We also worked to provide an updated medical kit for the Mir. As a result of *perestroika* and Russia losing a number of its satellite countries, they then began to have to purchase, from places like Czechoslovakia, medications which they needed, and sometimes these were simply unavailable to them for whatever reasons, and we wanted to make sure that we had a modern medical kit on board. So we worked closely with the Russians to define what that kit would be, and developed the Mir medical kit supplement, which was a substantial United States' contribution to medical capability on board the Mir.

We developed an agreement which stipulated that a crewmember being named to a mission would be reviewed by the host country's medical certification board, with the attendance of a physician from the other country's medical board. So when [Sergei K.] Krikalev and [Vladimir G.] Titov were selected initially by the Russian side, Dr. Arnold Nicogosian at NASA headquarters and I attended the Russian Principle Medical Commission--that's what they called their medical certification board, and as a result of this we understood pretty well the medical history of the cosmonauts involved. Similarly, when we sent our people to Russia, we invited the Russians to participate in our medical board meeting, and they did, to review the medical histories of the people we were sending over, Norm [Norman] Thagard and Bonnie Dunbar.

So if I were to synthesize the roles and responsibilities that I've just reviewed for you, you first find us providing health care. We also got involved in training, particularly in medical training. We had a longstanding cooperative agreement with the Russians, which made it easier for us to transition, because we knew many of our Russian counterparts. We found new participants on the Russian side as a part of this opening the door of cooperation with them. One of our responsibilities was to provide an updated Mir medical kit and another was to try to resolve differences of opinion between the two medical groups over medical tests to be done and training.

Wright: Those first days that the flight surgeons were involved, were you the one who spoke with them to give them the information? How did that all evolve of getting the flight surgeons involved to volunteer to go and be a part of this program? I'm sure they had lots of questions. I'm wondering if you were the one that was having to put together all the information for them.

Pool: There were some discussions amongst the flight surgeons about this and we found that we had some flight surgeons who were eager to do this job so they "self-selected," and we approved. Dave Ward and Mike Barratt were the first. Mike had some knowledge of Russian, and Dave Ward went with Norm Thagard to Monterey [California] to study Russian. Later a Russian language course was offered at JSC. Then they rotated to support the first increment.

Wright: What from your experiences working with the Russians in the previous years were you able to share with them to help them know how to handle those experiences once they got over into Russia? Did you have any good advice for them, or had things changed so much?

Pool: Things had changed a lot, although perhaps not for the better during that period of time, when we were dealing with our Russian colleagues during the Soviet era, we were dealing with the academicians, and they were “very well placed” and could get things done. After the changes that were made politically in Russia, we found that our group of friends and colleagues, while they were still academicians and revered for their knowledge, were not necessarily capable of getting the same sorts of things done, and this created a little bit of a problem. It did help very much to have Star City and the military cooperate, and they could get things done. But working with us in this way was a new experience for them too so we sort of had to learn some of these things together.

How do you get an American flight surgeon to Baikonur for pre-launch surveys and then eventually to go with the crew to the launch site? Norm was launched from Baikonur, so all of that took a little work on everybody's part. There was a fair amount of negotiation, spirited negotiation, over the medical testing that would be done supplementally by the Russians. What we had tried to achieve with the Russians was to accept their medical certification of cosmonauts and to get the Russians to accept our medical certification of astronauts. If they said, "Fly these people," we would fly them and vice versa. That way we wouldn't be doing tests over and over again on the astronauts or cosmonauts, or doing different testing in each country.

But that was only partially successfully. The Russians had a number of tests that they considered training, we considered those same tests medical tests, and we had a lot of long discussions about this. Eventually we finally reached agreement. Frank Culbertson was one of the key people who helped us negotiate the agreement.

Wright: Was that agreement signed here in the United States?

Pool: No, it was signed in Moscow.

Wright: Could you share with us more details?

Pool: We had had months of discussion about the limitations that we wanted placed on the testing that the Russians would do, and finally we reached an agreement which we shared with agency managers for the project.

Wright: Was that at the end of the long stay in Russia for you?

Pool: It was a component of a fairly major meeting on the Shuttle-Mir Program.

Wright: Did this program take you to Russia several times a year or on occasion?

Pool: I would usually go to Russia two to three times a year. I remember going to Russia for a meeting of their medical board, and I stayed in Russia slightly less than twenty-four hours, and then came home. It was a quick trip. That's a long way to go for a meeting.

Wright: More time in the air than you did on ground. Is that a correct statement?

Pool: Yes. About twice as long in the air as on the ground.

Wright: When your surgeons were there, they were there day to day with the astronauts?

Pool: Yes. Our flight surgeons lived in the Russian post flight rehabilitation facility called the Prophylactory.

