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

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

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

To continue to the Oral History, choose the link below.

Go to Oral History

ROGER D. BILLICA

June 17, 1998

Interviewers: Rebecca Wright, Carol Butler, Mark Davison

Wright: This is an interview with Roger Billica with the Shuttle-Mir Oral History Project. Thank you for making the time with us this morning out of your busy schedule.

Billica: My pleasure.

Wright: Thank you for gathering so many wonderful things that we're looking forward to hearing about, all that you have out here on the table. We'd like to start with you explaining to us your roles and responsibilities with the Shuttle-Mir Project.

Billica: Okay. I'm the Chief of the Medical Operations Branch here at NASA Johnson Space Center, and Medical Operations Branch is the organization that essentially is responsible for all aspects of health care for every space flight. I quickly wrote down, so I could remember to tell you, what the different things are. It's actually quite a variety.

When we say "health care," we mean very comprehensively anything having to do with the human element of flight, anything that would affect health and safety, illness, injury, preparation for flight. So things that we cover in general for all programs, whether it's Shuttle, Space Station, and we did for the Shuttle-Mir Program, Phase One, are establishing what the medical standards are for the mission and performing the medical selection and certification of crews. Anything having to do with health care--pre-flight, before the mission, during the mission, and post flight. So, all aspects of that.

The design, the development, the manifesting, the management of all of the health care equipment, the health care systems, so that includes countermeasures such as exercise activities, environmental health, as well as what someone would traditionally think of medical care activities.

Anything having to do with crew training in the area of health. So, the medical training of the crew, the training on our medical equipment, the training of the crew of what they would expect to encounter and how to deal with this experience. And the support of the rest of the training. So when the crews were to do any sort of potentially hazardous training, the water training, the winter survival training, or anything, for example, in the water tanks or in the centrifuge or in the chambers that would require medical support or medical supervision, that came under our responsibilities.

Mission support in general. Preparing for the mission, planning the mission, anything having to do with the human aspect such as schedules, work-rest regime, the sleep shifting, how much could be done during a duty day. We're basically the advocate for health and trying to keep a rational approach to anything having to do with what are we expecting these people to do. And planning the mission and then

providing a medical support team to the mission while it's occurring, in the Mission Control Center. And we did do that over in Russia.

So, all the functions I'm describing are typical for any mission, but we did for the entire Shuttle-Mir mission as well. Preventive health. Anything having to do with getting ready for the mission, physical fitness program to get in shape, an infectious disease isolation prior to the mission, a health stabilization program, anything just to help get them ready nutritionally, immunizations, things like that.

And then, of course, the countermeasure program, which a lot of people think of when they think of medical support to space flight during the mission. Things that are done to prevent the negative changes that occur to the human body from space exposure, from the lack of gravity, from radiation, from things like that, that present a risk to the human, make it potentially unsafe or risky to fly, we do preventive things to keep the person healthy, keep the performance at the level necessary for mission success.

Behavioral health, big area, particularly for long missions. The behavioral, psychological, and emotional aspects of a mission being out of country for, in some cases, a couple of years, being separated from family and home, and then being launched and left in this vehicle in space with only so many places to go for months at a time, that's a pretty big challenge for that individual. So the support to that, how to prepare them and then how to support them behaviorally, psychologically, and also, if necessary, being able to intervene if that became a little bit shaky during any of those areas.

Physical medicine, rehabilitation medicine. We have the responsibility not only to prepare them and to maintain them during the mission, but then when they get back, to help them recover and rehabilitate physically, emotionally, physiologically, and return back to their normal baseline. They do not come back the same as when they left, and our job is to get them back to normal in that regard.

Environmental health, establishing the environmental standards for space flight. What is safe? What is acceptable in terms of the atmosphere, the water quality, the microbiological environment, radiation, and noise, those sorts of things? We set the standards for those areas. The engineers and the design people, of course, then design to those standards. That's not our area. But then our job is then to be the health monitor, to go back and look. How did we do? How are we doing? As we talk about the missions, you'll see that that became a pretty big issue for Shuttle-Mir with some of the events, the power outages, heat and humidity, the atmosphere, the fire event that occurred. We were very involved. Then because of what we had up there, helping answer the questions, "Can we stay? Is it safe?" That became a pretty big issue.

