

# ORAL HISTORY TRANSCRIPT

CHRIS D. PERNER  
INTERVIEWED BY CAROL BUTLER  
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BUTLER: Today is July 26, 2001. This oral history with Chris Perner is being conducted for the Johnson Space Center Oral History Project in the offices of the Signal Corporation in Houston, Texas. Carol Butler is the interviewer and is assisted by Sandra Johnson and Kirk Freeman.

Thank you very much for joining us today.

PERNER: My pleasure.

BUTLER: To begin with, if you could tell us a little bit about how you became interested in aviation, engineering, and space and kind of how that led up to you finding out about the opportunity at NASA.

PERNER: I can go way back, I guess, if you want that kind of detail.

BUTLER: Okay.

PERNER: I was born and raised in a real small West Texas town of Ozona on a ranch. My dad was a rancher. I guess through high school I lived in that kind of environment, a lot of fun, hard work. After high school I worked a little bit in the oil field in all kind of dirty jobs,

met a lot of nice people, had a good time. I guess I learned, probably at that time, that I didn't like a lot of repetition in my work. You know, it's fun to do things, but when I have done them, then I want to go with something else.

About that time I got drafted in the Army. I guess that was the next major event. I did go to TCU [Texas Christian University, Fort Worth, Texas] for a couple of years and met my wife [Mildred Hopkins from Cleburne, Texas] there. Very shortly after that I got drafted in the Army, and that's probably where I developed a desire to be an engineer and get into the technical things of the world.

After normal basic training I was fortunate enough to be sent to radar school. I knew nothing about electronics or anything like that, but I found it very interesting. The end result of that, I was supposed to go to Korea with an antiaircraft battalion, and things happened such that I went to England instead.

The main job over there was to shoot radar patterns, clutter patterns, of all the airfields in England, which was a fine detail because I got to work with the Sperry engineers and I saw a lot of country, met a lot of nice folks over there, but I found out those engineers had a pretty good job, lived a pretty good life, and I decided right then that when I got out of the Army I was going to go back to school and be an engineer.

So I went to Texas Tech [University, Lubbock, Texas] on the GI Bill and went through four fun years at college. [Having received a BS degree in Electrical Engineering,] I went to Hughes Aircraft in Tucson, Arizona, and worked on the Falcon missile program, and that was really fun, but after two years it started this repetition thing, you know. I started doing things over and over.

So I signed on with Lockheed [Aircraft Corporation]. They were right in the middle of developing the Polaris missile program, and I stayed with them about three years, I believe, if I remember right, and rode the submarines and installed missiles on, I think, five different submarines, and worked on two submarine tenders, the large support ship that worked with the submarines. At Newport News [Virginia] we were building the USS *Sam Houston* nuclear sub, and since I was the only Texan [on the Lockheed team], I got to go out on the sea trial and spent almost a week on a submarine, which was very nice, and ended up in, let's see, Bremerton, Washington. I did a lot of troubleshooting on various subs from coast to coast. We moved, probably, twice [a year].

Again, the repetition thing starts creeping in. Although very interesting work, we started doing the same thing over and over again. So when we finished the submarine tender—I believe the name was *Simon Lake*—at Bremerton, my next assignment would have been Groton, Connecticut, to build another submarine—not build the sub, but install the missile system on it. I decided, "That's too cold. I've been there, seen that, done this. I want to go do something different."

The space program was in full swing. They had, I believe, several Gemini flights at that time under their belt. So I called a friend in Houston, and in a few days they sent out a very nice fellow to interview me, and shortly thereafter we moved to Houston and joined the space program. Greatest thing that's ever happened. I can't think of a single minute that I didn't enjoy going to work.

I was assigned to the Apollo program. Gemini, as I mentioned, was already in full swing. So I got in on the very ground floor of the Apollo operation and assigned to the command module portion of it. I knew right then that I was going to be with this job a long,

long time. I could just see all kind of good things happening there. I guess that's a real quick and dirty synopsis of how I got interested in engineering and that sort of technology and how I ended up at JSC [Johnson Space Center].

BUTLER: Well, that certainly is an interesting path to take, starting out in the oil fields, going to the Army, and ending up on submarines, of all things. Not something you would normally expect.

Did much of your early work with the Falcon mission at Hughes, with the Polaris at Lockheed, did much of that come into play with your later experiences at NASA, or were you in a pretty different area?

PERNER: No. I guess I'd have to say that all of it kind of played together, one thing led to another, in a good transition of experience. When I started here I was in the Flight Crew Support Division, and our particular section developed the displays and control panels for the Apollo command module. So, you know, there was procedural development work, certainly design and layout of components, and all that I did in the previous jobs. So it helped. My experience in the past operations was beneficial.

I guess an interesting point about that time, I wanted to get my professional engineering license. Although NASA didn't require it at that time, I thought it'd be a good thing to have. We took tests at Texas Tech while I was still in school that would support getting that license, and somehow or another those records got lost when I called for them. So I called Austin and asked them what I needed to do to make a run at this license. They said, "Well, you've had some pretty good experience. If you could come up and show us

some of the things you've done to the Professional Engineering Board, then we'll make a decision on whether to issue you one."

So I took the command module display and control drawings that I had helped with, marched up to Austin, laid them out on the desk, and those guys, I couldn't get them away from it. [Laughter] They were very fascinated with the space program, with the things that were being done, and the direction we were headed, and in a few days I had my license. I thought that was a pretty good mark for NASA, to impress those guys.

BUTLER: The space program certainly does capture the imagination of many.

PERNER: Absolutely.

BUTLER: When you came into NASA, you were from Texas originally, so moving to Houston probably wasn't too big of a shock. And getting back into a warmer climate, as you mentioned, the other one was too cold. What was the atmosphere at NASA like when you came in? Things were gearing up for going to the Moon. You said you moved right into Apollo. Was everything flowing pretty well at that point?

PERNER: Well, I can't say it was flowing smoothly, because they had just moved from their offices downtown Houston. I understand they had offices scattered around pretty good waiting for the new center to be completed. When I got here in 1964 or thereabouts, they had finished most of the permanent buildings. I moved into Building 4, and it was still being straightened out and painted and put together. So there was some confusion because of the

move from Houston into the new center and completing the new building. But everybody was getting their job done. I mean, it wasn't slowing down the space race in any way. They were still developing organizations, assigning members, and recruiting people, and that sort of thing.

They had some really good people. I guess that was the most impressive thing for me. I've worked with mostly military in the previous jobs, and these people came from everywhere, all the managers. I'd heard they were the best talent in the world, and I certainly believe that's true. So I was very impressed with my co-workers and their ability to get things done. I learned a lot from them real quick. I thought I knew a lot when I stepped in, but I found out there's some talent out there that people can't even imagine. So everything got started very efficiently and quickly.

BUTLER: It's fortunate to be able to work with a group of people like that.

PERNER: Absolutely.

BUTLER: Not many can say that.

PERNER: Absolutely.

BUTLER: You said the first things you involved with where the crew stations, the displays, the control panel. At what stage was the Apollo program when you came in? How many

designs had already been done, and what areas specifically were you working on there? Or was it all still being done?

PERNER: The basic configuration had been approved and bought off. You know, we knew what it was going to look like, we knew what the volume was going to be. The job that was in front of us—and all my work had dealt with crew interfaces. I didn't worry about the structure and things of that nature. We took the basic shell and put the furniture in it. And that was another very enjoyable part of the job I had because everything we did that involved the crew, anything they touched, could see or smell, we got involved in. So obviously, the displays and controls was a major element, because the crew can't do anything without controls and visual cues and so forth.

You mentioned stowage earlier. That was a major part of it. You know, volume and weight and those sort of things is very critical in any space vehicle. So we had to design and fit in storage compartments, and none of them were just square boxes. You know, you had to use the space that you had available.

The displays and controls required development in such a way that you could control all the machinery involved in the spacecraft, but also you had to work with the crew to make sure it was something they could use and would use. So it was a one-on-one kind of arrangement, which was very nice. Our astronauts are tops.

The job included food. We had a big camera operation. As you know, a lot of photography took place in those times. And clothing...[material was] very critical. And the outgassing was a big problem. When you go into space in a vacuum environment, things we don't pay much attention to in everyday life, odors, gases, and so forth, come from these

products so you had to be very selective in the materials you used. Quality control, as you know, is and has always been a number one issue. Things had to be fail-safe, in other words. So those were the general areas that we dealt with, I think, primarily.

