ORAL HISTORY 2 TRANSCRIPT

EDWARD L. PAVELKA, JR.
INTERVIEWED BY CAROL BUTLER
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BUTLER: Today is May 9th, 2001. This oral history with Ed Pavelka is being conducted for the Johnson Space Center Oral History Project at the offices of the Signal Corporation in Houston, Texas. Carol Butler is the interviewer and is assisted by Kevin Rusnak and Tim Farrell.

To begin with, maybe you would share with us a little bit about this Captain REFSMMAT that you brought in today.

PAVELKA: Okay. Well, basically what Captain REFSMMAT was, an idea that in the beginning Kranz wanted a way to help the morale of his, quote, "troops," you know. He's very much a military guy. He knew about *esprit de corps* and he knew about morale and these things. So he and I had several meetings, and we talked about different ideas, and we came up with the idea of Captain REFSMMAT would be sort of the ideal flight controller. So I made several sketches just on desk pads, as you can see here. It's really nothing but a sketch in pencil. In some of the later ones, I actually outlined them with markers so they showed up better, but this was the first one. It was a place where people in the organization could come and maybe just jot down a thought that they had, either something sort of clever or humorous, or maybe if they were a little unhappy about something, they could let off a little steam.

So it began that way, and people mainly from the trench started it out. Then, as time went on, we were, I think, in Building 30 at this time, and people would just happen by, and anybody could add something that wanted to. This one was the number one issue in the Captain REFSMMAT series, and we actually had, I believe, six, and then one Victor Vector

that was his arch rival. In a nutshell, it let the people choose a way to maybe vent their emotions a little bit without taking it out on their buddy at work. Everybody kind of got a kick out of it.

For example, down in Alvin there was a saloon down there that [John S.] Llewellyn [Jr.] liked to go to. I forget the name of it, but they had a buffalo down there named Buster. So one of the entries on here is "Viva Buster." There are all kinds of little things that mark the time that we were in. That's pretty much it. Captain REFSMMAT served his purpose for probably a period of maybe four or five years with the different editions that we had. Then it just sort of faded away. There weren't any big, strong requests to make another one, so we just let it kind of die a natural death. That was the way it ended.

BUTLER: Well, he still lives on in history, anyway.

PAVELKA: Well, this is the one that's in Gene's [Eugene F. Kranz] book, *Failure is Not an Option*, and then the others are kept by Ron [Ronald C.] Epps over in MOD [Missions Operations Directorate]. I assume when he retires he's going to hand those over to someone else. We kept all of our old console logs, too, and we have a curator of all the old console logs because periodically one of these people that's wanting to write a book, they'll say, "Come talk to me about Apollo 12," or Gemini 76 [Gemini VII/Gemini VI] or something. The thing is, you can do is go get that log book and look in there and refresh your memory of what happened in great detail. So it was our console log.

BUTLER: So those are kept on site still? Does somebody else now keep them?

PAVELKA: Right. Well, Ron Epps has both the Captain REFSMMAT and the logs, either that or someone in his organization. He has the Flight Design Division now, and there may be one of the people at a different level that are actually keeping those.

BUTLER: Well, that's certainly a valuable item to hang onto, as you said.

PAVELKA: It is nice to be able to go back and remember.

BUTLER: Yes. Well, thank you for bringing that in and sharing it with us.

PAVELKA: Okay. You're welcome.

BUTLER: Last time we had talked about most of the early Apollo missions, and we had kind of built up to Apollo 13. Obviously, that was a very involved time for everyone once the mission got underway and things started to happen. If you could tell us some about your involvement on that. You were on Gene Kranz's team during the mission. So if you could tell us about what was happening when it first started. What were you thinking? How serious was it recognized to be at first? Kind of work us through the mission, if you would.

PAVELKA: Well, you know, it started out being just like any other mission. Of course, we had had now a fairly large number of both near earth orbit and lunar missions, so we were beginning to feel very comfortable that we knew a lot about the environment, a lot about our processors, a lot about our procedures and how we could work. So we were fairly relaxed in this situation.

In this particular flight we were introducing several new flight controllers, and we actually had dual assignments on some of the shifts. I was with another controller, Bill

[William J.] Boone [III], who was a junior controller. So I was on the console with him as his trainer, if you will, or on-the-job training type. Other positions had this, too. So for many of the shifts, Bill would be there, and I would come in with him for the difficult parts or what was more complicated. Actually, during the part of the accident where they discovered it, I was just coming on when the information began to come in.

Of course, in the trajectory area, everyone more or less specialized in their own area. So we were interested in, what does this mean to us? Is it real? Of course, the systems people always had something going on. It could be a small problem or a large problem or not a problem at all, but they always had something to talk about because these vehicles were so complex. So they began to speak about the different clues and the comments that were made from the crew, and we began to look at our data to see if we could see anything, because many times, if there's a propulsion event, whether it's planned or unplanned, you won't see that immediately. It takes a little time to propagate into the trajectory. So with our radars and all, we began to look to see if we could see any evidence that would show more information about what was going on.

Bill was actually running the main part of the console, and I was doing some of the troubleshooting with other positions to see if we could correlate information. Then Bill pretty much went through that shift where we stayed on the console. They didn't feel like they needed a trajectory person to go on this special team with Gene for full time, so between Bill and I, we spent a little time with that team to see if they had some questions that we could go away and either do a study with information in the computer.

So from my personal standpoint, I was not in the actual heat of the battle, whereas people in the systems areas were really at the center of trying to figure out if they could make sense of their telemetry data, correlate that, was this a real problem. If so, what was the extent of it? What systems were lost? That was really what was going on in the control center. Our tone was very much of "How can we help?" We weren't about to fall out of the

sky. We knew that part of it, but what we didn't know was what we might be asked to do in the event of an emergency where we might need to do an immediate return. The options that we had were to try to turn the vehicle around before it got to the Moon or loop around the Moon, circumnavigate the Moon, and we looked at both of those options down in the trench.

It turns out that maneuvers to what we would call a direct abort have huge amounts of propellant, and you have to have a lot of accuracy. There isn't a lot of room for error. It's like probably—I'm going to guess ten times the size of a normal maneuver that we would do, maybe more. So with that, the errors that you can have, if your attitudes are off, and we begin to factor in also the fact that we might not know how well the spacecraft could hold attitudes or perform a maneuver or navigate or do a platform alignment, all the things that they need to do to find out where they were after.

So the final discussions—and these went on for quite some time—ended up to say, "Let us do something that is as gentle to the trajectory as we can." It would be like you driving down the freeway fifty miles an hour and you had the choice of going on up to Park Place and going around or slamming on your brakes, sliding around, and darting off in the other direction all at once. It's very much a dramatic thing to turn the vehicle around and start thrusting back toward the Earth. So a direct abort was not only expensive, but was not felt to be even a good consideration because we didn't quite know all the tools that we had on the spacecraft, the systems and that.

That's sort of my take on the mission. As it played out and we learned more and more about where we were and what was going on, we began to have a more orderly approach to, now, what we surely should do, rather than, in the beginning, you have a wide array of different choices that you can make. You could "what if" yourself almost to death. After those first few shifts, you just felt so wasted because all your energy was just, "What if we could do this," and, "Let's look at four different options on this." So we really spent a lot of time doing studies of what's the best way in this situation to get this trajectory back.

Another big factor that we have to take as an input is, how much time do we have to deal with? Can we spend another forty hours or can we spend another two days? Are we running out of oxygen? Even if it's risky, do we need to do whatever we can do to get back in thirty-six hours if that were possible? So those were the kind of questions. Thirty-six hours is not a real number. I'm just pointing out that for comparison of days versus hours, you have to make a lot of choices, and they don't all depend on the trajectory. They depend on the systems that you have and the condition of the spacecraft.

BUTLER: How much impact did the venting of the oxygen, did some of the processes throughout the mission have on the ultimate trajectory?