Epidemiology, tracking the trends of what happened, looking at the data, doing monitoring. What can we learn from this? What was the effect of the exposure? Have we created any increased risk to them

long term after the mission from what happened to them in space? Is there anything we can learn from this mission about health issues, all of the things we've just talked about, that we then need to apply to future missions? So the epidemiology and the medical data and the trends and what to learn. We have a project team that does that.

Then finally, using any experience in space flight to look at new technologies, medical breakthroughs, things that we can learn in terms of advanced capabilities that we can then apply not only in the space program, but then spin off back to society, that could be used. Some of the things that are on this table are some advanced technologies like that or represent some areas that we're working on that we were able to use Shuttle-Mir as a platform to continue to move forward on some new medical technologies that people are excited about.

So, I think that's a summary that describes the category and variety of things that fall under medical operations in space medicine. It was quite an experience for us to do that.

Wright: Tell us about your staff and what kind of folks that you have that help you get all of this done.

Billica: We've got just a great staff. It involves health care professionals. The team is led by physicians who are flight surgeons. These are physicians who come from a variety of backgrounds--internists and family practitioners and emergency room doctors, etc.--who at some point along their way decided they wanted to pursue aerospace medicine as a career, and either went to the military or some other training program and then came here to NASA to be NASA flight surgeons.

They come with those credentials and then they go through additional training to be certified as NASA flight surgeons, learning all of this about space medicine and becoming very knowledgeable in these things, and also being trained up and certified as flight controllers. So they're not only these physicians, but they're also flight controllers in the Mission Control Center, fully trained and certified for that. And they're also on flight status so that they can fly along with the crews, in terms of T-38s and getting to know and be part of the crew team. That's the nature and scope of who and what a flight surgeon is.

We selected and sent some outstanding flight surgeons to Russia. We assigned at least one to every one of the increments, and that flight surgeon went over to Russia with the crew and lived over in Russia, stayed in the Prophylactory there in Star City, and was there during all the training. Then while the crew member was in space, our flight surgeon then stayed in Moscow and staffed with the support team in the TsUP, the Mission Control Center, and came back in time for landing and then was the supervisor of the rehabilitation program. So our flight surgeons made almost as much of a time commitment and a time

away from home and I don't know what other words to use, but did the whole mission just as the crew member did. It was a significant commitment on their part.

Supporting and working with the flight surgeons are hundreds of people. We have other health care professionals, nurses. We have a staff of biomedical engineers--BMEs, we call them--who do much of this list. Every one of these things I just told you, there's a project team or a core team of people who that's their job and they do these things.

We also have a staff of PhD scientists in the environmental health area, who handle all the environmental health aspects--toxicologists, microbiologists, water specialists, nutritionists, pharmacologists, all of these sorts of people.

There's a staff of laboratories, people who work in the laboratories, who are supporting the analysis of the exercise changes, the bone loss, the neurological changes, the nutritional concerns. A clinical laboratory with technicians who do that.

We have a behavioral medicine team with a psychiatrist and psychologist, several psychologists and some support people who do that, who handle that part of the team. We have a clinic with nurses and staff who do that, and the technicians who support them. A wide variety of just administrative support and secretaries.

It all adds up, and I'm sure I'm leaving people out, but it's a big team. It's a team that does support all the programs, but there were those who were totally dedicated to the Shuttle-Mir Program, and there were biomedical engineers who, along with the flight surgeons, went over to Russia for the entire time of the missions and stayed over there for several months and worked with the flight surgeons. Then a lot of these other people would then go over for trips, taking the equipment over to Russia, get things set up, support training. So, several hundred people, actually, on this team.

Wright: As Frank Culbertson has said, no mission is routine, but I'm sure you have a pattern of how you would put together your Shuttle flights. Would you tell us about the challenges that you had to undergo to get your team prepared for the Shuttle-Mir Projects?