BUTLER: There's so many different factors to take into consideration here. As you were saying, you were dealing with the furniture inside the shell. How would you decide where things went, especially with the controls since there were so many different systems that had to be accessible? How would you decide the layout on those? You mentioned the stowage, you had to kind of fit it where it would, but—

PERNER: Of course, a space capsule is a form of an aircraft, I guess, so we took a lot of ideas and concepts from the aircraft industry. All these astronauts, especially at that time, were real good aviators with thousands of hours of flight time. So they contributed to the development of the layouts. Obviously, you want them so they could see them good in heavy G environment and zero G environment. So you work together with those folks to make sure they're in the right place, the lettering is large enough that you can see. Lighting was always a problem, but we got a lot of that from existing designs. Then the thing you had to do was shape them so they would fit in the vehicle.

I guess materials was probably the most difficult factor to deal with. If you'd come up with a layout, you know how you wanted it to look, but what do you make it out of that would use very little energy, would be very visible, didn't generate any heat, no outgassing, not flammable. So you deal with all those sort of factors when you put this together.



We had a lot of people around to keep us honest and out of trouble. We would come up with what we thought would look good, work good, suited everybody, and then you had to run it through the quality-control folks, which is a treacherous path because they check every single thing, you know, over and over and over. If they approve it, then you're in business. If they don't, they'll come back and tell you why, and you go find something that will work better.

I guess another real nice thing about NASA, they had all kind of facilities to check these sort of things. You know, White Sands [Test Facility, New Mexico] was a major proving grounds for a lot of the new materials that we'd come up with, and so it didn't take very long to run it through their loop. They'd either throw it out or tell you to go ahead.

Finding materials back in those days was a big issue. We used a lot of new stuff that nobody had ever had to worry about. In contrast with building ships and submarines, they could care less about weight. You know, the stronger, the better, and if it's heavy, fine, that's not a problem at all. But in aircraft, and especially the space vehicles, that was a major item.

BUTLER: Certainly was suiting your need for new and different things.

PERNER: Absolutely.

BUTLER: You mentioned working closely with the astronauts doing all of this, since they were the ones going to be using it. Were you also working closely with the contractors then?

PERNER: Oh, yes. That's an interesting thing about this place. Everybody works for NASA, but when you go in and start looking at the details, there are not very many civil servants, you know, pure NASA guys. The majority, vast majority, are support contractors. Without them, there would not have been a space program. Their contributions were—you can't even describe it.

My interface at that time, back in the early Apollo days, was North American [Aviation, Inc.], which later became Rockwell [International Corporation], and they were the big contributors to the building of the vehicle and most of the design work on it. I guess our job, we did contribute to designs and ideas and testing, but we were probably the pushers, to make sure that they delivered on schedule, that they went through the right test procedures, that we were getting safe equipment and, of course, keep it within budget. So we found ourselves managing in that light more than the day-to-day hammering out metal and delivering a usable product.

That was a good position to be in, you know, because you had access to all kind of the different ideas that were coming in, and you could help select the ones you thought were best and proceed with them.

BUTLER: Certainly an interesting role to fill.

PERNER: Absolutely.

BUTLER: You talked about the differences between the Apollo spacecraft and submarines, ships, and such like that, and the similarities with aircraft. Were you able to build on any of the work that had been done on the Mercury and Gemini capsules?

PERNER: Certainly. Those experiences and results were viewed very carefully in developing Apollo. We didn't want to put something in the command module that didn't work in the Gemini capsule so we stayed in close proximity to everything that was going on there. In fact, people in our section were on support teams that supported the astronauts in the Gemini flights, and those results were fed back to us...in real time so that we could benefit from them.

I did not participate directly in the Gemini flights, other than to go to the debriefings and hear the pros and cons of their experiences, but absolutely, it was step functions right up through the Shuttle. We used everything that was learned in the past to do things in the future.

BUTLER: Certainly very important to employ those lessons learned.

PERNER: Absolutely.

BUTLER: Were you involved at all with the trainers that were used for the simulations for the missions?

PERNER: Yes. In our division, I guess at least a third of the division was devoted to crew training, and you learn an awful lot when the crews go and do the training exercises. You know, we'd put a mock-up out there or simulator—our job was primarily mock-ups—and the crew would go in and run through their procedures, and they would invariably find things, "Hey, this isn't going to work. We need to do something different."

We would immediately take those kind of comments and feed them into our design loop. The beauty of having the mock-ups in our division, we could very quickly put in new ideas, take crew comments and incorporate them into the mock-ups and training vehicles, and they would say, yes, this is going to do it, or, no, let's move it a little to the right or paint it green or what have you. So absolutely, the training program supported very closely the design efforts.

The division again, the Flight Crew Support Division, was under [Donald K.] "Deke" Slayton, and the astronaut corps was under Deke Slayton, so we had it all in the same directorate, which made it convenient and efficient, I think. I don't think any design was ever even presented to a change board for approval or consideration without it first going through an astronaut loop of some kind to make sure it was something they felt was reasonable. They didn't always agree with it, but it was good business to have them in the early stages of it. They're a pretty sharp bunch.

BUTLER: That's good. Well, they certainly were picked as some of the prime candidates from their area of expertise as aviators.

PERNER: Yes.

BUTLER: Shortly after you had come to NASA a few years, you had been working on Apollo for a while, and the Apollo 1 fire happened, which was a great tragedy for everyone at NASA. There was a period of recovery there and some redesign. Can you discuss anything that you were involved with in that redesign process?

PERNER: This is the fire at the Cape [Kennedy Space Center, Florida], where we lost [Virgil I.] Gus [Grissom] and [Edward H.] White [II] and [Roger B.] Chaffee. We thought we had done everything possible to make that [vehicle] fail-safe and crew-safe and all the trimmings. We just overlooked the oxygen aspect of it and the flammability aspect. That was a tragedy, absolutely, a tragedy, in retrospect, that helped us later on.

When that happened I was selected to go down to the Cape with Dean [F.] Grimm, and he and I spent I don't know how many weeks. They gave us a whole building, and they brought pieces and remains off of the command module. We laid them out in this room like they would have been, you know, in the right position that they would have been in the vehicle so that we could understand how the fire propagated, what was damaged, and we hoped to find out why—which we did later on. That was not a fun job. I guess it was a contribution to a better spacecraft later on.

We did learn an awful lot from that and hopefully put designs in place so that it would never happen again. It hasn't yet, and I hope that everybody's learned from that experience. But probably, next to the *Challenger* thing, that was probably the worst setback in the process of building the spacecraft. I can't think of how anything would be worse than that. But that happens, you know. Many an airplane has crashed trying to develop new

designs, and they get better and better. People learn from those problems. We just thought we were smart enough that they would never happen.

BUTLER: As you had mentioned before, there were so many factors that had to be considered that sometimes not all of them are caught.

PERNER: Yes. I don't think you'd say we made a mistake. It was just [that] we overlooked something, and we fixed it.

BUTLER: That's the important thing, that you were able to build from that and fix it, to make it all work, that you're able to learn from that.

What were some of the changes that were made to the capsule?

PERNER: Well, the obvious, the immediate changes, we would not put anything on the spacecraft, clothing, food, anything, that had flammability characteristics. I won't say you can't make it burn, but it wouldn't support combustion. In other words, if you put a match to something, it might flame up but then it would go out. It wouldn't just spread like the oxygen crew compartment did. Of course, the cost went up. We had to come up with brand new materials that would not burn or support combustion. Clothing was one that probably aggravated the crew more than anything. You know, there's nothing more comfortable than a nice soft cotton shirt.

We came up with—when I say "we," I'm talking about hundreds, maybe thousands, of contractors across the country working on these things, but the material that comes to

mind was called beta cloth, really pretty white material, and just as irritating as it can be next to you. It was fairly tough, but if you flexed it a lot, it would give off dust and this sort of thing so it had to be coated with special materials that wouldn't support combustion. Again, outgassing was a problem. Many a test was conducted at White Sands to make sure that all this new stuff we were putting on board didn't generate odors, noxious gases, and so forth. So that was the big thing, and that took time. That caused us schedule problems.

I'm trying to think of some examples other than the beta cloth of brand-new material. Nothing comes to mind right now, but there was a lot of time and money and effort spent developing this sort of thing.

BUTLER: It's certainly important to have those developments, worth the time and money put into it, and the program did still recover in a timely fashion.

PERNER: It did.

BUTLER: It took about eighteen months, I think, to get back.

PERNER: Yes. I think that's right.

BUTLER: With coming back on line with flight status with Apollo 7, that must have been a rewarding time, to see everything go so well with that mission, from a technical standpoint especially, and there were no major problems at all with the spacecraft during that time. Was that a morale-builder for the center?

PERNER: Oh, absolutely. I think people had been working—you know, it was nothing to come out and see guys out here that'd been on the job for twelve, thirteen, fifteen hours. You didn't think anything of it. You're trying to meet schedules. I guess what I'm saying is everybody worked real, real hard. I think that Apollo 7 thing kind of stirred folks up, so they wanted to do real good to make up for that.