PAVELKA: It was equivalent to a fairly substantial maneuver. The venting, of course, was, as it turned out, in a number of directions because the attitude in the beginning was not a nice stable attitude, but they were sort of drifting around trying to figure out what was going on. So there were components of the velocity propulsion that would be in all different directions, but there were enough of those in a direction that affected the long-term trajectory that we were able to pick it up on radar. We didn't see any changes in that and were able to start measuring a stable trajectory after, say, maybe two and a half hours we didn't notice—when propulsion is occurring and the radars are taking that data in, it doesn't want to believe that you're doing a maneuver right then because this is what we call low speed or stable orbital tracking.

For the propulsive, like when we're launching or when you're doing the big maneuver to go into lunar orbit, we had what we called high speed tracking, and it's looking for propulsion. But the low speed tracking isn't. So we began to notice when we got into a stable part of the trajectory, and that was probably several hours before everything was

totally quiescent, you might say, and then we were able to see where we were from the trajectory we were expecting and what that meant for the mid courses.

Of course, at the same time we were looking at an array of different options. A free return trajectory was a really good idea at this point because we didn't know if twenty hours from now we would be able to do another maneuver to correct back to a free return. So there were lots of discussions about the more efficient maneuvers that we could do that would not be free return versus free return, which would give you the benefit of, if you didn't have much propulsion later on, you would be in a safer condition.

BUTLER: The movie *Apollo 13*, do you have any thoughts on that? They discussed trajectory a little bit. In fact, they talked about rocks being off at the end and causing some trajectory shallowing at the end. I'd like to get your input from the standpoint of having actually been there.

PAVELKA: Well, we always had the chance that our tracking and then the maneuvers wouldn't be exactly perfect, but in a normal situation, you always have another chance to fix it. We found that the trajectory, as we began to get closer to the Earth's field of gravity, that the angle for entering the atmosphere was shallowing. Of course, in the limit, if you don't have enough of an entry angle, the vehicle could skip out. Of course, it would then eventually come back into the atmosphere, skip again, but what would happen is you would be way, way off target plus you could end up with an angle that could cause you heating problems.

So as we began to notice this shallowing—and frankly, we had not had anything quite like this before, so we were trying to figure out exactly what maneuvers we needed to do. But again, the data that we were getting was consistent. So in the trench we sort of lived by our data. When people would say something, we'd say, "Show me your data," because we

had like three tracking sites and they were all agreeing, so we felt comfortable that we could correct that with a small correction.

But, of course, the later that you wait, the tougher it is. If you could have done that ten hours earlier, very small correction. But the feeling, again, was that this was something that was not exactly nominal, not right down the middle of the corridor, but it was well within the safety range. So the feeling was that we didn't have to try to do any heroic things with the trajectory, but until it began to stabilize, we were concerned about how shallow we were really going to see this trajectory. So that was sort of the discussions that we were having.

The tradeoff is, wait for more data, but as you wait for more data, the cost to repair that becomes more and more expensive. So at some point the flight director has to step in and say, "Now's the time that we need to do this," because he knows how the systems are, he knows how the trajectory that we've been telling him about is and the condition of the crew, etc.

BUTLER: Did you ever pinpoint exactly what was causing that shallowing?

PAVELKA: No. I think the post-flight people had some analysis on that. I did not get involved in that part of it, so I don't remember.

BUTLER: I'm sure we can look into that. I know they have reports on the whole mission and everything that happened. It's certainly interesting to hear your perspective on it.

After Apollo 13, you then moved in and you filled in as a retro for Apollo 15. You mentioned that a little bit in the first interview, in our first oral history. If you could you tell us again as to how that kind of came about and then what you actually did during the mission, what shifts you worked.

PAVELKA: It was never my long-term plan to become a retro. I had the section that had both the retros and the FIDOs in there. We called it the trajectory section. We had one of our controllers who was more of a senior person than the rest of us. We were probably in our late thirties; he was probably in his late forties or early fifties. He had gone through the military. His name was Jim [James E.] I'Anson. He had gone through the military and then began his NASA career after his military career. So he was twenty years behind us in terms of his age, but he had such spirit, and he was assigned this particular shift on 15. He had to have a gall bladder operation. Fortunately, we found out about this in time that I could begin training to be a retro.

My console, the FIDO console, was immediately beside the retro console as it was. It was in the center, and the guidance was on our right, the retro was on our left. Of course, the FIDO was the team leader. So in addition to that being the section head, it was my job to figure out how to solve this problem, and I knew my bosses were expecting me to step in there and do it myself.

We had possibly some other choices, but the way we were doing the flights and the spacing, if I had taken someone from, say, 16 and moved them earlier, it would have impacted their training, and they were, of course, involved a lot more in the planning shifts at that point. So Jim I'Anson had begun the planning process, and the shift he was on was not the most safety-related shift, I guess you would say. So I decided to take his shift. I began to train as a retro. So I had to learn things like how to do all the mass properties of the vehicle, how to use his processor, which was the return-to-Earth processor. It calculated maneuvers that would bring you, on the return leg, bring you back into the entry corridor to get exactly this right angle for the entry into the atmosphere.

In addition to that, the retro would do the trans-earth injection maneuver, which would get you out of lunar orbit. So they did all the "coming home" maneuvers, and the

FIDOs did all the "let's get you there" maneuvers, so to speak. But we all worked hand in glove. So I had seen enough of what the retros did that my main focus was to learn all the nuances and details of the this return-to-Earth processor and the mass properties.

The mass properties have to do with the weight and center of gravity of the command module, the service module, all the contents, the propellants, consumables, drinking water, potable water, waste water, etc., just anything that can be in there that could move or the amount of its content could change. The retro had to know that. But they had it very well organized in almost like a cookbook thing. So if you knew the language and knew where to get the data, unless there was something very unusual happening, you could go right through there. So fortunately we had a fairly nominal mission.

But we, of course, were looking for the unknowns now, since we had had the accident on 13. So our time was much more focused and not quite as relaxed to do like what-if studies when things were pretty quiet on the sleep shifts.

So I stepped in, did the shifts for Jim I'Anson. He had his gall bladder operation. He came out of it okay and served many more missions with us. He was a good friend. We lost him probably fifteen years ago, though. He was a fine fellow and we'll remember him fondly.

BUTLER: Good. Certainly fortunate to be able to work with good people like that.

PAVELKA: It was.

BUTLER: On Apollo 15, during our research there was one incident I ran across that I was wondering if it did affect you while you were working in the retro position, that there had been an error in the LM [Lunar Module] guidance computer as they were coming in,

actually, to land on the Moon. So it may or may not have. Dave [David R.] Scott had to take over control of the landing and such. Do you recall anything about that or if it did impact?

PAVELKA: No, actually, that was not a shift I was on. I heard discussion of that. The FIDO and the guidance were really in the middle of that, and the error in the knowledge of the LM computer is a sort of a shared responsibility between the FIDOs and the guidance. I was not on that shift personally, so I can't give you firsthand, but the discussions that I heard regarding that involved the knowledge of the vectors and the handling of the vectors into the PNGS [Primary Navigation and Guidance System] and AGS [Abort Guidance System]. That was the primary guidance and the abort guidance system of the lunar module, and the guidance officers are really the most responsible for the health and content and commands that come out of the guidance computers.

BUTLER: Okay. Great. Thank you. We always like to touch on any little details to see if they did impact each individual's role.

As the Apollo Program was coming to a close, did you have any thoughts on that? Here this had been the focus of the Manned Spacecraft Center for so long. It's what everybody had been working toward, was getting to the Moon. Do you have any thoughts on the end of that program?