Billica: I don't even know where to begin. This was a huge challenge. The last time we had done anything like this as an agency, of course, was Skylab long-duration flight, and then only went up to 86 days, 87 days, I think. I'm not sure that's the exact number, but in the eighties. And three brief missions, essentially, compared to what we did on Mir. And not too many people around from then. There are still some people around who supported that mission, but we really had to go back and dig out the records and try and remember and learn what was that experience. The Apollo-Soyuz, the only other joint mission with

the Russians, and that was back during a whole different time frame of U.S.-Russian relationships. So, really not a whole lot of similarities there in terms of how that was done.

We had to learn again how to do long-duration space flight over a couple of weeks, and it's an entirely different experience, entirely different set of challenges, just a whole different critter than a Shuttle flight. So, a steep learning curve for us there. Of course, the Russians had been doing this for years, but, again, that was part of the challenge.

The other big thing was to learn the Russians, understand them, learn how they do business, and they do things very differently, not only just in terms of how they do space flight, but how they practice medicine. They have a whole different culture and a whole different approach to health care than we do. Some of that was just fine in that it was just a matter of finding the common language, and some of that was not fine. Some of that was things that they do that were not what we do in terms of health care or philosophy approaching health care. We had to learn how to deal with that with them in a way that we did not compromise the ethics or the standards of United States health care, in putting together a joint program.

So, the two big categories, in summary, although there's lots of stories behind this, is long-duration space flight and how to do that, and how to work and get along with the Russians. I think we succeeded at both of those.

Of course, the big benefit of all of this is we are in such a better position now for International Space Station. If we had not done Phase One and just went from Shuttle to an International Space Station, without this experience, I'm not sure how well we would have done. I think we would have really fumbled around quite a bit trying to learn these same lessons, where here we had a much more structured learning experience where we were put into a situation where we basically had to fit into an existing program, learn from them, bring back from what the Russians do the best, and the experience and the knowledge that we could gain from that, at the same time learn what we wanted to do differently, and do it in a way that was less risky than just going out there and trying to learn it without that framework. So, a very worthwhile experience, but not necessarily always comfortable.

Wright: What are the differences from, say, preparing for Andy Thomas' flight compared to what you had to do for Norm [Norman] Thagard?

Billica: Oh, wow.

Wright: Can you walk us through some of the preparations or even share some of the stories with us about how you prepared for Norm's first flight?

Billica: Sure. When we prepared for Norm's flight, it was just a total blank sheet. We got a lot of different teams together that we had been using to get ready for International Space Station, various consultant groups looking at all of these things that I listed for you, and started putting together what we thought would be the appropriate things to do in terms of prevention and countermeasures in medical care. Yet at the same time going into that, our initial understanding was essentially we were the guests of the Russian program and we would do things the way the Russians had set it up. We were essentially going over there to support Norm, but that we would basically be guests and fitting into the Russian way of doing business. So we went over there just ready to support and help, but not really knowing what to expect what we were going to do, and we did not know how the Russians did things, and we really didn't know about the health care system or their processes or procedures, had no idea what to expect.

We sent two flight surgeons over there with Norm, and basically just showed up and said, "Here we are. What do we do?" Quite a scramble. Steep learning curve, as I said. We didn't know what medical support was present in Star City, so there was just a lot of communication back and forth. "We'd better get this over here. We need some medical kits."

Probably the biggest learning experience is the Russians had their own way of doing medical selection and standards, and so I made several trips over there to meet with my Russian counterparts. They made some trips over here. There was a weariness. There was an unknown. "Who are these guys and what are they going to do to our crew member?" I'm sure they were equally concerned about us. I mean, it was certainly a two-way thing.

The Russians view medical selection and medical training as one and the same. In NASA, we have standards and we select astronauts, and when they're selected, they're good to be assigned to any mission. And we do monitor them and we do some final checkouts before we okay them for mission, but essentially once they've been selected, the threat's gone and they can proceed with their training, and we support the training, but they know they've been assigned to the mission and their training.

On the Russian side, they pick cosmonauts, but all during their training they have more than one crew training for any given mission, and all during the training the things they're going through are part of the medical selection. They're being monitored and tested and put through various things where they're tested all throughout the training. It's not until right before the mission where they have another complete set of medical evaluation and tests--it's fairly extensive--that they're finally chosen who's going to do the missions. So it's high threat by the medical establishment throughout the training period. So the relationship of the crew to the medical doctors is very different.