Wright: Were you instrumental in setting up their initial stay? Was that part of your negotiations?

Pool: Sure. We had to get agreement with the Russians. That was very easy. The Russians were very quick to accommodate them. We agreed that part of their Prophylactory, at the Gagarin Cosmonaut training Center, which is similar to a small hotel, could be used by NASA. We still use an area on the second floor of the building. The physicians who are sent to assist our crewmembers stay there.

Wright: Once the American residents are on the Mir, your flight surgeons are in contact with them on a daily basis. Is that correct? Or can be?

Pool: Yes. The communications with the Mir, as you may know, is very limited. It's one of the really difficult areas for people supporting the program, because the opportunity to speak with the crew on board was very limited. It's a matter of satellites and ground stations and access. So we asked the Russians to permit us to speak to our crewmen privately, each day, and to a certain extent we achieved that. But there were days in which we didn't get to talk.

Wright: Was that something that was new for them, to have that request?

Pool: They didn't talk--still don't, as far as I know--that often, but they do have infrequent private medical

sessions with their crew.

Wright: Is there an area when you were negotiating that took more time than others to reach the area of satisfaction that you wanted?

Pool: The most difficult negotiations we had over the course of the program was the medical certification issue. What constituted a medically certified crew member? We had experience working with internationals. The Russians had had experience working with internationals as well, so maybe our experiences were somewhat comparable in that. When we first started dealing with ESA and other international partners, I think we had some pretty carefully thought-out limitations on what we would accept from them in terms of data and tests and so on. So we frequently reran all the tests they had done. As we developed a relationship with them, then we became more open and more trusting in our work with them, and now we accept them pretty much as equals in this arena, in this medical arena.

The Russians had maintained their sort of limited, less trusting relationship up until the start of Mir. So one of the difficulties we had was to develop the ability to trust each other. But that sort of thing takes time, and it took time in this case.

Wright: Was there a turning point or a specific situation when you realized that that trust and that relationship had now begun?

Pool: Well, there's certainly points along the way that seemed to push us in that direction, but we've not resolved all the issues with them yet. Perhaps even as we fly the international space station, we will still be resolving issues. I would expect that, as a matter of fact.

We've developed more formal ways of working with them. We've established the Multilateral Space Medicine Board, we have had our first meeting, signed the charter. We agreed that partner countries, for example, like Japan, had the need to do certain medical tests which we would not normally do on our people. As an example, they are very concerned about certain gastrointestinal tumors which are not unique to Japan, but are much more prevalent in their society than in ours. So it would seem reasonable that they would do tests like that, whereas we would not require it of our people because the yield would be so low. So our approach is getting more sophisticated.

Doing a psychiatric exam on someone who comes from another culture is very difficult. We rely heavily upon experts in Europe or Russia or Japan to assist with that. The Canadians and we are so much alike, I think, that we could probably trade off. It is important to recognize that behavioral issues in particular are very sensitive to culture. We'll have to learn to deal with that as time goes on in constituting

crews. What constitutes a crew that's going to be able to work together well? There are some things which we do which will help, for example, train for a period of time before the mission with the crew as a unit so that they can begin to function as a team.

Wright: When we were first training the cosmonauts here, did your area have to make many adjustments in order to train them, or did you train them just like you were doing your astronaut corps?

Pool: Language has been an issue, and, I suspect, will continue to be. There were some concerns at times about how well understood the training was, and even getting good feedback as to whether or not the training was appropriately received was difficult. So I think language is an issue and will continue to be.

Wright: Did you prepare written materials in both languages for them? How did we go about giving them what they needed?

Pool: We attempted to, but not in all cases were we successful in doing that. It just takes too much time. The job was just too massive, and I think it would really be difficult for us to do that so that our Japanese, Italian, Dutch, French, you name it. Fortunately, for many people, particularly in Western Europe, they speak English really well, and it's not much of a problem. As a matter of fact, many of the Japanese do as well, and certainly the Canadians.

Wright: Might be interesting to have the translators be skilled in medical knowledge.

Pool: Some are. We were very careful on occasion to employ people who were skilled both in the language as well as the discipline, physicians, for example, and other allied health personnel who were also gifted in translating were used and are used today. We did that early on. We've done that for years. We've had a group of people both on our side and on the Russian side who could translate for people having discussions of medical issues. That's absolutely essential.

Wright: When the flight surgeons that have been part of Shuttle-Mir first became employed with you, I'm sure that at the time they had no idea they would be going to Russia to work with this program, and I know that, as you mentioned, many of them volunteered to do that. Is that something now that the ones that are coming into your area are expecting to do, that this is a norm now that they will be working with international partners?

Pool: Sure.