I remember—I guess [Frank] Borman's flight [Apollo 8] around the Christmas time frame where he circled the Moon was a real shot in the arm, "Hey, it's going to work." And when [R. Walter] Cunningham and his troops, Wally [Walter M.] Schirra [Jr.] and [Donn F.] Eisele, I believe, became the first manned Apollo flight, when that was successful, you had to feel real good about that.

You've got to remember, during this time we were really in competition with another country, and although we tried not to pay any attention to that, it was a factor. We wanted to be the first ones up there. That goes back again, I think without the leadership and management that we had at that time we would never have been as successful. It would have eventually happened, but we had some folks that were willing to step up and say, "Hey, we're ready. Let's do it." And we did.

BUTLER: Certainly did. Certainly did. The missions did go very well, leading up to the landing and even beyond.

What were your duties during the mission times, when they were actually up flying? Were you providing support in any way for the missions?



PERNER: Yes. I guess my particular area, we supported from two different directions really. I was a subsystem manager for the crew station, and there were many subsystem managers across the center, you know, the ECS [Environmental Control System], the propulsion, electrical, communications, and so forth. Direct support during the mission came from the flight directors, which were the key folks, the ones you read about and you see on television. In the back rooms, and we called it the MER [Mission Evaluation Room], I believe, the subsystem managers and the design engineers congregated during a mission, and we were in direct contact not with the crew but with the flight directors. We monitored our systems, so to speak, throughout the mission, twenty-four hours a day, had shifts going.

We were just next door to the flight directors, and anytime the crew had a question or the directors had a question, they would funnel it into the MER to the appropriate subsystem manager, and he, with his team, would resolve any problems, get answers back immediately. So we supported from that standpoint. I believe MER stood for Mission Evaluation Room. I'd have to check that.

BUTLER: I think that's right.

PERNER: But anyway, that was its purpose, backup support for the flight directors, and they really earned their pay over there. Those were hard working guys. I think that was headed up by Don [Donald D.] Arabian at that point in time. You have heard of him, a fine fellow.

BUTLER: I sure have.

PERNER: The other thing that our division did, we had the mock-ups and the trainers. When the crew would have problems with a procedure or difficulty in locating something or a device would not work, we could go out in our mock-up and trainer—they were fully staffed the whole time the mission was going on—and we could duplicate the problem and, in most cases, come up with a real quick solution. So having that facility available during the mission was a real asset. That was part of our operation.

BUTLER: Can you think of any particular incidents from the early Apollo missions where you did contribute in this way, either by using the mock-ups or through the back room?

PERNER: I can't remember the flight exactly, but there was one, they had a water leak. We had a water dispenser in the command module for drinking water, and, of course, you had to reconstitute the food. They didn't have the frozen food deal that we've got on the Shuttle. And they couldn't stop the water leak. So I was asked to go out in the mock-up and duplicate that problem and come back with a fix. I was able to do that. I got more credit than I deserved for that, because a lot of people contributed, but that was one that comes to mind that saved them a lot of trouble up there that they appreciated.

BUTLER: That was certainly important. You've got a limited space in that capsule.

PERNER: And a lot of times, you can't imagine the number of different pieces of equipment that are stowed on board that little bitty spacecraft. Of course, to get it all on, you put it in every imaginable spot you could find. So it was not at all unusual for the crew to call down

and say, "Hey, where is the fifty millimeter lens for the Nikon camera? I can't find it." We would be in a position to pull out drawings and very quickly help them locate anything on board. If they had trouble loading a film pack or operating a food package, we could get them real quick advice on how to do that.

BUTLER: You mentioned the early Apollo missions, Borman's mission going around the Moon, being a real shot in the arm. What are your thoughts on Apollo 11, the mission that actually achieved the goal of landing on the Moon for the first time? Do you remember where you were and what you were thinking?

PERNER: Oh, absolutely. I don't know if I stood up and yelled or what. I know I felt like it. It was really an accomplishment that's hard to describe. All these years of working on this stuff. And I've got to tell you, there was times when we'd get together and say, "Well, yeah, we may get to the Moon, but if we get up there, we'll probably never get back." You know, there were doubts in everybody's mind about how successful we could really be, since it was something that people never even dreamed would happen. And when it actually took place, it was quite a feeling.

I don't know, but you probably have read and have heard a lot of people today, still, "Hey, they never got there. That was all Hollywood." I'm a ham operator and receive a ham magazine, and the owner of that magazine, I don't think he's ever put out an issue that he isn't stating facts that say we never got there, that it was all faked. I don't know if he does it to sell his magazine or what. I keep reading it because to me it's funny, just humorous, a guy

that's intelligent enough to own and put out a successful magazine, yet he really believes that. There's something wrong.

My dad, a rancher, I think he was pleased that I got in this line of work and was somewhat successful at it. I don't [think] he ever really, deep down, believed that we got to the Moon and back. He just could not imagine something [like that]—he had very little education. He was a successful rancher. He was good at what he did, but his background just didn't allow him to really accept what happened.

BUTLER: Well, that's certainly a leap, especially looking at the technology that we have nowadays, that you were doing it with technology from the fifties and the sixties.

PERNER: Yes, I agree. I think that was really a job.

BUTLER: A very big challenge. Certainly an accomplishment and one to be proud of, though, with having done everything.

PERNER: Yes, it is.

BUTLER: We definitely did go to the Moon.

PERNER: I just wish more people could have had the direct experience and contact with that program. I say it'll never happen [again], but that's not right; it will, probably not in my lifetime. That's the only disappointment, really, with NASA. I just feel like we ought to be

going to Mars now instead of circling the shuttles. We're doing a lot of good with the [International] Space Station and I know it's preparation for the next program, but I'm impatient. I wish we could [have] turn[ed] the Shuttle over to contractors, another organization, and let NASA go to Mars. I think if that would have happened, I'd still be coming to work every day.

BUTLER: Certainly that is a good motivation for coming in.

PERNER: Going back to the repetition thing, you know, it reached the point where, in my opinion, we were doing the same thing over and over again. I never liked that. I always wanted to do something new and different. Plus I got too old, needed to step down and let somebody else play with it.

BUTLER: I don't think too old quite yet. You still seem to be doing pretty well here.

Well, looking at things being new and different, Apollo 13 was very much that way. Everything needed to be done differently than had been. Can you describe some of your involvement with that? Obviously they were needing new procedures, new ways to do things.

PERNER: Oh, yeah. I know it wasn't any fun for the crew, but I've got to say it was a challenge that a lot of people enjoyed on the ground. It was really a scary thing, never had happened before, one of those things that, you know, "It can't happen to us," but it did, and it was just absolutely amazing how people responded when that took place. I remember I was

at home, and I got a call, and it was still dark, and they said, "Hey, we've got a problem. We need everybody out here that's in a position to help." So I grabbed my shoes and coat and hopped in the car, and as I drove from Friendswood, where I lived, out to the center, I could see lights coming on, people getting their phone call.

Some of them stayed out two or three days straight without ever—living on coffee and doughnuts, doing whatever they could, and mainly to be there in case there was something that they can do. The MER room, again, was very supportive of that [flight]. Lots of procedures were developed, and as people came up with ideas to help correct some of the problems up there, we would go back into the mock-up and trainers and put them in place, always astronauts there to run through them with you, and some of [the procedures] worked, some of them didn't. If they worked, we fired them up to the crew through the flight directors. A really interesting time. We had absolutely top astronauts on board to pull that thing out.

BUTLER: And top people on the ground to help them pull it out. It would take everybody pulling together, for example, the teamwork you kind of talked about before.

PERNER: Always teamwork. Always teamwork. I don't think any one guy could take full credit for anything in the space program, and that's what made it nice.

Apollo 13 demonstrated that, hey, things could go wrong and you could work through them and get those guys back. Kind of a nice feeling.

BUTLER: Absolutely. And quite a success at bringing them back safely.

PERNER: It was, very successful. We learned things there, also.

BUTLER: Were there any significant changes made that affected your area after Apollo 13?

PERNER: Nothing that I can recall. You know, that failure occurred in somebody else's subsystem. Nothing comes to mind right now of a significant nature that we did after that.

BUTLER: Well, changes that were to come a little ways down the line, as they started during the longer duration Apollo missions, Apollo 15, 16, and 17, and stayed for longer times, taking the Rover with them, bringing back a lot more samples, taking more equipment with them, what sorts of changes did that inspire for your area with the command module systems?

PERNER: The biggest problems on the long-duration missions, and of course, every follow-on lunar shot, people wanted to put a little bit more of this and a little bit more of that in there, and the command module reached its capacity very quickly. It was designed to have everything secured in a locker or enclosure of some kind. We quickly ran out of space.

