ORAL HISTORY TRANSCRIPT

MARK GEYER
INTERVIEWED BY RICH DINKEL
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DINKEL: This is Rich Dinkel on Monday, the 26th of January, 1998, at 2:33 in the morning at 34,000 feet, somewhere between Gander, Newfoundland, and Washington, DC, with Mark Geyer on our way back to the United States from seeing the rollout of the FGB, the first element of the Russian segment to be launched for the International Space Station.

Mark, I appreciate you doing this interview. Can you tell us how you initially got involved in the Space Station Program and in the Russian element, specifically?

GEYER: I took a job with the ACRV Program Office back in, I guess, it was '92.

DINKEL: ACRV?

GEYER: Assured Crew Return Vehicle. At the time they were looking at both putting an ACRV on the Space Station Freedom. They were looking at a couple different options. One was a U.S.-made, another was a European-made, and another was a Soyuz capsule. So what I did was first I worked with the Europeans and then eventually I went over to start working with the Russians. That program ended in December of '93 as the [Space Station] Freedom Program ended, basically. With the Russian experience, I interviewed with Keith who was starting to build his office on the Russian segment, Keith Riley [phonetic]. So he invited me to come on over and try it out. So I started out as basically just one of the integration team in the Russian segment.

DINKEL: What's your job today?

GEYER: Well, right now I have what used to be Keith's job. I'm the head all the Russian elements, and basically in charge of making sure that the Russian segment is integrated with the U.S. segment.

DINKEL: That's great. Can you describe at a necessarily high level for the sixth grader in Peoria what the purpose and the functional requirements are for the control module and for the FGB?

GEYER: Well, I guess some people are struggling with the name, but I've always called it FGB. It's kind of a strange translation of Functional Cargo Block, and the letters in Russian are FGB, so we call it FGB. It's kind of stuck. It doesn't make a lot of sense, but that's where it's name comes from and that's what everybody calls it.

FGB's real function, I think—there's two main functions. The first function is really it's our foothold in orbit. It's where we start. It's what we build off of. It has to maintain orbit and hold attitude close enough so that the shuttle can dock to it, allow us to put the node on there and then it goes and docks with the service module. After that, the service module basically becomes the guidance navigation and control system for the station. Again, its first function is really just give us a foothold in space to build off of.

After the service module comes up, its main function is really as a gas tank. It has the main tanks, holds upward of six tons of prop that can be refueled and reused. Really those are its two main functions. It has some pressurized volume that we use. We can store several items. We have volume in the FGB that we can store important stuff in.

DINKEL: The recent control module name, I take it is from the recent NASA desire to make all our modules and space things that the American public can relate to.

GEYER: I guess. It's a good question, because I have heard almost nothing about this name change, so I'm not sure what the status of that is.

DINKEL: Well, you only run the Russian elements. Why should anybody tell you? [Laughter]

Could you take a minute or so and give us—actually it will longer than a minute or so, to give us a functional description of the FGB, or the control module? I can't bring myself to say it yet. With whatever technical insight and some lessons learned. You might want to talk about some the eleventh-hour mods while you're at it as you go through it also.

GEYER: Well, as I said, its main function is to give us a start, give us a foothold in space. It's launched on a proton launch vehicle from Baikonur in Russia, or actually in Kazakhstan. Gets to 51.6 degrees inclination. It has a guidance navigation system that allows it to hold attitude. Its propulsion system is nitrogen tetroxide and udium-H [phonetic]. It has on both ends docking systems that, of course, that allow for us to attach other elements to it. On the forward part it has an APAS [phonetic], which is androgenous docking system. APAS, again, is an acronym that the Russians use. We put the same kind of reverse mechanism then on the PMA and that allows us then to dock the PMA to the FGB at the forward end.

DINKEL: PMA being?

GEYER: Pressurized Mating Adapter. And that's really where the U.S. segment starts, is right there at that interface. At that same node, let's say that same area where that APAS mechanism is— [Radio interruption]

At the nader part of that forward compartment, there's another docking mechanism that is used for Progress and Soyuz docking to the FGB. Eventually there will be what we call a docking stowage module, which is basically an extension, so that when the station begins to build up, there'll be so many obstructions that we need to be able to extend that docking mechanism out further.

DINKEL: Let me interrupt just one second here and say that we're looking at a diagram now that will be appended to the transcript of this interview so the readers can see what we're talking about right now.