Wright: Is that changing maybe in your criteria where they'll have people that are skilled in languages, or at least skilled in desire that they want to do this?

Pool: Perhaps that will eventually take place, but now I think it's necessary to give them language skills sufficient to do their job. It's been amazing to watch how well they do. They've done really well, sometimes on fairly short notice. Even the scientists with whom we work, some of whom are self-educated in the other language, maybe two or three trips to Russia, and the next thing you know, they're off arranging MRIs and going around in the community and getting things done, with the language skills they have, without a translator. I've watched that change.

Wright: You've watched your personnel evolve into the situation.

Pool: Some of us are still limited to a few phrases.

Wright: Well, maybe because you haven't been out there for such a--they were there for several months at a time, is that correct?

Pool: Not all of them. Some of them were just there for a few weeks at a time. But they made a big effort to learn the language, which is great.

Wright: I can ask you the same question, because when you first started your job with NASA, did you expect to be working with the Russians in your field?

Pool: No, although then fairly soon after I joined the agency, we flew Apollo-Soyuz and we worked with the Russians at that time.

Wright: How were you involved with that project?

Pool: Not very much.

Wright: Then as the astronaut corps or its crew, your responsibilities, that was just one part of it. I know Shuttle-Mir was just a part of it. Can you give us an idea of what else that you do, or what other programs that you worked with other than Shuttle-Mir?

Pool: When I came to work for NASA, I worked on the Apollo Project and was in mission control for all of the Apollo missions. After that I worked on a major project to develop technology, and we weren't flying much after. I worked on a project to develop a telemedicine system for application on the Papago Indian

Reservation, and from that NASA learned a lot about the future application, those sorts of techniques, as well as providing, I think, a real service to the Indian Health Services Center for R&D, as well as the Papago Tribe. We gave them a much better health care access system.

Then I got involved in medical operations and developing medical systems which we used to support the Shuttle.

I got involved, in 1977, developing the first set of medical standards for space flight. The early medical selections for astronauts were done without a set of standards. The individuals were ranked as to their health, from the healthiest to the least healthy, and there were no standards. There were things that physicians used from the experience. Most of them had military experience. Military did have standards for aviation, but there were no real standards for space flight. So, in 1977, actually starting back in 1976, we reviewed the standards of the DOD [Department of Defense] and the FAA [Federal Aviation Administration], and began to craft a set of standards we thought would be appropriate for astronauts.

At the same time, we moved from the pilot astronaut era to the era of pilot. mission specialist, and payload specialist. So we had to decide what were the standards for those categories, medically speaking. Underlying this effort was the premise that we would select people who would have, from a health point of view, a good chance, a very good chance, of having a career uninterrupted by medical problems, and we clearly wanted to eliminate those from the astronaut corps who would have the potential of having a very serious medical problem which might either affect a mission, themselves, or their colleagues in an emergency situation.

In 1977, we published the world's first set of standards to medically screen astronauts, and we've updated that about every five years since then. We asked our Russian colleagues did they have a set of standards. They said, no, they didn't, but about a year later they published a set of standards which looked a lot like the ones that we had, and that's normal, because our standards look a lot like the military standards, too, because that was an excellent experience base for us to draw from.

I've also been involved in a fair amount of research that's gone on over the years. I was involved in the development of the NASA JSC biotechnology capability, which is leading-edge science, and one of the most important things we're going to do on Space Station.

Wright: Were you able to contribute any of your science ideas or methods to what was happening on the Shuttle-Mir?

Pool: We put together the science package for the Mir Program, at least initially, and then the extramural

community contributed to it. But that really started as an in-house effort. We had a number of programs under way from which we drew to create the scientific tasks which were to be done on Mir. It was a wonderful opportunity for us, because now we were given the option of looking at people who were flying in space for long periods of time, then getting to see how they adapted and how they readapted when they came home. We'd only done that with Skylab, and this was a real help to us.

One of the things that we learned during our closer cooperation with the Russians during Shuttle-Mir was that while they had a fair amount of data, we felt that their scientific diligence was not the same as ours, and a lot of what they believed to be true was based on anecdotal experience. There are a lot of limitations to doing human research in space flight, but some of the things that we had heard from our Russian colleagues and had previously accepted as factual based on the science that they had done, we learned later in our Shuttle-Mir experience were based on things that we would not have given so much credence to, and, therefore, there were still open questions.

Flying in space, particularly in microgravity for long periods of time, is not very friendly to the human body. There are a lot of body functions which degrade. There's a fair amount of deconditioning that goes on, and the countermeasures, including exercise, which we have used over the years really haven't solved the problem. So we're still working that puzzle very hard to try to figure out how to do better. Cardiovascular system becomes less responsive, particularly on return to gravitational field. Bone mineral is lost. Neurophysiology is definitely affected. The Russians say--and I think they're quite correct--that returning cosmonauts from long missions can't play simple games that children play, because their coordination and so on is not up to it. That's certainly been proven true now that we've begun to fly with them and look at our people similarly.