The tests the Russians do, some of them are very different. There are things that we had a difficult time understanding, "Why do you do this? What do you benefit from this? What decisions are you making from these tests?" Some of the technologies that they had, and still have, are, for us, old technologies and things we would no longer do or no longer expose our crew members to. Lots of X-rays and lots of things like that, that we just don't do anymore.

They have a Chief Medical Commission that it took us a long time to understand. What is this Chief Medical Commission? It's made up--essentially if we put together the equivalent of it, it would be our Surgeon General, Surgeon General of the military, the head of the National Institutes of Health, the president of Yale and Harvard Medical Schools, the head of Centers for Disease Control. I mean, all of their top medical authorities in their country that form this Russian Chief Medical Commission as part of their Department of Health of their country, basically a Cabinet-level organization. This is the group that would come together and meet and, at the selection of the crews and right before a mission, would have a week-long set of medical tests done, then present it to them. It was very strange and very different from us.

So the first time we went through all of this experience I just described with Norm Thagard, we were sort of standing on the sidelines going, "This is very different," and at the same time trying to protect Norm from any undue risks or exposures, because we'd heard a lot of horror stories about--and I'm not trying to paint a bad picture. I mean, the Russian medical people are very well trained, very professional, very smart and brilliant people, but the resources they had to work with in a lot of cases were not up to American standards. You heard a lot of horror stories about reusing medical supplies and reusing needles and things like this. So we were on edge and looking for where we needed to protect our people.

We had heard stories about some of the other countries who had sent crew members, who were basically put under the authority of the medical doctors in Russia, and ended up having procedures done to them that we would never allow or never do, but if these people wanted to fly, they had to now subject themselves to this medical system in Russia that was very different, and a different philosophy and approach to health care and medicine. Different doctor-patient relationship. Not a same attitude toward confidentiality and privacy of data. Not a same attitude about informed consent, that you gave the patient the information and they had to agree to things. So, very different atmosphere just in terms of health care that we went into.

We got into some confrontations with the Russians on these things, saying, "No, you will not do this to our person." They had been used to other countries coming in and basically saying, "Well, here's our crew member. We want to fly, so we've got to let you do whatever you want to do." Well, we had a different philosophy. So there were a lot of tug-of-wars that went on. There were a lot of phone calls, a lot

of meetings. There were aspects of the Norm Thagard mission where we threatened to pack up and go home. We, essentially, as the doctors were throwing our body down in front of the crew member, saying, "Over my dead body you will do this to our crew member," after having talked to our management and to our crew member, saying, "Here's what they want to do. We don't think we ought to do it. We think this is more and beyond. This is a risk that we shouldn't do."

So there were some very uncomfortable times during the first one or two missions where we reached a point of conflict that came close to ending the whole program, and had a lot of meetings with NASA management and elevated issues all the way up to the Dan Goldin level, where we had to stand firm if we were not going to allow a praesen of things that just were totally unacceptable.

As I get into this now, the emotion of that comes back to me. There were some pretty tense times. Of course, we were expected to go solve this. "Don't let this happen." And, "Why is this happening?" And, "Go fix it." But I think there was an appreciation on the crew member's part that, "Thank goodness the doctors are not letting this happen, and standing up." So a lot of trips back and forth, a lot of negotiations, a lot of writing agreements and protocols.

So the difference was, having gone through a couple of times, we established a routine that by the time we got to Andy's mission, we knew what to expect, the Russians knew what they could do and what we were willing to do, and we pretty well had it figured out. We knew now how to do the Chief Medical Commission. The Russians knew what tests we were going to allow and what not. So it smoothed out and it became routine.

By the last few missions, this conflict that I'm describing was gone and we had a working relationship and a comfort level and an understanding we knew how to do things. We understood what things were for the formalities that we needed to go through so that it would feel okay to the Russians, and they knew what things that they could not demand of us so that we wouldn't get in a conflict.

That's just in how we did the health care things. Also, by the time we got to the Andy mission, we were contributing a lot of medical equipment and supplies to the missions, where initially we just sent some extra medicines and things up.