PAVELKA: Well, it is interesting, because up until Apollo 11, there had been tremendous interest in the public, the media, work, friends, neighbors, etc., tremendous amounts of interest. Of course, a lot of people didn't really realize that we were going to be able to do this. Then as we were successful on Apollo 11 and the flights after that, except for the heightened interest around the accident, and, frankly, the accident didn't get quite the same type of interest at the time it was happening and immediately thereafter. It was like, "Those

guys had a really bad day, but they pulled it out." It was only until people began to look at what we did with what we had left that it was really viewed as a huge success in terms of being able to at least get the crew back and learn a lot about what we could do.

But as we got toward the end of the program, there was less and less interest externally. I mean, for us, we were working back-to-back flights, and we didn't really have time to analyze what was going on. We knew there were a lot of things happening in the rest of the world, but they kept us hopping with the simulations and then another flight, and we would try new and more pressing things to see if we could stretch the limits of the systems.

Another thing I noticed, being like a first-level manager, was that budgets began to shrink and be cut. In fact, I guess they really cut that program short. In the original grand plan, there were going to be more lunar flights, and they just got to a point where somewhere up in the Washington [DC] bureaucracy they decided that the program would end here and we would move on to other programs.

It took us a while, because, like I said, we were very preoccupied with just the job at hand, but it took a while to let it soak in that this business was not as popular and unique as it was. We had experienced a high there that, you know, we didn't really realize that was the high or what was going to happen after that.

It was a little bit sad. I hated to see the program come to an end, but I really hated to see what happened when we didn't take any steps to capture the knowledge that we had for a next time. Of course, even today, looking back on those many years ago, of course we would have many things that would be better, and our technology in many ways has gotten better, but there are many things that would be the same. I don't know how well we took steps to capture those things.

Your project right here is an item that would have been really nice to have done back at the end of the Apollo Program when we had many of the people that we had fresher memories, we had records, many of those records. We hung on to them, and then your office

would move, and you would be encouraged to throw that old stuff away, and then eventually you end up with not very much of it. So it was sad, looking back on it. It was a highly successful program, but it seems to me like at the end of it I was personally disappointed that there was not some effort to capture what we had for posterity for here's what we could use later if we ever decided to do this again.

BUTLER: That is unfortunate. Hopefully, we can at least make up for some of that with this type of project that we're doing here. Luckily, people have been able to hold on to a few things, like Captain REFSMMAT.

PAVELKA: For example, I mentioned the log books earlier. We have kept those things, but at one time we had a book with the hard copies off the console from each maneuver that was done on each flight. I don't think we have kept those over the years. For the Gemini and Apollo Programs we had them, and they were just binders on a shelf, and you could look up there and pull one out and you could look in there and see exactly what maneuver you did and every parameter on it.

Well, those old hard copies from the console were—what would I say? It was a funny process they used, and the paper was sort of limp and maybe photosensitive, because after years would go by, you'd look at them and they would get fainter and fainter and fainter, but you still could read them. They lost their legibility little by little. So maybe the process wasn't that good anyway. But that would have been some good stuff to stick in a special storage vault and just keep.

BUTLER: Well, hopefully some of that can live on, maybe not in hard copy form but at least in some form or another, through people's memories and their words that they share and

through the books that have been put together. It's nice to see people coming out with those now.

PAVELKA: Right. You know, I have not read [Christopher C.] Kraft's [Jr.] book, but Kraft has some new book out, and it actually covers more than just his NASA experiences. His book and Kranz's book and there are a couple others out there really have done a good job of capturing a lot of those what I would call the glory days and some of the details about how it all came about.

BUTLER: Absolutely.

Well, moving out of Apollo, in about 1974, you moved into the Mission Plans and Requirements Section. What did you do in that area? Were you involved much with Skylab, or were you working on planning ahead for Apollo-Soyuz and Shuttle-type activities?

PAVELKA: The focus was primarily on future activities. I didn't get heavily involved in Skylab because of the challenge that it presented in the trajectory area and the control center area was kind of a different one from the leading-edge stuff that we had for Apollo. So while we had a group of people that were pulling those shifts, the Missions Plans and Requirements area was putting together plans for what should our control center look like for future programs and, in particular, Shuttle. In those days, we knew that Shuttle flights would be long flights, and we knew that space flight would become a lot more routine and that we could take steps where we could take advantage of the fact that a lot of parts of it were routine.

So we came up with some ideas. One of them was called an office MPSR, and it would be like if the main control room were in this building and this were one of the support areas—MPSR is called a multi-purpose support room, MPSR. An office MPSR would have

been that maybe if you worked in here, your desk would be here and you would also have information from the flight, all the information that you'd need to do your job as support in the flight control sense, but you would also have your PC [personal computer] and maybe some document that you're working on.

In our mind, we saw this multi-tasking thing where a person could scoot over here and look at some data, support the flight director, and then look over here and perhaps work on some report that was for a past flight, some other office-type work that you would have. So that was the idea. There were several really good people that we had. Of course, again, at the top of our organization at this time was Kraft and Kranz and [George W. S.] Abbey, some of those folks, [Glynn S.] Lunney, [Clifford E.] Charlesworth, and those guys. So we were putting plans together, bouncing these ideas off of our leaders to see what they thought, and coming back to the drawing board and coming up with new ideas.

The layout of the control center, the new control center that we have and the layout of the old control center with where the support rooms were and how many that we needed, that was the type work that we did. What type of provision would we have for the customers that would come in? The whole idea of the cargo back in the cargo bay of the Shuttle was something that we had a lot to learn on that because for the earlier programs, NASA packed most of its own experiments. It was not like most of those came from universities and scientific labs. Many of them did, but my impression is most of those came from other NASA centers that had experiments. So now, for Shuttle, we were going to change that, and we were going to accommodate paying customers who would have satellites to launch, experiments to run, materials processing, furnaces, and so and so on.

So we needed to figure out in their MPSR area, what did they need, how much area did we need to give them, what sorts of capabilities, how would they interface with the flight control team, what data would we provide them, etc., etc. Those philosophies and support

techniques and the layout of the control center is what we really did in that mission plan section.

BUTLER: Certainly very different than what you had been doing.

PAVELKA: It was quite different. It did allow us to draw on some past experience and putting our thinking cap on and what might be happening in the future, envision what should the concept be. At that point it was pretty much a concept of what will work. Many of the ideas that we had were thought to be maybe a little too expensive or a little too elaborate. So we kind of got back into the middle of the road with what was the best tradeoff for what NASA could provide.

The other thing that we had to work with was that in the beginning, we just had the old Building 30, and that was when we evolved our plans and discovered that we needed to add a new wing on to the building because what we had, we were outgrowing. We had two operational floors, the second and third floors, with control rooms in them, but those control rooms were so tied to the old technology of a mainframe computer, blue consoles, and the type of voice communication that we had that to take that totally out and put in all the new technology would have been much more expensive than to build a new building because it was integrated into the way the building was originally built. Also, the old building would not handle the size of the new capabilities that we needed. That's sort of how we got the new control center.

BUTLER: Certainly has served quite a need as it's grown over the years.

PAVELKA: Right.

BUTLER: In between this time frame with the end of the Apollo missions and moving into Shuttle and the future programs, Gene Kranz and you had talked about the mission control patch. You told us a little bit about that last time before we started. I wonder if you could share with us some on tape. I actually have a picture right here.

PAVELKA: I wish I could have found my sketches on that. What we did in the beginning, this was sort of a final product that came out of about, I'm going to guess, six months of going up and down the halls getting ideas from people. What we did originally was solicit inputs, and we got maybe twenty sketches from people with their ideas. So I sort of took the path for Gene and collected this stuff. I had a little notebook full of that. We had many shapes, as you could imagine. Some were shaped like some of the spacecraft, etc. Came up with this shape. The idea of the band across here was my idea of a way to—this was the original one, too, mission control.

The sigma was the sign to represent science and engineering, and it was the sum of all those efforts that we would have going into a mission. Then we had, of course, the planets, the sun and other planets. This could be the Moon or other planets and then the Earth. Then we had a little orbiting spacecraft here that had an Earth-sensing—had a little cone out the bottom because we had a big program called Earth Resources. We tried to represent many of the programs. These were some of the symbols of earlier programs. Then this "res gesta par excellentium" [phonetic] was Gene's Latin. I think it was "progress through excellence." It had a meaning like that. There's probably a definition of it in here.