I wish I had pictures of some of the loss configuration command modules. We ended up—you know, just the fact that you didn't have a locker to put something in didn't deter these scientists one bit. They'd go to a change board and absolutely demand that this had to fly, and it was important, you know. So our job was to find other ways of stowing equipment

in the command module and then providing space to bring more rocks back. [Our drawing is] almost like a cartoon.

For every flight we developed a configuration drawing<sup>a</sup> that showed the location of every single item and how it was to be stowed, procedurally and otherwise. So we got to the point it looked like our configuration drawing was a cartoon. We'd have stuff in the floors actually tied down with ropes and tucked under the crew couches. It was really not a professional-looking job, but it was the best we could do and it worked. So as long as it was safe, you know, we could tie it down and restrain it, it was acceptable.

Once we got it to fit, then the next job was getting it by the structures people. You know, they were about CG and weights. You couldn't just put everything over in this corner. You had to distribute the load in such a way that it would be safe for landing, aborts, and what have you. So we had to take our cartoons and run them through the Structures and Mechanics people, and they'd do the weight and balance analysis and make sure that the thing would fly once we had all that stuff in there. That was probably the biggest impact. Of course, more food, more film, more cameras, and all that, but that's what made the job fun, every flight was different. No redundancy. I never got tired of doing the same thing because we never got a chance.

As you probably know, before each flight you'd go to the change boards over in the program office and get the configuration approved. Any change and you had to go back to that board and get that change approved. It got to be almost a daily routine for me to go over and say, "Sir, we need to add this. Its gonna weigh this much. We'd like to put it here." They would review all that.



They started out with Joe [Joseph F.] Shea chairing those boards, and then Kenny [Kenneth S.] Kleinknecht, Dr. [R. W.] Lanzkron, and they were very good at what they did. I'd leave those boards bloody sometimes because I wouldn't have my presentation prepared as well as it should have been for them, but I really admired those guys. They kept us honest, and they made sure it would work before they'd approve it.

BUTLER: An important consideration.

PERNER: Absolutely. Best management in the world. I wish our government had their help.

BUTLER: You certainly did have some pretty outstanding managers through the program.

The Apollo missions, then, eventually have to end, unfortunately. I think a lot of people would have been happy if they could have continued. What were your thoughts with the ending of the Apollo program?

PERNER: Of course, it was probably one of the most successful programs, I feel, that the country's had. We'd all like to keep sending people up there and do different things, but we had plenty to do following Apollo because Shuttle was coming on. We'd already started playing with the Shuttle, doing displays and controls and laying out crew compartments, and building mock-ups and trainers and evaluation items. So there certainly was no boredom in the space program when Apollo ended.

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<sup>a</sup> The configuration drawing was the only NASA drawing in the Apollo drawing tree. All the rest were contractor drawings.

My job continued on in the same direction. I guess by then I had got out of the fun level. I'd progressed up the management chain a little bit, and I had to worry more with people than hardware, which is a different challenge, not as much fun. It was a different job. I would a whole lot rather have been in the mock-ups poking around and trying out things than arguing with "Charlie" about why he wasn't going to get a raise this year and things of that nature.

So when Apollo ended, getting back to your question, it was not a big shock to the folks. Everybody's jobs continued, doing basically the same thing in just a different vehicle. We even had, for the most part, the same contractors supporting us. Rockwell was still in place from our standpoint.

Then, in a little bit higher management position, I got more involved in source boards and things of that nature, which I didn't worry about at all back in Apollo days. So that was kind of a different world. Of course, new contractors bid on the new program so we had that to do, and we had to have different facilities.

We had to update our mock-up training facilities for a different vehicle, and we very quickly learned that what we had for Apollo was not big enough for Shuttle. So I found myself going to C of F boards, Construction of Facilities, where we go and ask for money so that we can modify or even build new buildings. I was fortunate enough to get enough money to add on to Building 9A, which was the big mock-up facility. We nearly doubled it in size to support Shuttle. That's a real experience, to go to Washington [D.C.] and beg for money when you have what, seven or eight other NASA centers competing for the same dollars, kind of a competition. I enjoyed that. It was different. I'm not a good speech-maker, as you're finding out.

BUTLER: Oh, you're doing fine.

PERNER: But I did have the opportunity to make a lot of presentations and to show why our need for the dollar is better than Ames' [Research Center, Mountain View, California] or somebody else. We were successful. We got a lot of new buildings put in place.

One in particular that I am fond of, our WET-F [Weightless Environment Training Facility]—we've had three different water facilities. The first one started out as an old oil storage tank, and it supported Gemini very nicely, kind of gave us a little bit of help in Apollo. Then we built what we called the WET-F. They had a building at NASA—maybe you never saw it—where it had a centrifuge in it, a very large centrifuge that was used for the early tests. When those were completed they no longer needed that centrifuge or the facility so they took all the hardware out and we built a big swimming pool in there, and it's called the WET-F. I guess it's still there today. I'm not sure. It served a very good purpose.

All the astronaut training and equipment evaluation was done there for Apollo. We used to take them out in a barge out in the bay, and they'd go through rescue training and ingress, egress, and all that. But that's kind of weather-critical, and you couldn't take pictures under water most of the time. So the WET-F allowed us to do all those things in a controlled environment. You could train the crew in December without them complaining too much.

But when we got to Shuttle, although we used it for a long time, Shuttle filled the whole thing up. We found out that, for Space Station, which was coming on, a follow-on to the basic Shuttle, we needed a big swimming pool. So I counted fifty-two presentations [that I made] trying to get money to build what we now have out at Ellington [Field], that water

tank. Our WET-F people decided we just could not support the Shuttle-Space Station interfaces with the current water facility.

So they came to me and asked me if I would put a pitch together and go to all the centers and present this thing. I mean, we're talking [200 x 400 x 60 feet]—deep, a lot of water, because you can't get C and F money if you don't have the rest of NASA supporting you in some way. If you go and say, "I've got to have a water tank," and Marshall [Space Flight Center, Huntsville, Alabama] sits over there and says, "No, you don't need one because we have one," well, you're dead.

So with the help of Vern [Vernon C.] Hammersley [Jr.] and Mike [Michael S.] Brzezinski [Jr.] and the people that really know water facilities, we put this pitch together, and I went to all the NASA facilities, got an audience with them, and presented this rather lengthy package of what the configuration should be and why we need it, hopefully to get their support.

When I went to my management, everybody said, "That's the craziest thing I ever heard of. Nobody can build something that big," but we were talking at that time forty or fifty million dollars to put this together. But we just bowed our neck and went ahead and presented it. Surprisingly enough, the other centers were all for it. They didn't believe I'd ever get the money, but they could see...that [it] would support their programs, because nobody had a really deep-water facility.

I quit counting after fifty-two presentations. I went to Washington, presented it to anybody that would listen, and it got shot down several times and almost forgotten about, and we'd dredge it back up and go at it again for the next C of F cycle. Finally, we had enough

people agreeing that, in order to provide the training you need and the engineering evaluation support, you're going to have to have this big tank.

Oh, and prior to that, everybody would say, "Well, there's bound to be something like that already in this country. Let's use what exists. Don't spend money on something new." We went to Hollywood, we looked at the Caribbean, anyplace that had clear water, and there's just nothing like it anywhere. The only people that came close to it were the Russians. They did have a real large tank. But the logistics, obviously, would not be too swift there.

So anyway, we got people interested in it. The Space Station Program people agreed that we needed something like that. So it started looking pretty good again, and we even had a location marked out here at JSC to build the building. We had the design, had [an] architect set the whole thing up, [but] we just couldn't come up with the right dollar figure.

At the same time, in support of Space Station, they built a huge facility out at Ellington. It was going to be where you could bring all the Space Station pieces together, flight hardware, and put it together and then ship it to Florida. That scheme played out. They decided to do all that assembly work at Florida. So the building wasn't needed anymore. George [W. S.] Abbey said, "Well, hey, you've got this big building out there. Let's dig a hole in the floor and put your swimming pool in there." So that's where it is today. It finally happened, and I got to see it before I walked out the door.

BUTLER: Did you get a chance to take a dip?

PERNER: Quite an accomplishment.

BUTLER: Absolutely, and that certainly has played a critical role in the space station program, Hubble [Space Telescope] as well.

PERNER: Absolutely. I understand it stays very busy over there now. It's a one-of-a-kind facility.

BUTLER: Talking about the facility out there, as well as the original WET-F, your involvement with that actually was from the crew interface aspect as to how they would be doing different procedures and such with the equipment. Were you also involved in some of the setting up from the safety considerations? There was an incident at one point with the WET-F where there was problem. Were you involved with any of those details?