GEYER: On the aft end of the FGB then there is another docking mechanism they call a hyber docking mechanism, which is a mix between this probe and cone, which is used for the smaller vehicles like Soyuz and Progress, and a larger mechanism like the APAS. So it's kind of a combination of that. That's where the service module will dock to the FGB. Again, that's part of its main function, which is to allow other modules to be attached to it. The tanks are external to the vehicle. Again, as I said before, that becomes its main function after the service module docks. That's basically it, I guess.

DINKEL: Does it have an ecosystem?

GEYER: No, it really doesn't have an ecosystem. It has a scrubber on it to clean the atmosphere. When the service module comes up, that scrubber will be turned on. But it doesn't have an ecosystem by itself. You couldn't live on the station with just an FGB. You need the service module there to actually clean the air and produce the oxygen.

DINKEL: The FGB is currently being provided by Krunichev [phonetic], a Russian manufacturer. I'd like you to talk about that just a little bit. They're under contract to the International Space Station prime contractor, Boeing, to deliver this. Can you tell us a little bit about that? Then I'm going to come back and ask some contractual questions.

GEYER: Well, Krunichev, of course, has been a major aerospace manufacturer for years. In fact, they built bombers in World War II. The rocket factory they now have is actually built on what used to be the runway for their airplane manufacturing system. So they've been a major part of the Russian Space Program. They've built vehicles much like the FGB before. In fact, if you look at the *Mir* modules, other than the base block, they look a lot like the FGB. The aft part does.

Energia, which, of course, is the integrator for the whole space station, provides a lot of the parts of the FGB, including pumps, valves. All the software integration is done by Energia. So they play a big part in that in that vehicle, as well.

DINKEL: That's NPO Energia, another Russian aerospace contractor. Mark, had the contract between Boeing and Krunichev been let when you arrived?

GEYER: No, I first came on right at the beginning of '94, and so it had not been. We were still struggling with who was going to pay for the FGB and how that was all going to be worked.

DINKEL: [unclear].

GEYER: Yes, that's exactly where I was going.

DINKEL: What then was the origin and idea for the Russians to build for us and us to pay the bill?

GEYER: Well, to get the full story, I think Doug's the right guy to talk to, but I'll give you what I know. In the end, my understanding is the Russians came back, after our initial discussions, and believed that the FGB was really not required, that we could have started building off the service module, which is kind of what had happened on *Mir*. I think Doug can explain more why we decided to do that, although in the end I think it was a good decision. RSA [Russian Space Agency] then basically said, "Well, if you really want to do this thing, then you can pay for it."

In the end, we agreed that the United States paid for development, design, development, and manufacturing of the FGB. Well, RSA then pays for operations, sustaining, and for launch.

DINKEL: By Doug that you refer to, you mean Doug Drewry [phonetic], of course. Let me change gears here just a little bit. Now, I'm not specifically talking about the FGB after right now, because we sent money through our prime direct to the manufacturer, a direct line. We basically had no monetary or programmatic problems, which we'll come back in a minute. But could you discuss and sketch the general funding problems which are related to the Russian flight hardware products these days?

GEYER: You mean, basically the service module and other—okay.

DINKEL: Trace the [unclear].

GEYER: All right. Well, when we first started integrating this, we were working pretty hard on specifications and ICDs and overall bilateral agreements that you need at the very beginning of a program. Energia did the majority of that work, and Krunichev. So even though they weren't getting much money at the beginning, it was difficult to tell, it was difficult for us to see the impacts, because we really didn't expect to see much hardware in those early phases.

About, I'd say early in '95, we began to get hints from Energia that they were not going to get the money that they expected for service module and that it was going to start to be a problem. It turned out that, that was in '95, and it was almost a year and a half later before we actually got any resolution to that. It just continued to get worse. I think the problem was that they were still funding the *Mir* heavily and the government had so many people that were looking for money, [unclear] and so forth, that they just didn't have the money to give to the station. It took a lot of political clout. Basically, we were about to run into a brick wall, where it was pretty clear the service module, one, was not going to make its original launch date of 4/98, but may never actually be launched at all unless this funding issue was solved.