Anyway, I came up with a sketch that was very, very close to this, and Gene contacted Bob [Robert T.] McCall, Robert McCall, who was a very noted space artist, and he actually worked up all the final artwork, and we iterated with him to make sure we had everything. He did a wonderful job on it. So this patch, then, became—we had decals, we

had these golf shirts, we had them on just about everything. We put them on our console documents that we used.

Then probably about fifteen years after the original issue, part of our organization went to Gene and they said, "You know, we really need to represent all the organizations," because control would represent the people in the control center. But they came upon a proposal that would change this to operations. So operations would include the planning people, the simulation people, as well as the flight controllers. So if you look at a patch today, it will look just like this, but it says, "Mission Operations."

We also had these made in the cloth patches that were embroidered, like the flight crew patches. So that's sort of the story behind that, and I wish I had brought it, I have a little notebook. In fact, if I can locate it, I may bring it to you and just let you put it in with some of your archives or something.

BUTLER: Oh, that would be great.

PAVELKA: It has pretty much this drawing. Probably all these symbols weren't on here. But otherwise, pretty much this drawing and every version that was turned in as a suggestion.

BUTLER: Well, that would certainly be interesting. We could make copies. What did you say the band represented? I think you started to say, but—

PAVELKA: This part?

BUTLER: You said the band going across.

PAVELKA: Well, it was just a way to get the words on there, and I kind of let it overlap and go around to show that it was sort of encompassing this part of the space program.

The sigma was Gene's idea. As you know, the sigma represents science and engineering and it's the sum of it all. So I thought that would be a good way to do that. That's pretty much exactly the sigma that I drew. McCall I don't think changed that part at all.

BUTLER: That's certainly interesting.

PAVELKA: I didn't know that was in there. That's neat.

BUTLER: Yes. The mission control, mission operations team certainly did have a huge part to play in the mission, so it's fitting.

PAVELKA: And that was just another item like Captain REFSMMAT and the patches. Gene was always interested in things that would make the spirit and the morale of the people because he knew that we had a tough job. We were spending a lot of time away from our families, so he wanted to do things that would make us feel a little better about what we were doing. I don't think a lot of the people perhaps consciously acknowledged that. I think subconsciously they probably enjoyed a lot of the things that he did or felt better about them and their morale was better, but I'm not sure that it really struck them that it was something he was doing to try to help the organization.

BUTLER: It certainly is important to try and keep that whole team atmosphere and that morale, keep everyone working together.

PAVELKA: What we had was not any good at all unless the team all worked together. Everyone had to be a team player. We had so many exceptional people who, by themselves, could do so much, that it was difficult sometimes to make them want to be team players, because they had the capability to go be superstars, you know. That was all part of it, too, was to be team players.

BUTLER: Well, the team changed a little bit in between the Apollo and Skylab missions and Shuttle when you moved into the Apollo-Soyuz mission, had a completely different aspect on things, bringing in the Russians, who you'd previously been in competition with and in some circles were actually considered enemies, on the military front to an extent.

Could you tell us something about your involvement in that side of Apollo-Soyuz and how that may have affected the atmosphere, both at NASA and in general?

PAVELKA: Okay. That was an interesting program. It was little bit of a surprise to some of us in the control area when the management brought it up. Of course, we had always referred to the Russians as the "rascally Russians," you know. So we weren't going to be able to do that anymore, at least when we were working with them.

There was much planning that had to go on. First of all, I was still a supervisor in the flight dynamics and trajectory area, so a lot of my focus was on staffing, making plans for the mission. Of course, the mission was not terribly complicated in terms of comparing it to what we had done earlier. We got those plans in place, but then there were all of the group and the international planning that we had to do with the Russians.

They formed working groups, and I was in Glenn Lunney's working group, called Working Group One, and we had many of the plans to put together. I was the lead on a document that was called the contingency plans, and the contingency plans were supposed to contain every situation that we could think of within reason and how we would react to that,

what the U.S. would do, what the Russians would do, what they would do with their systems and what they would provide, what we would do with our systems and what we would provide.

These contingency plans were, again, primarily on the grand scale of if you're in orbit and the Apollo loses oxygen, what do you do and what does that mean? Does everyone go into the Soyuz? Will they fit? What do you do with the docking adapter? That's probably not the best example, but some of them would be like what if you did not have propulsive capability to change the orbit with the Apollo? Then would the Soyuz do these kinds of maneuvers? We went through probably fifteen or twenty different contingencies, and we planned each one of those.

Well, a lot of this that we tried to do, in those days we had teletypes. Fax wasn't quite on board yet. We didn't have anything like worldwide web so we could interact with the Russians. So it was that we had a series of face-to-face meetings. The early ones were just the higher program-level people, but then we began to need to get the working-level people together.

I'm not remembering the exact year, but I think it was in late September and early October, and I'm thinking it was like [19]'75 or '76, our working group went to Moscow [USSR] for two weeks. Of course, the thrill of being able to travel like that was interesting. The strain and worry about going in behind the Iron Curtain was troubling. It was high profile enough that we all told ourselves it would be okay.

But we went there and the gentleman that was my counterpart—I was the lead for NASA and the Russian lead was named Anatolia Korolev, and [Sergei Pavlovich] Korolev, that name is a very big name in Russian space. He's one of their national heroes. However, the fellow I was working with was not his relative. He happened to be the group of non-famous Korolevs. But anyway, he was a very brilliant and very well-educated engineer.

What we found out was the comparison between the way the Russians operated and we operated was that we would have groups of people that would do the controlling and another group of people that would support them doing the planning, and then we would have computers. Other people would help us publish books, and we would have contingency plans, and we had simulators, and we trained.

The Russians did it totally different. Their philosophy, and even today, is that they would train in an extra real space vehicle, not a simulator, which they would try to get some information out of. What we would give to someone to run a computer program for this, they would work that out in their head. They knew the orbital mechanics. They knew so much more in their heads than we had to know, and they sort of did it the way maybe [Albert] Einstein would have done it back in the forties or whatever.

It struck us that they did not have most of the advances that you could take advantage of using computer technology. They had some computer technology, but they weren't taking advantage of it nearly the way we were. Their spacecraft was probably not fault-tolerant in every system, whereas we were used to having one or two back-up systems to our primary system in everything that was important. That was just the way NASA was. So the money that we spent for expensive spacecraft and simulations and training, and we would plan for all the different contingencies, we came into this contingency planning with a totally different expectation than they did because, frankly, the impression we got was that they felt like their spacecraft and their crew were expendable. If they had a problem and it all went away, they'd just roll another one out there and fire it up because they had stacks of these spacecrafts.

I'm rambling a little bit.

BUTLER: No, no, not at all.

PAVELKA: So to compare, again, the planning, I got to be very good friends with this—we called him "Toya" for short. He was a very, very dedicated person. All of the people in their team were members of the Soviet Academy of Sciences, who were very—that's their elite scientific people. The things that we learned when we were over there in Russia for this planning meeting were, number one, we thought that their buildings looked like they were all built by amateurs. You know, you'd site down the side of a building and it was like that. Just little things. This was some of their important buildings. It's like they did not have the pride of craftsmanship that we had grown to expect.

Then when we got into the meetings with them, we found out that I could commit "This is the way we will do this, and this sounds good to me," and Toya would have to go—he'd say, "Okay. I'll take this to my leader, and I'll come back tomorrow and we'll decide this." Always they had to go to the next guy up or maybe the next guy up who also had a KGB [Soviet National Security Agency] guy in his pocket or whatever. We never knew. But they were not empowered to say right now, "We'll do it this way. Let's move on." That was not a huge problem. It just slowed us down a lot, and it was disappointing because I knew he was coming up with good ideas and the people above him weren't going to add a lot to that. But that was the work process that they were strapped into, and they really didn't have a choice.