PERNER: Well, we had several small incidents with the WET-F. I can't think of one specifically where anybody was permanently damaged. There was a fatality in the original—not in the tank. I'm talking about the old oil storage, the very first one. We used battery packages to work lights and things in the tank, rather than putting extension cords over in there, and while they were charging one of the batteries outside the tank in preparation for a test, it exploded and it killed one of our support guys. But with the WET-F that you're mentioning, I don't know of any [fatalities]. There was some accidents and some problems, but I don't know of anything that was—is there something you had in mind?

BUTLER: I think there was one where someone had had an incident where they had gone down and had to be rescued, a near drowning-type incident.

PERNER: Yes, and I think we may have had more than one of those. You know, anytime anybody's in the water, we have several support divers in the water with them, and they're monitored continuously. There was a time or two that the support—they were glad the support divers were there, and they brought them up, but we didn't lose anybody. By the way, you mentioned that, the new facility, have you seen it?

BUTLER: Yes.

PERNER: It's something else, you know, with video monitoring of everything that goes on, and the safety aspect of it is—I won't say it's perfect, but it is really up to date.

BUTLER: You always have that opportunity to learn from any small incidents that would occur.

PERNER: Right.

BUTLER: It's certainly a big part of training for the space program, using the facilities.

PERNER: It is. It's the only way you can really realistically simulate zero G. You can go up in the "vomit comet" [KC-135 aircraft], if you will, and duplicate it for a few seconds, but you can't do any long term procedural work and hardware evaluation in that airplane. But you do a pretty good job of it in the water tank. You can go through all the maneuvers and

procedures. You're not pressed for time. Although I've never had a spacesuit on, I've heard astronauts say that they've learned a lot about wearing that kind of an enclosure just by going through procedures in the water tank. So it probably helps a little bit there.

BUTLER: Were you involved with designing the different systems to be used in the tank? Obviously, things would have to be done slightly different so that they could be used underwater versus what they would have in the mock-up or simulators.

PERNER: Not really. My division was responsible to put that stuff in place, but I've got to give credit to the support contractors. They did most of the development work. Our NASA folks would come up with some basic requirements and maybe some concepts, and then the contractors would go off and come up with a way to accomplish that.

Johnson Engineering was a major factor in our water facility. They did all the support work. They supplied the divers and came up with some pretty good ideas on how to make it better. So I think they should get a lot of credit for our success in that world.

BUTLER: A couple of times in the Apollo program, dealing with the water facilities, the interaction between the NASA civil servants and the contractors, obviously having to work very closely together throughout this time frame, but were there ever challenges because of the difference between the civil servants and the contractors?

PERNER: I don't know of any. You know, there's always going to be disagreements and, "Hey, you're wrong. Let's do it this way" kind of things, but I think the working relationship



between the support contractors and the—those same contractors supported our mock-up world also. We had the same contractor in both places. I'd say the relationship there was excellent.

Maybe the way our source boards work contributes to that. You know, when you're selecting a support contractor, the users of that support play an active part in the selection of the contractor. I've always liked that. I thought that was—as a division chief at this last source board, when we picked Johnson Engineering, I felt like our division played a major part in selecting the contractor. [We] picked them because [we] liked them and because [we] thought they could do a good job and [we] could work with them, and all that's important.

So there shouldn't be any conflict. You know, you picked the one you thought would be the best. If your choice was right, then it would work. I don't know of any problems there. I think our support contractors and NASA harmonize pretty good.

BUTLER: It's certainly important for the success of the program that's needed.

PERNER: Yes. Without support contractor help, nothing would have happened.

BUTLER: Going back a little bit, were you involved with the work on Skylab? The command module part was the same as for Apollo, although again different considerations for what do you put and where to get it up there and back. But then, the workshop itself, did you have any problem with that as well?

PERNER: Skylab, that was a great program. That was our first space station. That first proved some of the best astronauts we had, Dr. [Joseph P.] Kerwin with Paul [J.] Weitz and [Charles] "Pete" Conrad [Jr.], I think, and they made it fun. Those guys were just princes to work with. Skylab, kind of—here we are back to the routine—it kind of broke up the Apollo routine so we could do something different, and it was different. You know, they took some big module, I forget now what it was, and converted it into Skylab, a big orbiting laboratory.

My job in developing the interior of Skylab was not really significant. You know, we offered suggestions that worked in the command in the LM [lunar module] they incorporated in the Skylab, and of course, the flight up to the Skylab was something we'd done many times. It had docking probes and some equipment there that was a little unique.

We played a major role in how we would outfit the Skylab, you know, what kind of food you'd take, how many pair of pants and the clothing. We supplied the camera gear for that mission. All that was done in management from our world, and Skylab provided quite a bit of excitement on the maiden voyage. You know, one of the big sails wouldn't deploy and they couldn't get the power they needed, but Pete and Dr. Joe and [Paul] fixed that.

Here again, our mock-up facility played a major role in being able to salvage that mission. We were able to duplicate the big sails over in the mock-up under the leadership of Don Arabian. I think he was assigned as a project leader on "Hey, it's broke, fix it. Tell us how." He used our facility and our people to go over and do the engineering on that, and they were able to kluge things together and make it work up there. It was a lot of fun. That was a good program.

BUTLER: Certainly did satisfy that new and different—

PERNER: Yes, it did.

BUTLER: I guess aside from the initial problem with the launch and the difficulties in getting the station back to an operational standpoint, from your perspective, with the storage, with the transportation of materials back and forth, what would you have considered the biggest challenge in all of that for Skylab?

PERNER: I can't think of any real show-stoppers. We had a continuous strings of questions. You know, it was a new vehicle, a new setup. How do you do this? Where is this? It was a big volume compared to the command module and had a lot of stuff in it. So we stayed busy helping them locate things. But I can't recall any really major issues that we were involved in from our part of the world.

Is there anything that you were aware of that—

BUTLER: No, nothing in particular. I thought I'd see if anything stood out for you. So you were involved, then, again, with real time support, then, as—?

PERNER: Yes, in the same way we did the command module. We had the MER room going.

BUTLER: After Skylab came Apollo-Soyuz [Test Project, ASTP], again a very different project, not so much in the spacecraft itself but in the involvement with the Soviets and getting that interface going, and I believe you were involved some with some of the

considerations on the docking module, since that was a different setup than had been used before.

PERNER: Yes, again primarily from a mock-up and trainer standpoint and little bit different stowage arrangements, but nothing really significant that I can think of. Again, that was a change of pace. And what made it more fun than ever, I guess, was having some of the older astronauts involved in that one.

BUTLER: Deke Slayton finally was getting his chance.

PERNER: He finally got up there. The bad news was that we lost him as a director, and he's one of the best managers and supervisors I ever worked under. Boy, I can't say enough good about him. Even though you were a "peasant," he never believed that. He treated you like you were right up there with him, and if you did something good, he made sure you got recognition. If you did something bad, he made sure you knew about it so you would not do it again. I don't know of anybody that wasn't appreciative of the way he supported them. Anyway, having him on board to work with was a lot of fun.

BUTLER: It was nice to see him get that chance.

PERNER: And they did a good job. I think the program was very timely and helped relations with two countries that really didn't like each other very much.

BUTLER: Were you surprised at all by the program? Here, you had been in competition with them for so long, and now doing this joint mission.

PERNER: Oh, not really. I think that had to happen. You know, two countries like that just almost have to get together and get harmonious on a space venture. I think that might have happened a little sooner than most people would have expected, but I think in time it would have come about. We were glad to see it. The Russians, my experience with them in Space Station, they're not the most pleasant people in the world to work with because they do things differently.

You know, they have a different attitude about schedules, and they conduct their meetings in a little bit different fashion, and I suspect they're sitting over there saying the same thing about us. We didn't always see eye to eye with each other, but boy, they're some sharp engineers, and it just took a while to get used to them. You know, they'd come over here, and we would extend our courtesies, and sometimes they were accepted and sometimes they weren't, but we managed to get the job done. Although I never went to Russia, the people that went over there regularly, after a while they didn't want to go back.

BUTLER: Definitely different than—

PERNER: It's different. But they're pretty sharp folks.

BUTLER: While we're talking about that, and you've mentioned Space Station here and working with the Russians in that capacity, what were the differences or similarities between Space Station as you were working on it just a few years ago versus Skylab back in '74?

PERNER: Well, of course, Skylab was a one-module unit, and it was owned and operated by the United States of America with no help from anybody else, which made it great. Space Station as we know it today, we just own a piece of it. I get the feeling sometimes we're paying the total bill but we only get to stake claim on small portions of it. You are interfacing with a lot of different countries. That's not all bad. It's just that you don't have the control and flexibility that you did when you had the whole operation.