As you know, I guess in April of '97, they got a substantial amount of money from their government. They got more in May. Things started moving very quickly. They did not get all that they expected, that they thought they needed by the end of this year, end of '97. We got back from GDR [General Design Review] last—I guess it was Monday, almost a week ago, where a lot of the subcontractors were continuing to complain that they had built the hardware and not been paid. I think really we're going to see this all the way through the program. They're going to get allocations of money early in the year. They're never going to get quite what they think they need to get. Some of it they can maybe do without. Some of it's going to hurt. I think this is going to be an ongoing struggle.

DINKEL: Yes, I agree, Mark. Mark was referring to the General Design Review that we attended on the 19th of January at Energia. When all the subcontractors who were not delivering on time were asked to stand in front of us and their Energia counterparts and explain why, it was a very distressful situation to me and did not give me confidence that the subcontractors were going to provide. I'd like to hear your personal opinion on that.

GEYER: Well, you know, part of what we saw was truly there is a funding shortfall. Part of it, I think, was a little bit of grandstanding for us, as well, to get the United States to help scream a little bit about this money, because normally they don't show us things that they don't really want us to see. But the good news is that a lot of these guys have already built the hardware and they're just waiting to be paid to ship it. Also, there don't appear to be a lot of technical problems. So it's just a matter of if the money flows that they'll be able to provide the boxes on time. So that's the good news.

As I said before, the bad news is, I think this funding, this squeezing of the funding is going to be something we're going to see all the time, and I think even when we get over the service module hurdle, we're going to have the problem with the Progresses and Soyuzes because they take money, obviously. They're building a lot per year. We already heard at the General Design Review on the 19th that some of the components for the early Soyuzes and Progresses were also having some funding problems.

DINKEL: Let's focus back now on the control module, the FGB again, regarding the contract with Krunichev. Compared to the other Russian elements and the way they were supposed to have been funded, the FGB has worked quite well. We haven't had to worry hardly at all, and it was delivered on time, on cost. What is your personal comment on this and perhaps you can shed some light on why it worked so well.

GEYER: Well, I think the strength of the Russian segment of the industry is their continuity of experience. These are the same guys that have been building stuff for thirty years, not just the designers, but the guys on the floor, which is something that we don't really have. Some of the designers that we have here are the designers we had for shuttle. Not many. Almost none of the guys on the floor are the same guys who built shuttle or who built Skylab or built Apollo. So we're making mistakes like drilling holes in the wrong place, you know, on the node and so forth. The Russians don't really have that problem.

Some of the hardware for ISS has been upgraded because of the *Mir* experience. Some of it has to be changed because ISS has different requirements than the *Mir* did. But a lot of it is very, very similar, so they know what they're doing. They've done it before. They work very hard. It seems to me, the only real issue with the Russian segment is the funding problem. So if they get money like they did on FGB, they know how to perform.

DINKEL: Show me the money.

GEYER: Right.

DINKEL: I'm going to ask you this question, but I don't want you to use up all my tape when you answer it. But give me a good answer and your personal opinion and tell us what you can about the development and the evolution of our personal relationships, as well as our professional relationships, with the Russians, both at Russian Space Agency, Krunichev, etc., since you've been with the program.

GEYER: Well, I think the biggest change has been that the Russians are always very suspicious about our asking questions, our need to know and understand details of the Russian segment. They basically are of the opinion, when we started in '94, that they know

how to run a space station, they've flown them before, they don't need us intruding on their work. It took a long time, and, in fact, we still struggle with this on occasion. It takes a lot of effort to justify NASA's need to know and understand details of the Russian segment in order to make sure that it's an integrated station. That's really our function, is to make sure that from end to end, it works together.

I think they've come around. We've actually gotten a significant amount of information on the Russian segment, I think enough to do our job. I think that's the biggest change. It was very, very hard at the beginning, getting that information, getting through that brick wall of "Why do you need to know?" I think we've gone beyond that.

RSA's role at the beginning was we didn't have a lot of dealings with them, at the beginning, as I said before. Really, it's really picked up in the last couple of years since the funding issue has been a problem. They've been a bigger participant. Energia has brought them in and made them sign the protocols. Especially when we talk about assembly sequence, make them part of the agreement, because funding is such a big part of the agreement now. So they've started and stepped up and played a bigger role.

Krunichev, I think, actually, their overall role in Russian aerospace, I think, has made a quantum leap. Before, I think, as [unclear] after the GDR they used to be considered the younger brother. But now with this FGB success, I think they're being seen as on par with Energia. So they've really moved up in the world. I think we've learned how to work with them, as well. It has caused some stress between those two companies, but that's another thing that's changed.