Then my translator—each working group had a translator—my translator lived in Pacific Palisades, California, and her name was Aida Taylor. She was Russian. She had an aunt who lived in Moscow. So Aida spent—when Toya and I would be working, she would be there translating for us, although he spoke very good English. But anytime we had to record anything in a document, in other words, the translators would make sure that there was a perfect, so to speak, English and Russian version that was available that corresponded.

But what I found out was that Aida would visit her relatives in the evening after our work was over, and it was absolutely heartbreaking, the stories that she would come back

with. Of course, several generations would live in an apartment. It was the job of the grandmothers or great-grandmothers to go out and do the shopping during the days and look for the bargains and that. Even these people in the Soviet Academy of Sciences could not afford cars. It was probably not even in their hope to ever have a car. They would make, in our equivalent money, like sixty dollars a week. A pair of blue jeans over there at that time cost about that. They treasured our blue jeans. They would buy them right off of you if they could, because in those days they didn't have that denim available to them or something. I took that as it was the standard that everybody in the world had blue jeans, but they treasured those. Gold and blue jeans, you had to watch that. They would try to buy rings right off your hand because of the gold.

But the purchasing power that they had was what was heartbreaking. Here's this man who's spent his life being educated. He works in their prestigious Academy of Sciences. He makes sixty dollars a week. If he works all week, he could buy a pair of blue jeans. That just broke my heart.

The people that got the cars and the nice homes were the people that were in the Party. So knowing that, and of course having the translator who had a relative who could tell her really what was going on, but it really was kind of heartbreaking.

So fast forward then to working groups that we had in the U.S., because we would have one in Russia and then one in the U.S. The last day that I was in Moscow before we headed out, we had the first snow. I was staying at this hotel called the Rossia, which is a huge, huge hotel. I think it's like 6,000 rooms or something. My room looked right out to this St. Basil's Cathedral, a beautiful cathedral. So I got to see the first snow. I think it was the first snow of the year.

It was so cold there. Being from Houston, I'm not used to the cold weather. The courtyard side of our rooms had windows that would open, and my friends and I, we would get the blocks of cheese and the little thing of wine, and we'd just set them outside the

window. That was our refrigerator. In the evenings when we'd meet and talk about how the planning was going, we'd have our wine and cheese and talk.

We always thought we were bugged. We thought the rooms were bugged, and they probably were. We didn't know if they were bugged with cameras and microphones or what. So you were never totally comfortable.

Then when we got ready to fly out, they told us we could not take any rubles out, particularly the coins, the ruble coins, the Russian money. So of course, when we had change we'd just throw it in our shaving kit. So we all had a little bit of it for a souvenir. We got in the plane, and we're ready to take off, and then they stopped everything and they said, "There's been a delay." Of course, we're all ready to get out of this Iron Curtain area. Time passed, and finally they told us that they were having to replace the shock absorber on the nose gear of the airplane because the runway was so rough that they couldn't safely take off. So that was what the delay was. We were worried that they were going to come in and search our shaving kits for these rubles.

Anyway, it was very interesting. I enjoyed the trip over there, but it was tense, a very tense time. During the day, when you were working, you didn't think about it that much, but when you went back to your hotel room, went to have your meal and then were getting ready to go to bed, you know, you're always thinking, "Okay, everything thing that I say is being recorded," or whatever.

So then the next thing that happens is we had working group sessions in the U.S. So all their counterparts and my counterpoint, Toya, come over, and we have an area here at NASA that we met, and that was again for two weeks. Two weeks was kind of the standard. So I took it upon myself that I was going to kind of adopt him, and rather than him having to go out to eat, because I always, in those days, brought my sack lunch, so I would bring him a sack lunch. Well, I think this went on for two or three days.

Finally, I think his KGB—there were always people that stood around, that you couldn't quite figure out what their job was, and we figured those were the KGB guys. We think the KGB guys got to him and told him that he wasn't supposed to, because he said, "You can't bring me a lunch anymore." Because we would just sit down right where we were working, and we'd open our lunches up and we would talk and eat, and we did that for about three days. After that, he said, "Well, I can't do that anymore." I knew it wasn't his idea, so I just said okay and I just didn't make a big deal out of it.

The working group sessions here were about the same, except we, of course, didn't feel like we were being spied on quite as much. But always when you would go someplace for a meeting and you began to know who was working on what, you would see these guys walking around, and you hadn't seen them working on anything, and you figured it was a pretty good bet that those were the KGB guys.

So that was how we did our pre-flight planning, was through these working groups, back and forth, back and forth. I only got to go there once. Some of our groups got to go over two or maybe three times, particularly the people that had to do the design and building of the hardware, like for the docking adapter. They had to spend more time. But for us, we got our contingency plans in pretty good shape in about two sessions and didn't have to go back over there.

BUTLER: You talked about when they came over here and adopting your counterpart to an extent. Unfortunately, they put a stop to something as simple as lunches. But were you able to show him some of how you lived here and bring him home at all or take him anywhere?

PAVELKA: Well, we wanted to do that, and we were able to have a party for them, and we were able to pick them up in our cars and take them to this function. We tried to invite them to someone's private home just to let them see how we lived, and they wouldn't allow that.

Looking back on it, we think the reason was that they didn't want these people to see how different it was. That gets back into the sad part of where they were and where we were. There may have been some cases where some of the people got to go to private homes, but when they were over here both times, we tried to have functions, tried to have something at our house or someone else's house, and it never was possible.

We had groups get together. There's a place over here on Nassau Road 1 called the King's Inn. It's got a different name now, but they had a big ballroom there. The cosmonauts and the astronauts went out deep-sea fishing one day. Then that evening we had this reception, and they brought in all this fish. So they had the little fish-fry and the hors d'oeuvres, and the Russians had supplied the vodka.

This was my first experience with Russian vodka. I'll just tell you that it's very deceptive. It tastes very much like a cocktail, and it's very potent. They delight in filling your glass and filling your glass. I learned after this one party that we had at King's Inn that what you do is, you take the first glass and you smile and you take a sip, and then you go to the men's room and you get rid of this and you put water in your glass, because this stuff is so strong that you just have a huge headache. [Laughter] But it was their very good Russian vodka, and they brought caviar and these things and then with the fish thing. That was the type of socializing that we were able to have here.

I didn't touch on it, but while we were there, they showed us some very nice tours and dinner things in the evenings, wined us and dined us, and they took very good care of us while we were there. They took us through some old monasteries that were like 1,200 years old and things like that. So it was very interesting and educational and enjoyable. So we reciprocated by showing them parties and things here in the evenings.

BUTLER: Were you able to help them get any blue jeans when they came over here?

PAVELKA: Well, they did. As a matter of fact, they all had lists, and I think they all had saved up, because particularly they were shopping for their wives. One fellow had this piece of paper that had a tracing of his wife's foot, and he took that in to buy shoes. Of course, they were buying blue jeans and other—but they went crazy at places like Target, just anyplace like that. I don't think they had Wal-marts back in those days, but it was like those type stores.

Go-go boots were popular then. Every guy had a bag of go-go boots to take home to his wife. Of course, their sizes were in metric, and we had our shoe sizes, so they would bring these little footprint things to make sure it was about the right size, I guess.

BUTLER: That's interesting. That's certainly a small detail that someone wouldn't normally think of.

PAVELKA: And who knows what else they treasured, but I know the clothing, they totally enjoyed being able to stock up and take clothing and stuff like this home.

BUTLER: That's certainly could almost be considered a side benefit that they got out of the Apollo-Soyuz Program, is that opportunity. What do you see as the benefits for both sides out of it? What were learned from one side or the other?