I think because of the other nation's involvement, things go slower. You know, there's a lot of coordination required, give and take on design items. I left before all that started gaining fruition. It's good from a cost standpoint. Theoretically, they're sharing the cost with you, but from a design standpoint, you know, everybody's got an opinion so it takes longer to settle on a design that everybody's happy with. I hope it's successful. I want it to work real good because I want to see the next step before I check out.

I really would like to see a trip to Mars in the near future, and I don't think that'll happen unless Space Station is successful, if they can get all their differences ironed out. I think it nearly has to be a joint mission of some kind, the way things are headed.

But there are big differences. I mean, Skylab and Space Station as we know it today would be hard to—I guess they will accomplish similar objectives. You know, there's a huge zero G laboratory, and the Skylab, relatively speaking, was pretty small, but this other one,

you know, where you can go up there and live in it for a year, you can get a lot done. I'm optimistic. I think it's going to be a good program. I just wish they'd hurry. [Laughter]

BUTLER: I think that's one of the challenges of working with so many different partners, is hurrying is a little hard sometimes.

I'd like to take a quick break here, if we could, and go ahead and change our tape.

When we concluded, we were talking a little bit about Space Station. I'd like to go back and talk a little more about Shuttle. We talked about it briefly earlier, but some of your involvement there. You mentioned as the Apollo program was coming to a close you were already working on Shuttle designs, layouts. Shuttle itself was a very different vehicle from Apollo, from Skylab, bigger, more room for things, but also more that wanted to be done with it. If you could talk some about how you were able to pull together those designs for Shuttle, what some of the biggest considerations were there.

PERNER: Well, of course, Shuttle is bigger. You had more room, and for the most part, the mission durations were shorter. So that made it a little bit easier from our perspective.

It was no longer a space ship like the command module. You know, it got blasted off with a rocket, but it [the Space Shuttle] could fly, it could come back and land. So you had different kind of displays and controls and avionics to deal with.

You had the big cargo bay and EVA became more of an item in Shuttle missions. Apollo, the only EVA, really, was if you landed on the Moon and got out and walked around. You didn't have planned EVA. In a few cases we did, but it was not a major item like it is on

Shuttle. I don't know of many Shuttle missions where you didn't have at least one EVA scheduled. So that was an item.

It had the big airlock as part of Shuttle to support EVA. It allowed you to go in the cargo bay. You had the deployment and retrieval of payloads to deal with in the Shuttle vehicle. Most of those robotic [designs] were done by other people, but they still had an interface that we had to deal with from a display and control standpoint.

The training aspect, you still needed mock-ups, which we provided, and we were always trying to increase the fidelity of them, make them more realistic. So the challenge was there. It was a different enough program. We did the same kind of things but in different ways with different hardware. I mentioned we had to increase the size of our facilities for Shuttle. I don't know of anything really basically different. The crew still had to have food and clothing. We applied the same design constraints on those vehicles as we did in Apollo.

Kind of a digression a little bit. The Shuttle program brought on more tourists. Our mock-up area was not only a training facility, it was one of the major tourist attractions, always full of people that wanted to look inside and ask questions. The Shuttle laid out over there [in Building 9A] gave them an opportunity to do more of that than they could with an Apollo capsule so we had a lot of visitors, which is good. Everybody enjoys showing off their product. Even the Queen of England [Elizabeth II] came to see us. We got to show her some of the things that we did over there.

BUTLER: Wow. That must have been something.



PERNER: So it had not much to do with the space program, but we did have a lot of tourists and visitors that we took care of in our facilities, unlike some of the others at the center. But our job in general with Shuttle was not much—different configuration and all, but we still did the same kind of things. We still supported the missions and kept the mock-up current with anything new added. That was one part of our job, since it was very crew related. Not much could go on in the center without us knowing about it. If something changed that would affect the crew, then we got involved in it to some extent. That was kind of fun.

BUTLER: Got to be in the center of the action there.

PERNER: Of course, if something went wrong, we got involved in it. [Laughter]

BUTLER: That's the catch, yes. Certainly it's interesting that you mentioned the tourist aspect, and having talked about having to get the money to build the larger facility for Shuttle and to build the larger facility for the water tanks, the training there. Tourists are certainly a big part of helping get that sort of support for the space program. So it's good to see that there was that much interest, even if it might cause some logistical concerns from time to time when you're trying to do training as well as incorporate these people.

With Shuttle, a variety of new payloads and experiments were also being integrated into the whole mix. The big payload bay would even carry Spacelab as well as being able to handle the satellites. So a large variety of different types of things were going on. But did they all have similar interface into the whole system, or was there some differences there?

PERNER: From our standpoint, I guess there were not that much difference. The only thing that we worried about was size, and as I mentioned earlier, we learned very quickly that everything is going to be bigger in Space Station so we need larger facilities. We had to duplicate the configuration in volume of payloads to support training in the water tanks. They didn't have to be detailed. In fact, a lot of our stuff were rubber balloon kind of things, you know, just form factors. So we had to deal with that, and it's not that difficult. As long as our grappling fixtures and so forth would interface properly it wasn't a problem to us. We didn't have to put all the whistles and bells on. So I don't think payload configuration and design bothered us much unless the crew had a direct interface with it.

I'm trying to think. We had a payload that got out of control on one of the missions, and we wanted to retrieve it. It was a real heavy thing. I wish I could—I'll think of it on the way home. We had to duplicate that thing. The object was for the astronaut to go out and grab that thing and stop its rotation and then bring it back into the Shuttle. Due to its mass, that was a problem. So we had to duplicate the mass of that thing over in our mock-up. I can't think of the name of it. That was a challenge. It was so heavy, and we had to have the correct rotational speed, and then we'd hang a suited astronaut on the end of a pole, and he would go over and learn how to handle that thing. It was so heavy that we had to keep it rotating all the time, night and day, because if you let it sit very long, the bearings would change shape [(cold flow)], you know, just that weight without moving.

BUTLER: That's interesting.

PERNER: That was kind of fun to deal with.

BUTLER: That's certainly quite a challenge.

PERNER: Then rigging up a gin pole with the crewman so that he was perfectly safe was somewhat of a challenge, a little bit different than anything we'd done before. Of course, all that's in one G instead of zero G, so you had all the weight factors to deal with. I'll think of the name of that [payload]. But anyway, it worked. They retrieved it. I can't even remember the astronaut that ended up going up and doing that job.

BUTLER: I know which mission you're referring to, but unfortunately I'm drawing a blank at the moment, too.

PERNER: But those are the sort of things that we dealt with, with respect to payloads.

BUTLER: Certainly new challenges in that area.

PERNER: Yes.

BUTLER: Was this the same mission—actually, I think it probably was different. Were you involved with the mission where they ended up having to have the three crew members go out to capture a payload basically with their hands? This was in the [19]90s, and unfortunately, I'm not remembering the one now either, but what you were saying earlier made me think of it.

PERNER: I'm sure we were, to the extent I mentioned earlier, helping them with the training part of it. Unfortunately, in that time frame I pushed myself up to the division chief status and I didn't get down into the fun part of it so I can't remember details. I vaguely remember what you're talking about.

BUTLER: Well, there certainly were a lot of different Shuttle missions doing a lot of different things.

PERNER: Yes. You know, we had the [Hubble Space] Telescope repair mission, which was a real interesting operation, from our standpoint anyway, different hardware, a whole lot of different interfaces. We got to develop new tools and came up with some really weird stuff. But the guys down in the section and the mock-up area had the pleasure of getting into the nitty-gritty of that.

BUTLER: You've mentioned some of what you were doing at the higher level, dealing with budgets, making presentations, dealing with personnel concerns. Were there other areas that you were involved with now at this management level?

PERNER: Yes. Management is a whole different world. I can't say that I didn't enjoy it, because it was so different from what I started out doing, but I guess I never felt like I had the sense of accomplishment when I finished something from the management standpoint that I did when I put something down on paper and saw it fabricated and it worked. That's

always fun. But it's also kind of nice when you have a guy working for you or with you and he gets into a little bit of trouble and he's not happy with his job and you can work with him and get the problem sorted out and he's happy. That's nice, too. I guess any manager experiences that at one time or another.

But the big contributions I guess I made as a manager was going out and getting C of F dollars so that we could get the facilities we needed and being successful in getting good contractors that did what you wanted them to do and did it well. Of course, I served on safety panels and various things that support the whole center, just as one member of a large group. You have the opportunity to select people.

When I got my division chief job, we had a new division. It was sort of a new creation. It was called the Manned Systems Division. I later had to change it because it insulted the female race, and we went back to Flight Crew Support Division, the first division that I joined when I came to NASA.