Wright: Do you believe it's going to be a benefit to moving into the International Space Station?

Pool: Sure.

Wright: Are there other benefits that you have found the Shuttle-Mir will provide for ISS?

Pool: I don't think we could have asked for a better testbed to learn what we needed to know. We looked at the good things and we've also looked at some things that were lessons for us, and we had better learn those lessons. The business of having appropriate redundancy in various life support systems has been made very clear to us. We must have the ability to deal successfully with contingencies like fires, and leaking of the atmosphere to the external environment. Carbon monoxide being released into the cabin as the result of a small fire. All of these sorts of things have been very important for us to learn. We've

learned a lot about the efficacy of exercise and how perhaps not to do it. And on and on; the list is long. I'm afraid the list is longer than our learning curve. Let's see if I can say it in a better way. There's a long list of lessons, and we have not learned them all.

Wright: And for you? Do you feel like these last four or five years that Shuttle-Mir has been fast and furious, the lessons that you've learned regarding your profession, and how to make decisions, or whatever you've learned? Could you share some of those things personally, the growth that you've had a chance, maybe even watching Russia change? I'm sure it's quite a bit of difference from the first time that you went to when the last time that you've gone.

Pool: Yes. I think I have a much better appreciation of how medicine is handled in Russian society. Perhaps it's handled a bit differently in the cosmonaut arena than it is in the general arena of the population at large. I think we have a much better understanding on both sides. I can't speak for them, but I can say at least for our side, we have a much better understanding of why they do certain things they way they do. I think that's helpful if we're going to cooperate with them on the International Space Station, as we are. We needed to learn how to do that. It's good to be a long way toward that goal. We're not fully there, and as I said earlier, it'll take perhaps a long, long time to ever truly complete this, but I think we're far enough along we can handle it, which is very helpful indeed. Now we've got to bring in the Japanese, people from ESA, and the Canadians, and make it all work together.

Wright: And the book continues; just the chapter title changes.

Pool: Surely over the years other countries will want to participate, and we'll have to develop ways of bringing them in and letting them participate.

Wright: Was there an increment or one of the missions, even the Shuttle missions that went back and forth to Mir, that has a special memory for you, that something you wanted to see accomplished during this time period was accomplished, or just anything significant that you'd like to share with us that brings back some good memories?

Pool: Well, I think we were all very pleased to see Norm Thagard come home and get involved in the rehabilitation. I think he came home with a good experience. Shannon [Lucid], as well. Then we started to have difficulties, not with people so much, but with the Mir systems--coolant leaks, a fire, a number of things like that which, really, we had to work very hard. We first had to understand what went on with our Russian colleagues, because in some cases we were both in the fact-finding mode. Some cases they knew,

and some cases they had to share that with us, and some cases we both didn't know. We just had to go find out. There were some difficult times in dealing with this, and I think that's good because of what we learned.

I'll give you just one example of something we've--I hesitate to say "learned." That may be not the right way to put it. When they had the fire on the Mir, one of the problems they encountered was that in a smoky cabin, with an oxygen mask on--which is, by the way, what you ought to be doing--you couldn't communicate with each other. They couldn't use hand signals very well because the smoke in the cabin, and they couldn't hear each other. I don't know whether you've ever tried to talk with somebody with a mask on, but the voice is muffled, and you can shout as loud as you like, that may only increase the difficulty of understanding. Plus you're speaking in a different a language in a very stressful situation. So how do you fix that? Well, one of the things we ought to consider doing very quickly would be to develop a mask which would permit people to communicate with other people who have the mask on. That would be helpful in a smoky cabin, helpful if you're on each side of the cabin and can't shout loud enough to be heard. So there are a lot of little things like that, that we need to work on and ultimately fix for Space Station.

Wright: I think so many times when people think about medical issues, they think of physical ailments or physical problems.

Pool: Well, we're more like an occupational health unit in that we look at the environment and how the human adapts to that environment.

Wright: I know your area was responsible for so much of bringing back and testing and making suggestions.

Pool: Yes. We did bring back a lot of samples from the Mir and the Shuttle, and still do, and test them for water quality, air quality, whatever.

Wright: I'm glad you were there, and I'm sure that those astronauts that were in residence as well as there on the Shuttle that are glad that we have such a good crew of people down here supporting them.

Pool: Thank you.

Wright: We thank you for your time. We appreciate you doing it.

[End of interview]