PAVELKA: Well, for us, it certainly was not technical. It was more of an appreciation for what the Russians had done with what they had to work with and their personal capabilities. I appreciated that. I think what they gained was a lot of insight into technical techniques and ways that we used computers and data that they were not advanced into that stage of analysis and planning. They also got a lot of detail on our systems and plans for our Apollo spacecraft. They ran batteries; we ran fuel cells. They ran oxygen generators that burned

flames, and we ran tanks of oxygen. The approaches were very different. So they got to see, I guess what you'd say, from above the table as opposed to something that their KGB people might have been able to buy as a spy in earlier years.

But to me, the biggest thing was that people began to see that there was some grounds for cooperation and that the two countries could figure out some way to cooperate on something, because back then they weren't cooperating on very many things at a diplomatic level. Of course, I appreciated just knowing my counterpart and what he could do and what he had learned and what he could do without the fancy computers that we had. I appreciated a lot more what they were going through.

Of course, technically, we were, I'm going to say, fifteen years ahead of them in terms of what we would do, but more than that, our philosophy was totally different. Our philosophy was, if it was the safety of the crew, we would have one or two back-up systems for everything that was important. Their philosophy was, "We'll have one of everything and we hope it'll be good enough, and if it's not, we'll use another one." So it took a while to get past that very large difference in philosophy.

BUTLER: That certainly is a big difference.

With the end of the Apollo-Soyuz mission, had there been any discussion or did you have any thoughts as to whether there would be other such missions in the future at all?

PAVELKA: There was not much hint of whether there might be additional ones. After having gone through that, the people that worked it hoped that there would, because we rather enjoyed it, more from the standpoint of just a cooperative thing and learning a little bit more about how they did business and how we could do business together.

The other side of that was we felt a little bit cheated that they got a lot more technical insight and benefit out of it than we did. It was not fifty-fifty as far as the technical part of it.

But once you past that and said, "Okay, I understand that," then it was nice to have a project that was cooperative and international that worked. So, you know, there was interest in NASA, but I guess it just never quite came together until this Space Station thing.

BUTLER: A few years later, but hopefully they were able to build on some of these experiences that you had learned.

PAVELKA: Right.

BUTLER: I think maybe we'll take a brief break here.

PAVELKA: Okay.

BUTLER: And then we'll finish off with Shuttle.

[Recording interrupted]

BUTLER: ...after Apollo-Soyuz, and you had already been working in the Mission Plans and Requirements section, and you talked a little bit about that earlier on, for Shuttle and planning for the Shuttle missions. Before Shuttle became fully operational, in '77, I think, you moved into the Operations Integration Branch. What were you working on there and what was your ties?

PAVELKA: Actually, the Integrations Branch was a continuation of the planning for the Shuttle control center, for the procedures. We needed a starting point for the flight rules, and we, of course, had not—this was a very different-type program because, for example, we

didn't land in the water; we would land on runways. So we needed to have a group of people go out and establish a starting point for where would be the places we could land and then how many of these would we want to equip so that we could land. So I had a group of people that started planning for what you might call a runway landing plan for the Shuttle, and that was going on, and we were also doing the planning for evolving the actual control center itself. That was the largest part of it.

And how we would work in the control center in detail, who would do what, how many shifts a day would you work? We were doing the planning for the overall team. So the mission plans that we had would go across the whole team, and then what we would want to do is use the technology that was coming up, but what we had learned from the earlier programs, fold that into the procedures that we would have for the control center. So that was really our main challenge there.

About a year before the first Shuttle was supposed to launch, I was selected as a branch chief in the Flight Planning Branch. I don't know if you had that on your list or not.

BUTLER: I don't know that I did. Was this when you were operations division chief and assistant for operations in MOD?

PAVELKA: It was between the Integration Branch and that. Again, I could get a date for you, but the best I can remember, when I went there, it was the year before the Shuttle was supposed to launch. The situation was that Tommy Holloway had been selected as a flight director, and he was the chief of the Flight Planning Branch at that point. So he went away to be a flight director, and I was selected in Jim [James W.] Bilodeau's division, which was the Crew Training and Procedures Division, as the chief of the Flight Planning Branch.

At that time, of course, we had flight plans. Tommy Holloway and John [W.] O'Neill were sort the daddy of flight plans as we knew them up to that point. But we knew for

Shuttle that we were going to have do things a little differently, and we knew that we would have longer flights and much more diverse flight. So one of my first jobs was to select for a new section that was called the Ascent and Abort Trajectory Section. I selected Chuck [Charles F.] Dieterich. Chuck Dieterich had been a retrofire officer earlier, and I knew he knew trajectories inside and out. I met with a little bit of resistance there because I was bringing a guy in from out of town, rather than picking someone from that branch, but in the end it turned out to be the very best choice and the people recognized that, but it took a little while.

The job, though, of the Flight Planning Branch, again, relative to preparing for Shuttle, we had to get together a way to do long-range plans if you were going to have a really long Shuttle flight and a way to re-plan that. What we were thinking was that we would re-plan it at night and then execute the revised plan the next day. Well, the way we had gotten used to operating before was if something changed, you did it on the fly. You re-planned it right then during the execute shift.

We thought, because this would be more of a business as usual—that's what we thought, anyway—what we would do is we would plan at night, and if something went wrong during the day and you didn't get 100 percent of it, well, for a business-as-usual thing, 95 percent wouldn't be that bad.

Well, as it turns out, that didn't float. It sounded good in the beginning, but no one wanted to accept less than 100 percent of everything all the time. So for Shuttle, the landing was quite different. We had some work to do there for the flight planning. The fact that the vehicle was reusable, there were some aspects of that that we were impacted by. The fact that we had a fleet of five vehicles that would be used over and over again, yet each one of those turns out were equipped slightly differently, as they got newer, some of those had other capabilities.

I guess the one that stood out all along, the very first one, 102, was always different. Because of the way it was equipped, it ended up being a heavier vehicle and so could not carry the same payloads because of the way it was designed for some of the early testing. Anyway, our planning had to account for from flight to flight. Even though the vehicle is, quote, "the same," it's different. So you had to have the right information in planning, particularly for the ascent and entry portion of the planning, because the Shuttle would be very active in some of the abort modes.

Let me regress just a little bit on the landing sites. Every 15,000-foot runway in the world, we made a database that had every one in it. Then because the people at Kennedy [Space Center, KSC] were very involved in the landing strip there, we involved a fellow down there named Wes [Wesley W.] Branning, and he and I became co-chairmen of a group called the Landing Ops [Operations] Working Group. What we did is we worked back and forth and together to—see, KSC would supply the crash and rescue equipment and training that would go to any of the landing sites, so they had to be involved in that. We would be involved in the planning from day to day on how we would choose different landing sites, depending on what our trajectory was and what the weather was and etc.

So in the beginning, we had all kinds of runways. The considerations were, in some cases some of the places had runways that ended right off into the ocean. There's one in Hawaii, I think. It's a nice 15,000-foot runway, but at the end of it, if you went another quarter of a mile, you'd be in the ocean. Then there was one in Spain that was like that, it had a hump in the middle of it. There were just all kinds of problems that you found out once you started looking into what these runways were.

But we finally ended up with a series of, of course, the lake bed at Edwards, and then the primary runway at Kennedy, but then there were several others around the world that were contingency landing sites where you would say, "If I need to go into Guam, what I'll have to do is get vehicles and a team of people flown out of Kennedy in there as quickly as

possible." So the Kennedy people were really in the hot seat as far as making something more difficult, because they had all this equipment that they had to move around, and that had to do with the big fans that blow. Because, you know, they weren't sure in the early days what kind of outgassing you would have from these tiles and also if there were venting from the thrusters, which would be poisonous. So they had to have the right equipment wherever you were going to land. So there was that planning that we did that was brand new to the Shuttle Program because before we just landed with parachutes on the water and a ship came and picked us up.