Joe Kerwin was the director at that time, and he allowed me to go out and hand-pick the people I wanted for this new division, which was unique. I don't know of any other division that was put together that way. Our job, our charter, was to do the things I've mentioned over and over, to support the crew, the training, develop crew equipment, camera gear, food. So I could go all over the center and pick the people that I thought would do a good job in those areas. I thought that was really great because most of the time they say, "You're the chief. Here's your division. Make it work." You know, you didn't have the latitude of pick and choose like I did.

I had spent many years working with people all over the center, so I kind of knew a bunch of them and was able to pull them into my division, and it was so nice. I'm very

biased, of course, but I think we had the best, most efficient, happiest division in the center. There wasn't many weeks that went by that somebody wasn't requesting a transfer into our division. That made me feel good.

BUTLER: That's certainly a compliment.

PERNER: Coming up through the ranks, it helps. I'll argue with anybody that opposes that concept, because you know how it feels to be at each step. So when you have engineers and section heads and branch chief and on up, you know exactly—I served in all those positions so I knew exactly what their concerns were and how they felt they ought to be treated and I tried to do just that. Sometimes I was successful and sometimes I wasn't, I guess. Anyway, from that standpoint, the management job was fun. Getting away from the engineering and the hardware, I missed that.

BUTLER: It's certainly understandable that you would miss that. It's good that you were able to enjoy the experience, though, as a manager and make it a success for you.

PERNER: Sure. The problem was, I found myself going out into the shops telling them how they ought to be doing things. [Laughter] It was kind of hard to break away and do what I was being paid to do instead of trying to do what they were being paid to do. But we got along pretty good. Great bunch of guys. I don't know of anybody at NASA that people couldn't enjoy working with.

BUTLER: You've mentioned a few times some of the people that you have worked with throughout your career at NASA, and you've mentioned a couple of them by name. But are there any that you'd like to comment on in specific, either that impacted you personally in your career or that you think were critical for the space program?

PERNER: Oh, boy. We could spend another two hours bragging on people. I guess one that I'll always have pleasant thoughts about was Deke Slayton. He was the first director that I worked under and is such a fair, honest kind of guy.

People that I worked with and for, I guess George [C.] Franklin. I don't know if you've visited with George yet, but he was my division chief at one time, and I always thought a lot of him. He was also the LM subsystem manager when I was the Command Module subsystem manager. So we had a good interface during the Apollo program. George was a down-to-earth kind of guy, real sharp, came up with good ideas and knew how to get them done.

Outside the division and my management chain, I guess I'd have to mention Glynn [S.] Lunney. He was a flight director in the Apollo program when I was in the MER and subsystem managing. I always respected Glynn. He, after each flight, would have a splash-down party, and the flight directors usually were the promoters of it. We'd go out to Ellington when they still had the officers club out there, and he'd buy a few kegs of beer, and he made absolutely sure, to my knowledge, that everybody that supported him and the mission, he would come by and personally thank them. I thought a lot of that. He sure respected the people that supported him and let them know about it.

Milt [Milton L.] Windler, same kind of guy. He had a lot of responsibility and depended on his support people, and then he made sure they got recognition.

My program folks, gosh. I mentioned Kenny Kleinknecht. Scariest guy I ever was around, but boy, I sure did like him. He got things done. And he helped me. I believe he was instrumental in getting me a GS-14 when they were kind of hard to come by, said the right words to my bosses.

Of course, Aaron Cohen. There's no finer guy than that anywhere. Good manager, good engineer.

You can name nearly anybody that's manager out there, and I can tell you something good about them.

BUTLER: That's good. It's fortunate to be able to work with people like that.

PERNER: It is, and so different from other jobs that I'd had. In the Hughes Aircraft world and the Polaris world, excellent work but some strange folks every now and then that you run into. You know, they're off doing their thing, they're very dedicated at what they do, and they don't demonstrate the teamwork that NASA does. I think that's what made it so nice. You could depend on nearly anybody out there [at NASA] to help you when you needed it, and you always felt that they would trust you. And excellent place to work, or was. I guess it still is. I haven't been out there in a while.

BUTLER: It still seems to be pretty good.



Eventually you did decide to retire from NASA. Things were starting to hit that repetitive cycle, I guess, for you to some extent, with Shuttle going on. But before you retired, did you have any—we kind of touched on it earlier, but did you have much involvement with any of the early plans for Space Station or any of the Shuttle-Mir activities?

PERNER: A little bit. You know or maybe you don't know, there were a whole bunch of Space Station designs distributed around. In my opinion, they didn't pick the right one to go with. [Laughter] But we contributed and spent a lot of hours helping with those early designs, you know, describing what the crew compartment should look like. In fact, we mocked up a lot of configurations for analysis over in our mock-up area. In fact, we had the best Space Station, I think, mocked up over there, ready to go into production. Then things changed, and with the Russian involvement and all this it took a different direction.

But we did, we would come up with different concepts, mock them up, had people come in and review them, get the pros and cons. I feel like a lot of that information did get incorporated into our current Space Station. I don't know exactly what it looks like anymore. I know it's changed a whole lot. But I've seen pictures and drawings, and I recognize some of the stuff. We had a lot of people coming in from all over the country reviewing it and commenting on some of the designs. So, yes, from a conceptual standpoint, we made contributions, I think, to the current Space Station.

BUTLER: Looking at Station, and this will be more kind of not specifically based on any of your involvement with Station but more from your experience with Apollo, Skylab, Shuttle,

but Station being something designed to stay up there for so long, and taking into account all these considerations of what has to go up there, what can come back, the trash that will build up while it's up there, how do you plan for something like that, that's that long-term habitability, dealing with some of those issues, just based on your experience?

PERNER: I don't think it's all that different from what we did in the past; it's just on a larger scale. Obviously you need more food. They're going to be doing more things, there's more objectives to accomplish, so your training has to be somewhat different. But basically, it's still, you fly stuff up, you dock, you unload, you bring out the trash or whatever they need to get rid of, and you bring it home.

I think it's just a larger scale. They're going to be doing it more frequently, and like you say, the duration of the missions for the guys in the orbiting vehicle are much, much longer. I don't know how they can stand it. But the process is the same, you know, I think. You're going to go through the same R and QA [Reliability and Quality Assurance] rigor with every new item you put on board, and you still have zero G to contend with, the same safety concerns. So I don't know of anything that would be significantly different in the way you'd do business.

BUTLER: Okay. Just a bigger scale for it all.

When you decided to move on from NASA, did you go into any consulting or anything afterwards, or have you just been enjoying some time to relax and do whatever?

PERNER: Like one of the guys told me, he said, "I'm not doing anything, and I don't start that till noon." [Laughter] I can't say that I'm not busy. I stay busy all the time. I have a lot of hobbies, and we have a ranch out in West Texas [where] I grew up, born and raised out there. We've built a house so we can go out and stay for a while, and that always takes some fixing up and messing with. I don't ranch. I don't have any livestock that I worry about. My brother is still active in the ranching business so he takes care of all that. A lot of deer and turkey to see, and it's 450 miles away so it's kind of like going to the Space Station to get out there. But my wife enjoys it, and we spend a lot of time—I go out there maybe once a month. So that takes a lot of time.

I like to hunt and fish, and we travel a lot. We're going to go visit Spain and France and do a little cruising this October. I do wish they would improve the airlines. [Laughing] When you're over six foot tall and try to sit in one of those seats for eleven and a half hours, I believe, you have to really want to go.

So I stay busy. I am enjoying retirement. I was a little reluctant to take that step, but it's probably the second best decision I ever made. So yes, I'd recommend that to anybody. I had a good career. I look back and enjoy memories, and I'm enjoying retirement so far.

BUTLER: Looking back over your career, and having talked about some of the people that you've worked with, some of the teamwork, and you talked about working with the crews very closely, one of the things that the crews are known for is their spirit with each other and with some of the people they would work with, some of the jokes they would play on each other, some of the "gotcha" games. Were you ever involved in any of that? Are there any humorous experiences?

PERNER: Not really. I've heard some of those stories. No, I don't think so. We didn't get into that too much in our world. Everybody had a good time and enjoyed working with each other and everything, but I don't remember any noteworthy pranks or jokes being pulled on me. It's a pretty serious business most of the time. The crew is a little bit different breed of cat, so I can appreciate them getting involved in some fun stuff like that.

BUTLER: As you said, you were able to still be serious but enjoy what you were doing and have a good connection with the team. So that's important.

PERNER: Right.

BUTLER: Looking back over your career with NASA, what would you consider the most challenging aspect of it? Then also, what would you consider your most successful accomplishment?