Wright: Tell us about how that evolved. I know when we've had a chance to visit Mike Barratt, he shared with us the book that was put together with Russian-English, how to do everything from headache to some of those procedures that still mystify me, but it was a "how to do everything" book. But that was just one sample. Can you give us other things that evolved through this process that the United States contributed to the Mir?

Billica: By the end of the process, we were sending up environmental monitoring equipment, some of the equipment where we were getting ready for International Space Station. Some of that was sent up in a hurry, with some of the environmental problems that happened. I'm sure you've got all that down in history. But with the fire event and the smoke, there were some other problems where the environmental controls went out, the carbon dioxide system, the humidity controls, these sorts of things. As we had crew members up there being exposed to these things and there were questions being asked on the United States' side, "Well, is this safe? Is this healthy?" and the Russians had limited technology. They have some, but not enough really to satisfy a lot of the commissions that were coming together, asking some very tough questions about, "Is it the right thing to do to stay up there? Is it the right thing to do to send another crew member up there, just in terms of health and safety?"

And so at some instances, with very quick turnaround, we were sending up things on the Shuttle. There were even some missions where we weren't completely sure at the time that the Shuttle docked that we would leave our new crew member up there, and we were doing some real-time testing going onboard the Mir and looking at things and testing the atmosphere and getting calls down to confirm that, indeed, the atmosphere was okay, the toxic levels were okay, and we could kind of say, "All right. It's okay. It's good to let the crew member go on there."

So, some things were real-time quick decisions. "Let's send some stuff up there." So as time went on, we accumulated some hardware and equipment, and as medical events occurred on the Mir, where we realized there were some medical problems, we started expanding the level of some of the medical kits. They have Russian medical kits, they have Russian equipment, but, again, in some cases different medicines, different approaches. They don't have the same pharmacy that we do in some cases, so we would send up additional pharmacies. It got to the point on some of the missions where there might be a medical problem or a medical event that would occur, mostly minor, but still, where we would talk with the Russians. They'd say, "Well, what do you have and what do we have?" And that's where the joint medical book came together.

Wright: That's great.

Billica: It ended up at any given medical event we might use some Russian stuff, we might use some NASA stuff to deal with that event. But it evolved. It's hard to go back and point, other than to maybe some of the environmental events that occurred, where there was a definite step-up, it's more that in most cases where the Russians became familiar and we learned their system, where gradually we added some things on.

There were some things where we met with some of our Russian counterparts right at the beginning of the activity, and we agreed that jointly here was the level of medical capability that should be in place for a long-duration space flight. That list of "Here's what should be in place to support a long-duration flight"--advanced life-support medical equipment, things like that--was essentially a wish list on the Russian side. They didn't have some of this stuff either. For example, a defibrillator monitor. If there's a cardiac event or a heart arrhythmia or something, that's what you'd want to have. We both sat down and signed an agreement between the Russian medical and the U.S. that this is what should be there. They didn't have it. We didn't have it. But by doing that, we had an agreement and we said to the Russians, "All right. We'll go develop one. We're getting one ready for Space Station. Then we'll provide it to you and then you can make it part of your medical equipment up there." So part way through, we had one ready. We flew it up on the Shuttle and it became part of the Russian medical equipment that was available up there. So, some things like that. And we have that on the table here.

So, different pathways. Different ways we were able to gradually expand things to, first and foremost, make sure we had a level of comfort for our crew member, but, secondly, to jointly evolve and expand our joint medical capabilities and experience to a level that both of our teams had always said, "This is what we should have," but the opportunity wasn't there. You're always competing with, of course, other resources, and we have to be able to use a risk management analysis that convinces not only the medical group, but the rest of the NASA program management that there is a sufficient need to justify putting some additional medical equipment or medical capability up there.

Wright: It's not like you can make a house call.

Billica: No.

Wright: They're pretty self-sufficient, aren't they.

Billica: Right. And it's not like you can just walk in the door with a truckload of medical equipment and say, "We're the doctors. Send this up there." You've still got to have a rationale and a justification that makes sense. So that's where the epidemiology and all of that comes in. What are we learning? What are we seeing?

And there were some significant medical things that happened on Mir that I think opened a lot of people's eyes outside of the medical community where they finally were saying, "Wow. There could really be some bad things that happen. We need to make sure that there's a medical program available to support this."