So that was different. The [launch] abort modes were quite different, too, because we had—and I think they still carry on the books one called return to launch site, which is a very aggressive and dangerous mode, because, actually, as the Shuttle is launching and it goes down range, the return to launch site [(RTLS) abort] would actually turn it around and drive it back to a landing at Kennedy at the launch site. No one in our group, the trench, ever felt really comfortable that we wanted to do that, because it was so aggressive. You know, it's like moving the mountain, rather than walking over to the mountain.

Then some of them are like transatlantic, where you land in Moron [Spain] or someplace over in Europe. Again, over there, they had a lot of weather problems. So if that one is weathered in, you've got to figure out what are your choices.

So the strategy for launch aborts for Shuttle, because it had so many capabilities, was much more complex, the landing was different. Then, of course, on orbit, it had more computers on board, more capabilities with what you could do in the cargo bay, the ways you could do EVA [Extravehicular Activity], the arm. All of these things affected the overall operation for flight planning.

Now I'm backing away from the trajectory part that I talked about so much earlier because the flight planning really is covering everything you do on the flight. Now what we'll do is talk about how are we going to interface with these people, let's say, who have a

satellite to be deployed in terms of flight planning, because their opportunity for where they deploy needs to be factored into what we're doing in the flight plan, but we need certain information from them to do the planning, and they need information from us to be able to commit to, let's say, when they do the deployment.

Some of the more complicated ones also were like the Spacelab, where you knew you were going to have a larger crew, racks and racks of experiments that the crew will be operating some of these at different times. How do you factor that into a flight plan, and how do you make the flight plan flexible enough that if one of the experiments is not going to work, you can have the crew use their time on something else and not be wasting their time?

So the flight planning challenge was quite interesting to me, and I ended up having that branch for ten years. We stayed a year away from the first Shuttle launch for about four years, I think, and finally we had our first Shuttle launch.

I was a little bit of a cultural shock to the people in the flight planning area because I had been in mission operations and flight control all of my career, and this crew training and procedures group had been, for the most part, not console operator people. They had the flight activities officer, the FAO, and some of the people that supported him in the back room. That was about what they had.

On the earlier programs, they started out with a long white sheet of paper, and they would write the flight plan, hours and hours of flight plan: this happens and then this happens next. It was not particularly computer oriented at that time. What we brought on line was the automation of putting that into a computer, having the computer help you some do the planning, but not throw all the stuff in and then the computer figures out what to do and magically throws it up. Because the Shuttle and NASA operations are so complicated and flexible, you can't let a computer do it all.

So what we had was an interactive system with a smart operator who had the tools to be able to go in and do these plans. That was a difficult point to get past, because there were

many of the bosses that would look down on this process and say, "Why don't you just do that all automatically?" The culture of the people was they wanted to do it all manually. Somehow you needed to get in between and have the best of what the operator could bring to the process and the best tools so that he could do the planning job as well as it could be done.

Where I was the cultural shock is that I required them to build a console handbook for their position in the control center. Well, they had never thought of that as something that was good for them, "them" being the FAOs, the flight planners. But we had many meetings, and we didn't really negotiate a lot on that. I told them it was required. Maybe a year and a half or two years after we began that, which is still about a year before the first Shuttle, that began to come together very nicely, and they began to embrace that as a concept that they needed. But for about a year of that time they really didn't, and they thought I was putting upon them and punishing them because I had been in flight control and they hadn't, da-da-da. So that all worked out okay. There was just a period of adjustment there that needed to happen.

I stayed with that branch about ten years. We saw all the early Shuttles fly, and I was the chief of that branch. Probably our greatest moment in that branch was to successfully be able to respond when there was an anomaly in the Shuttle and the people had the tools and the procedures and they knew how to respond. That was very rewarding, to see that happen.

BUTLER: Not exactly an anomaly, but touching on what you've talked about with the landings and with the planning on STS-3, they landed in White Sands, which had been essentially one of these contingency sites, a little more advanced than some of them. Were you at all involved in that, in the planning for that aspect of the mission? This was something they had actually decided, I think before or early on before the mission actually—shortly before it launched.

PAVELKA: Honestly, I'm not remembering exactly all the details there. I know that we had always had problems when we would have weather. But actually, this is a little bit interesting, but George Abbey always liked White Sands, and there was always a desire a little bit for him to want us to go that way if it was the right thing to do, of course. But it was not like you had to convince him any. I don't know if you're aware that he has two middle initials, but we all said that they stood for White Sands. [Laughter]

I don't remember the details of what caused us to go there, but I do remember that every time we would land there, there was a lot of extra activity because you had to first of all get the vehicle back on the carrier aircraft and ferry it back to the Cape [KSC] and refurbish. Typically, in the early days, that cost you about an extra month. So you knew that your schedule was probably going to slip for that particular vehicle. Of course, then learning to get several vehicles in flow was something that was a big learning curve for the KSC folks.

For us, what was a big part of the curve was we had to know how to configure our simulators differently for each version of the Shuttle, reflect that in the flight planning process correctly, and, of course, in the control center because we have calibration information in there that would be dependent on what the configuration is for each individual orbiter. So the idea of reconfiguring the control center became a really big deal with the advent of the Shuttle Program. In fact, we added an organization originally to a branch, and it has since grown into a division, that's a reconfiguration organization because they have the onboard software to reconfigure, they have the ground control center to reconfigure, they had the simulators to reconfigure, and that's just the big three. There's probably a lot of other small things.

But the paperwork and the checks and balances that goes with each one of those is deafening. It's horrendous. What you put in to load those computers has to be absolutely correct, both the ground and the onboard. We had many cases where we had near misses,

where we almost—we have a problem, and we would discover something that looked funny in a simulation, and we had to decide was that a simulation problem or a real flight software load problem or something else. In some cases, we would discover, even though they were testing in what they called the SAIL, Shuttle Avionics Integration Lab, sometimes a real subtle problem would make it past the SAIL testing and we would pick it up in simulations. That's scary, but it also shows that it's good to have really high-fidelity simulations that exercise every path. That's what we tried to do, anyway.

BUTLER: Certainly have seen over the years the value of those simulations.

PAVELKA: Exactly. Exactly.

BUTLER: You then did move on, at that point, to become operations division chief and assistant for operations of the mission operations director. Was that your next step?

PAVELKA: Right. Right. After ten years in the Flight Planning Branch, John O'Neill became the division chief in the Operations Division for a period of time, and I was selected as his deputy. Then several years after that, he went to the directorate staff, I think as assistant director, I believe, and I became the chief of the Operations Division. I had that division for many years.

That division was a very diverse organization. It had a Payloads Branch, it had an Operations Branch, it had Flight Planning Branch, and each one of those is quite different. So the Operations Division was really made up of several groups, each that had a large scope, but each one was focused differently. So we actually staffed three console positions from the Operations Division.

They moved us around to many different buildings. We always felt like we didn't get the priority for getting the best floor space in Building 30 or Building 4. Many times we would be split between two buildings, which was difficult. But then they started this little building, Building 585, and our division was split between 585 and Building 17, which is the old round centrifuge building over there. So it took some work to keep the people feeling up when the organization was split out like that. But we really had talented people, and because of the work they did, it was very obvious. In other words, there was no question at all about the importance of their work. So the people all really felt good about the work that they did.

So that job lasted [about 10 years] until I was selected as deputy assistant director for Operations. There I worked with [Brock] Randy Stone and John O'Neill. In that capacity, I mainly specialized in Shuttle because at that time we were bringing in a lot of Space Station planning. That was starting to become a really big item. We were trying to figure out in our organization would we split a particular area into Space Station and Shuttle or would we have different organizations, separate. The answer actually was different in different areas.

In some areas it worked to have it shared. Just take, for example, electrical. If you're an electrical systems expert, do you have all the electrical systems experts that you have in this room and then half of them work on Shuttle and half work on Space Station? Well, that turned out to be better to separate them because what they work on electrically is so different.