PERNER: I think the biggest accomplishment, I'd have to say, would be my role in getting funding for the water tank. That took years and an awful lot of time. I feel like that if it wasn't for Brzezinski, Mike Brzezinski, and Vernon Hammersley, who came up with the requirement based on their experience, and others like myself putting together pitches and going all over the country trying to sell this thing, I don't believe that tank would be out there today. It was very expensive. It was an engineering challenge to even build it. You know,

building deep-water tanks in the Houston area is a tough thing to do. So I'm real proud of that. I would say that's probably the major thing that I contributed.

Challenge. I guess the thing that I had the most trouble accepting was after I got to be a division chief, I always like the people that worked for me and wanted to give them the recognition they deserved, like any other manager, and they came in with a thing called affirmative action that made it real difficult to do that. Affirmative action in concept is wonderful, but to me, the name is wrong. It ought to be, you know, give everybody an equal opportunity. What they laid on us out here, like I couldn't hire a good engineer that wanted to come in unless I had this many minorities. We had quotas. Nobody's going to admit that, but we did. I couldn't promote somebody if there was somebody else over here that hadn't been promoted, whether they deserved it or not. I really struggled with that.

I want to say right now, though, that in my division I had more minorities, more females than any division at the center, the ratio. I'm proud of that, and I had them because they weren't forced on me. It's because I picked them because they were the best. I'm saying that to illustrate you don't need affirmative action to get the best people. If you'll just go out and get the people that deserve to do the job and are capable, it's going to all take care of itself.

I noticed that the affirmative action probably hurt some folks more than anything. They were put into jobs that they couldn't do well, and that reflected on the rest of [the minorities]. To me, that was always a challenge, to deal with that, to get people the promotions they needed, to get people hired on that I needed to get the job done, and yet meet the requirements that were being laid on me by my management, and sorting all that out

and making it work. I wasn't the only one that struggled with that, but that's a challenge. I don't know if it's still going on today.

BUTLER: I think it is.

PERNER: Maybe it's smoothed out a little bit.

BUTLER: I think to some extent that's still a challenge, and it probably will be for a while.

PERNER: But it really affected me. I lost some good people, the opportunity to get some good people, because of that. I don't know who dreamed all that up and put it into effect, but we had to live with it.

BUTLER: That certainly is a significant challenge, definitely.

PERNER: And the other challenges that any manager faces, I guess, is getting the resources to do jobs that have been assigned to him, you know, dollars and people. But that's not a unique challenge. I think that comes with any job. At NASA we were fortunate to have congressmen and public opinion that supported us most of the time. You know, you usually felt like the country was behind you and the Congress was behind you and you could get reasonable appropriations without any trouble.

It was not a challenge to get up and come to work every day. I'll say that. I never had a problem coming to work out here. It was always something I looked forward to. Come early and stay late, that was everybody's motto, I think.

BUTLER: It certainly did seem to work that way. And you are, again, fortunate that you were able to enjoy your job that much. A lot of people can't say that.

PERNER: That's true. I am. I'm very lucky from that standpoint, having that opportunity.

BUTLER: Most of us feel the same way about our job. We're pretty fortunate to be able to talk to folks like you.

PERNER: Well, that's good.

BUTLER: Well, before we finish, I'd like to ask Sandra and Kirk if they have any questions that they'd like to follow up with.

FREEMAN: Sir, I have a couple. You said that when you first got there you worked with a lot of the crews, the astronauts, on controls and displays. Out of curiosity, what was it like working with the astronauts. Was there some that were easy to work with, some that weren't? And what kind of situations, if you can remember, were changed because of astronaut input?

PERNER: First of all, yes, there were some easy to work with, some not so easy, but I enjoyed working with every single one of them. I can't think of a one of them that was what I'd call a pain in the you-know-what. You can't help but respect them, because that is a sharp bunch of people, their experience and their background, and most of them had Ph.D.s at that time. They didn't just come in and suggest things willy-nilly. They had substance behind it. And they were real personable people. It was just fun to be around them. Like you mentioned, some of them pulled pranks and jokes and so forth. They were just a happy bunch of guys and really enjoyed what they were doing.

Yes, their comments and suggestions were incorporated in many of the designs because they were really good ideas. We didn't always agree. You know, we'd be off doing something, and they'd come in and redline it and say, "That don't work," but usually when they did that, they had a real good reason for their input. They were always willing to listen to you. None of them were "It's got to be my way or I'm not going to do it." They didn't have that kind of attitude. They would listen to your rationale, and if they couldn't see holes in it then they'd go along with it. So [it was] give and take and very enjoyable.

FREEMAN: Now, do you remember some specific, one or two specific things that did change?

PERNER: Well, I've mentioned John [W.] Young's contribution to the space program. There were some switches, and I believe they had to do with, during launch you had to operate some switches to change some displays, and, you know, you're in a pretty heavy G-loading at that time, and John maintained that he couldn't reach—I don't recall the switch precisely right



now, but he couldn't reach this switch and we needed to relocate it. We tried to have some method of madness to where we located things, and we thought we had it in the right spot.

So John says, "Well, if you locate it, then I'm going to have a swizzle stick that I can reach that stick with." So he created what we call the John Young swizzle stick, a little rod with a hook on the end of it that he could reach over and actuate those switches. So that got put on. We took it to the change board and sold it and put it on board. To my knowledge, all the crew used it on their flights. So just one small example.

BUTLER: Was that for Shuttle?

PERNER: Yes. [It was useful in the command module and shuttle.] Being pilots, they used what we call the eight ball, the flight attitude indicator display. They made a lot of inputs to that thing as to the markings on it, the clarity of the markings, the size and all, based on their experience. We took those and incorporated them in. They, better than anybody else, could tell how well something could be seen during various times in the mission. So we would have been nuts not to incorporate those kind of suggestions since none of us had ever flown the kind of things they had.

So nearly all the avionics, we paid attention to their inputs. We argued on the size of food lockers and clothing, whether a decal ought to be over—or the patch on this or on the other, things like that. We could beat them on those, but when it came to avionics, those kind of things, they pretty much ruled.

FREEMAN: One other thing. You were talking about the food storage, that you had to take into account gas or anything else that would cause discomfort for the astronauts. Now, did you actually test the food yourself to come up with these ideas?

PERNER: Oh, yes. Early in the program—well, you know, the very basic food you squeezed out of a toothpaste container, and that went away in a hurry. It tasted terrible, and it wasn't really necessary to do it that way. So we started packaging food. In fact, we had the food packaging facility over in my division, where we would actually cook and package food at NASA to fly.

That didn't last too long either. Rita [M.] Rapp is a person that, if you could talk to it would be wonderful, but she's one that's passed on. We've lost her. She was the nutritionist for all the flights. She decided what food would go on, and we'd help her package it and all.

What I'm leading up to, the later flights we found out she could go down to Kroger's and buy most of the food that the crew wanted, and then we would package it in containers. It would be safe and nonflammable and prevent the outgassing problem. But as the missions progressed, the food got better. We learned that you could open a can of sardines—well, not really sardines but something of that nature—and eat it up there without having to go through all this exotic food prep and packaging that we did in the earlier missions. So we learned as we went.

The astronauts had a big input into that. Rita would develop a menu, and they could go in and select what they enjoyed eating. We used to put them in quarantine—I don't know if they still do—for a period prior to each flight. They would eat those foods over there and

make sure it's what they wanted, and if they didn't, it got changed. So they developed their own menus, so to speak. Some of them had some weird stuff they took up there.

BUTLER: Just as long as it made them happy.

PERNER: Yes. That's the whole point.

FREEMAN: Just for clarification, the John Young swizzle stick you were talking about, was that Apollo or Shuttle?

PERNER: That was Apollo, in the command module. He may have had something similar to that in Gemini. I'm not sure. But I know it was in Apollo, and he might have used that in the Shuttle, too. I'd have to dig into that a little bit, but he was a swizzle stick guy. Have you been able to corner John and get him to come up?

BUTLER: Not yet, unfortunately.

PERNER: He would be a good one.

BUTLER: He would be.

PERNER: He'd have you in tears.

BUTLER: Yes. Yes. We're hoping we get a chance to talk to him.

PERNER: Good.

FREEMAN: I have nothing [unclear].

BUTLER: Okay. Sandra?

[Addressing Mr. Perner] Is there anything that you'd like to mention that we haven't touched on yet that you can think of?

PERNER: Gosh, I've already said more than I thought I'd ever be able to pull out. I can't think of anything offhand. I appreciate the opportunity to dig back into the past and contribute to what you're doing. I hope it's successful, and I really do hope somebody will publish a book or something that we can pick up and read. I'd really like to hear what the other guys can remember.

BUTLER: Oh, absolutely. Well, we certainly hope that we can, and we certainly appreciate you coming in and sharing your experiences with us.

PERNER: You're very welcome.

BUTLER: It's been very interesting.

PERNER: Thank you.

[End of Interview]