DINKEL: That's a good answer. On that same subject, considering all the things we've discussed thus far, what were your personal feelings, or what are your personal feelings right now after having just witnessed the FGB rollout on the 17th of January [1998]?

GEYER: Well, I'm very excited, because we're done playing with paper and things are actually going to launch pad. All the work that we've done, we're making real decisions, we're taking risks. We're actually going to learn a lot by having to fly real hardware. We're close. Even with the service module problems, you know, it's not a "They're never going to come." It's just a matter of which month. The node's down at Kennedy and it's just getting to be a very exciting time.

DINKEL: Yes, I agree, I feel the same way. When you think that the FGB and its rocket are going to be put on a rail car here very shortly and shipped to Baikonur for preparation to shoot, it's just around the corner. Let's hope it keeps going good.

I also noticed something when we visited the plant at Krunichev. I came to the realization that NASA builds space hardware in plane rooms, and Russia builds space hardware in factories. I'll let you comment on that and see if you make the same comment I would have.

GEYER: Well, I think that clearly based on their success you can do it either way. I was startled once when we were at the Krunichev factory near the complex stand and I actually saw birds flying around in the factory. That's something you would never see at Kennedy. Yet, again, they have a high success rate. Their equipment is just made such that they don't have to worry about those details.

DINKEL: I need to ask you just more personal-opinion question, if you don't mind. What effects will a further slide in a service module completion schedule potentially have on a launch date of the FGB?

GEYER: Well, as you know, the FGB goes up first, then the node comes up, and then service module comes up. Right now there's about a six-month gap between FGB and service module and that gives us some time to ring out the operations and so forth before the crew comes up. The crew comes up very nearly after the service module comes up.

The problem is, again, that the service module is the key guidance and navigation system for station. The FGB is really just again giving us a foothold. It's up there temporarily. The FGB avionics only lasts, are only certified for four hundred days. So you're taking a risk. The longer you expose that system by itself, without having the service module up there to take over, you're risking the overall station. So you don't want that stuff to be up there any longer than it needs to be before the service module comes up.

So we need to look hard at when we think the service module will actually launch. That's what we're going to be doing in April and early May, to try to make a decision as to whether we think it's close enough that we're going to go ahead and launch the FGB.

DINKEL: I'm beginning to feel like Yosarian [phonetic] here a little bit, too. It's another Catch-22, because if our Russian friends and partners are late on their element, the service module, the element that we paid for is going to have to be stored or handled in some way at our expense in Russia somewhere. So to lower our own risk, we're going to have pay the fiddler yet again. An interesting concept. I don't know how we managed to get ourselves into these.

GEYER: Of course, you've got all the shuttle launches that are slipping, too, which is a cost for us.

DINKEL: Absolutely. Mark, this has been a great discussion. But before I give you the opportunity to get the last word or words, to discuss whatever questions I should have asked,

but didn't, or just wrap up whatever you want to say, I need to ask you who else ought to be interviewed regarding the FGB, the control module, or any of the Russian-related topics that you think we need to go to talk to next.

GEYER: Well, I certainly would talk to Doug Drury, who is the FGB program launch package manager. He's been there since the very beginning. In fact, went with the first team to Moscow in August of '93. Certainly, with Keith Riley, who had my job at the very beginning and is now mission integration manager, so he's got a lot of background, too. I think those are two key people that you ought to talk to.

DINKEL: Thanks. That's all the questions I had written down. Do you have anything special you want to say, or say "hi" to your mom or anything?

GEYER: Maybe there's one thing. What's really been an honor for me to work on this segment is the fact that on the NASA side, a lot of our, let's say, graybeards have either retired or some have passed away, including the astronauts. The astronauts who were there back in Apollo, I think John Young's the only one who's still around.

On the Russian side, it's very different. The guys that I worked with that are my counterparts in negotiations and so forth have been part of the Russian Space Program since the early to mid-fifties. I've worked with guys who are on console during [Yuri] Gagarin's flight. I've worked with guys who have gotten the Order of Lenin for designing the Soyuz, and the guy who designed the guidance navigation for the Laika [first dog in space] flight. It kind of takes you back every once in a while about the history that these guys have and their dedication to space. It's more of the more fascinating things about this job.

GEYER: That's great, Mark. That was a great interview. I appreciate your time, your effort, and your candid responses. Thank you.

[End of Interview]