But trajectory, for example, was better to combine because although the vehicles and the characteristics were different, they all flew in circular orbits or whatever, according to Kepler's law. So we had to work those philosophies and approaches out in the organization.

We began to have lots of visits from the Inspector General, wanting to know how things were going. We had enough of these investigation groups that were coming in to see how NASA was doing business, "How is your budget?" and etc., etc., that one of the side jobs that I took on in my job as [assistant] director was to focus all this information so that if anyone came in in an investigation group, I was supposed to get the knowledge of who they

were going to talk to and about what and help that person with past experience of what we had been doing with those so that we had a consistent way that we provided information and also that when it was all over, we knew what information we had given to each of these different groups.

I can't even remember all of them now, but there was one that was headed by John [W.] Young one time that was investigating this. There would be different groups that would be investigating either a problem or trying to come up with a solution that maybe the NASA Administrator had said, "We need to have a way to approach this problem at all the centers. So how will your center handle that?"

You can see that this level of what I was doing at this point was a little broader and not quite as technical as the early days. For several years I did what they called the POP, Program Operating Plan, the budgets for the whole directorate. This was a thing that would take about two months to do. When it was all over, you got to stand up in front of the center director and present the directorate's budget. That's where you began to really appreciate how nice it was back in the old days, when, for Apollo, they said, "What do you need? How much? We'll have it here tomorrow." It was so different.

So I guess the last couple of years of my career were mainly into the business, the budgets, the overall operations of the directorate, and then focusing primarily on Shuttle as a program, particularly for the safety. We had a safety organization within MOD that dealt with primarily payload safety and how it related to the Shuttle. That was a new area, so I mothered that quite a bit to try to make sure that got established.

BUTLER: It certainly is, as you've said, very different from the way you had started.

PAVELKA: It was quite different, and it took a while to have that feel comfortable.

BUTLER: More on-the-job training of sorts as you were going through all of this, learning as you went on.

PAVELKA: Right.

BUTLER: Throughout this time frame, when you were working on the Shuttle program in all these different areas, are there any events, either related to missions or related to planning budgets or anything in there, that stand out in your mind? Any memorable moments or even things relating to people?

PAVELKA: Let's see. Well, one of the really bright moments was the first time that we were able to use our new control center. That was completely different technology. It was going to allow us to operate in a quite different way because we had always been very dependent on, as I mentioned earlier, the large computers and centralized. This would allow us to use a distributed computing system and PCs. The problem that it presented was, our controllers had to have extra training because they had to know how to operate the computer part of it.

But bringing that system on line was a really proud day for me because we had seen, probably from seven or eight years before that, coming up with the ideas about what we needed, just drawing little squares on pieces of paper for what we were going to need in a control center, and now to see the control center actually open for business was really a proud moment.

I guess seeing that first Shuttle land and all that working was outstanding, too, because we had done the approach and landing test where we dropped it off of the back of the carrier aircraft. We'd done those in California. But we'd never really done landing out of orbit before. Of course, these all had to be pinpoint landings. You wanted to be there at the

landing strip. So that was pretty exciting and made me feel really proud to have it come back and land right where it was supposed to.

BUTLER: Did you get to be out there at the landing strip to watch it, or were you watching it from mission control, watched the landing?

PAVELKA: No, from the control center.

That's probably the high points for me.

BUTLER: Looking back over your whole career with NASA, Shuttle, early programs, what would you consider your most significant accomplishment or contribution, and what would you consider your biggest challenge throughout that time?

PAVELKA: That's a lot of time. I think possibly back when I was in the Flight Planning Branch, to kind of get everything pulled together and pointed in the direction it needed to be pointed to head for the new Shuttle era, to get the new flight planning system in place, to get a new ascent and entry organization in place. I probably feel like that's one of my really strong accomplishments, I guess for the administrative part of that.

Technically, probably I would have to go back to my first apogee rendezvous with Pete [Charles] Conrad [Jr.] in Gemini. That was something that was only done once and it's not been done since then. It was very ambitious, had to work hand-in-glove with the flight crew. It was something that I enjoyed a great deal. So that was probably one of the real high technical points.

Challenges. I think this would probably be the staffing of the Apollo missions, well, where the Gemini and the Apollo missions overlapped in trying to make sure that we had the right people assigned and trained and had enough people to staff those, because those

missions were coming a month apart, the Geminis were coming a month apart, and then overlaid on that were the Apollo missions. That took some doing to try to figure out how to get out of that box.

BUTLER: Certainly those are some notable accomplishments and challenges there. Each actually has a little bit of both in them.

I'd like to take this opportunity now to ask Kevin and Tim if they have any questions.

PAVELKA: Sure.

RUSNAK: I did have one, based on something you had mentioned earlier, and that was the lack of time that you guys had to spend, particularly during the Apollo era, outside of the job, either the limited time you had with your families or for yourselves, that kind of thing. I guess this is a personal question, how you think that affected your family or maybe families in general around NASA.

PAVELKA: Well, to tell you the truth, most of our friends turned out to be, quote, "work friends," so they were in the same boat. I guess we didn't notice the luxury that other people had of spending a lot more time with their families, and we sort of accepted it as that was just the way it was. For the most part, everyone else out there was going through the same thing. I mean, we didn't spend a lot of time comparing to, let's say, the guy that was a corporate executive or something like that. If we had, we might have been disappointed. I don't know.

I always enjoyed hobbies, and my main hobby was working on old cars, so I kind of immerse myself in that. Because at work, you know, we would work hard, but we worked with paper and pencils and computers. So when I'd get home, I'd enjoy getting out there and getting a little grease on me working on these old cars. I involved my son in that and my

wife helped me some, too. So we had some family synergism with hobbies. We were able to have some good quality time, but it was just not as much as we're finding out we have now. But it doesn't hurt to struggle. There were times when, to make everything come together and put the time in at work was a little bit of a struggle. But looking back on it, you know, I think it was worthwhile.

RUSNAK: Quite often the contributions and the sacrifices that families made are usually overlooked in the histories of the space program and such and the amount of time you guys put into getting the job done.

PAVELKA: Well, we do hand it to our wives and families that they put up with extra time that we weren't around when they probably had to do things that husbands would have done around the house or with the family. Of course, there were experiences that we're seeing now with our grandchildren that we wish we'd have been able to have with our children but weren't able to. So there's a little regret there, but that's part of life.

RUSNAK: Well, that was all I had.

PAVELKA: Okay. Thanks.

BUTLER: Looking back, would you ever have imagined where your career would have led you?

PAVELKA: Not at all. As a matter of fact, I had this vision when I was getting ready to graduate from college that I wanted to work for NASA, and as I mentioned to you, it was my very last offer, but it was just sort of a "gleam in your eye" type thing. Frankly, the whole

space program unfolded almost from nothing during the period of time when I was working there. Looking back on it, I really feel so fortunate to have been in the right place, because there are talented people coming out of college right now, and the most exciting thing they're going to have to do is, if they sit down around the table with me and we talked about it, they would be disappointed, because we really had the cream of the crop as far as excitement and experiences and opportunities. I'm so grateful for that, that I did have that opportunity.

You could almost see within a program sometimes how it was going to unfold, but then when the next program came along, it was so different, and it just captured your imagination and whisked you away. We in the group, my age group, that were in NASA were extremely fortunate to have the opportunity, because if one day they go back to the Moon, I think the people that are involved in that will love it. Of course, they'll have a lot of new things available to them, but that's the kind of thing that possibly will never happen again.

BUTLER: You certainly were fortunate, and we're fortunate that you've shared those experiences with us.

Is there anything you can think of that we haven't touched on?

PAVELKA: I'd like to thank you all for doing this. I think it's a great idea, and hopefully there'll be some benefit down the road. Of course, I want to thank my family for being there for me.

BUTLER: Well, thank you very much. We certainly do hope this will be of benefit. It's been a benefit to us, and we appreciate you coming in.

PAVELKA: Thank you.

[End of Interview]