ORAL HISTORY 2 TRANSCRIPT

DALE D. MYERS
INTERVIEWED BY CAROL BUTLER
LEUCADIA, CALIFORNIA – 5 MARCH 1999

BUTLER: Today is March 5, 1999. This oral history with Dale Myers is being conducted in Leucadia, California, for the Johnson Space Center Oral History Project. The interview is being conducted by Carol Butler, assisted by Summer Chick Bergen and Rebecca Wright.

Thank you for talking with us again today.

MYERS: I'm delighted.

BUTLER: We talked before and we covered a good overview of your career, but I thought maybe we could go into a few more details. Maybe we could start with looking at Apollo 8 and your involvement in the decision to send Apollo 8 to the Moon.

MYERS: We had just finished a really terrific flight on Apollo 7. I think it was George [M.] Low who came up the idea of doing Apollo 8, which was to go around the Moon solo with the command and service module [CSM]. The problem was, the lunar module [LM] was behind schedule, and if we waited for the lunar module to be ready to go for the next flight, it looked like there was a good chance we would miss making it in this decade.

So the idea of coming to the figure-eight around the Moon came up, and George [E.] Mueller sent all of the program managers in the industry a letter asking them if they were confident that we could make that flight. Our first critical issue, the key issue, was that without the lunar module, we were in a position that if the service module [SM] engine failed, the guys would sail on out into space. So it was pretty important that we make that thing work.

It had worked fine on the previous flight and we went through a whole series of detailed reviews on all the elements of the command module [CM] [and service module (SM)] to make sure that everything was good and everything looked like was ready to go, all the equipment had been properly certified and had no anomalies that looked like it might give us a problem. …After a review with the Aerojet[-General Corporation] guys and with our people, just totally soul-searching that thing, I signed off, saying, "I'm confident you can make that flight."

I think if I had not signed it, they probably would not have gone ahead with it, because they had really relied on industry to make a full confession if they had any problems, and then we didn't find any. So the flight went and was a total success.

Bill [William A.] Anders keeps telling me he was the first one around the Moon, because he was on the right-hand side of the command module, and that's the way the command module went around the Moon. [Laughter]

BUTLER: With Apollo 8, and it actually getting to the Moon and going around, did you watch the mission from Mission Control?

MYERS: Yes, I always was in the SPAN [Spacecraft Analysis] room, which is the room behind Mission Control, where the industry guys were. We had a connection, a telephone connection, back to Downey, which is where all the engineers were that were involved with the command and service module. We had a few of our guys there in the SPAN room, so if there were any problems beginning to show up on the command module during the flight, we'd be on the phone with the right guy at North American or the right guy at the contractor, to be sure that we had maximum up-to-date information to feed into Mission Control for any conclusions that they reached.

So I was very busy in the back room all the way through that flight. I didn't sit around and get philosophical about it at all. It's a matter of, is your machine going to work, you know. So that's where I was all through that flight. It went very well. I don't remember any major anomalies at all on that flight. It was an excellent flight, as were all those that came up to the Apollo 11 flight. We did a good job on the command module.

BUTLER: Absolutely. While you were there in the SPAN room and you were prepared for anything that happened, as they went behind the Moon the first time and were going to fire that engine to into lunar orbit, what was it like at the time, the atmosphere or your thoughts?

MYERS: Everything got very quiet at that time. You always worry about it, but we had had so much success with that engine after some very troublesome [early development] days, and we were spending a lot of time up at Aerojet and had become very familiar with that engine and how it worked. I really didn't have any major concern.

Now, in retrospect, you look back, we had looked through all the systems, and we had looked through all the systems of the service module, which included the oxygen tanks that blew up on [Apollo] 13…If that had happened on [Apollo] 8, we would have lost those guys, because we had no lunar module to bring them home. So even though you have been through all the elements and you can't find anything that would give you a problem, there are always what we used to call the unknown unknowns—the unk-unks. Those are things that are just complete surprises, and that's what happened on…Apollo 13, and it could have happened, something of that nature could have happened on Apollo 8. Of course, it didn't.

BUTLER: Fortunately, yes. With Apollo 8, when they did get into orbit and were actually shortly getting ready to leave, and they radioed back to Earth for Christmas with the Genesis message, was that a special moment?

MYERS: Oh, yes, that sure was. I've forgotten where I was when that happened, but I heard it. I remember hearing it directly, so I don't know whether I was at [the hotel] or in the SPAN room when I heard that message, but it sure was a powerful message to me. It was a great moment in the Apollo Program.

BUTLER: Very great moment. Helped push the next step in getting to the Moon. Then the next mission, Apollo 8, did come back and ready to move on and to test the LM. What was your involvement with the next couple of flights, Apollo 9 and 10?

MYERS: Well, I was always in that same position; I always was in the SPAN room. I never went to a launch. I was always stayed at Mission Control. So I don't remember much about it. They were good missions.

I remember something about [Apollo] 10. I'll tell you about 10. Nine was the first time that I realized that astronauts really get seasick. There was some problems with some of the astronauts during that flight, but otherwise everything seemed to go well. I think it was another major step forward.

When you're looking back at what we did, we flew [first with Apollo 7] in October of 1968 and we went to the Moon in June of 1969. So a heck of a lot happened in a very short period of time, and it wouldn't have happened if…all this equipment hadn't worked essentially perfectly all the way through that period. Sure, we had some problems, but no major ones, and nothing that couldn't be fixed very quickly for the next flight. So what were we doing? We were flying every two months, and in those days that was a pretty significant series of activities.

So Apollo 9 was technically a success. Apollo 10, Tom [Thomas P.] Stafford and Gene [Eugene A.] Cernan, and I forget who else was on it.

BUTLER: John [W.] Young.

MYERS: Yes. Went around the Moon, in orbit around the Moon, and they had a problem with their flight control systems, but I'm not sure what it was… I remember this specifically, because I got asked about it in a press conference right after the flight, or right after it happened. One of the astronauts—and I'm not going to name him—said on an open mic [microphone], "Son of a bitch!" And they ain't supposed to do that.

So at the press conference we had, this was after the flight—no, maybe it was during—maybe it was about that time, because I was asked specifically about what this astronaut had said. I remember saying, "Well, those spacesuits really, sometimes they're very irritating, and this fellow was saying, 'Some of us itch.'" [Laughter] That's because, I think that came from my association to Wally [Walter M.] Schirra [Jr.], a lot of puns. So that happened. [Apollo] 10 was a good flight.

[Apollo] 11, I remember more of the specifics of it, but the launch and the flight out were pretty nominal. In orbit, the thing we worried about was the docking mechanism. That had always been a complex and kind of an elegant thing, and had…given us trouble on the ground previously. Never gave us trouble on a fight, but you worry about it, you know. If the lunar module goes…down [to the Moon] and the upper stage comes back up and the docking is the issue, [that could have been very difficult]. So that got to be a pretty tense period while we were waiting for that to happen. But it worked without difficulty and so it was another successful flight.

BUTLER: What did you think when you saw your goal achieved?

MYERS: Oh, man, it was spectacular. How can you describe it? All these words that Mission Control uses, like "fantastic" and "spectacular," all those words are right when you're involved in a program like that and it happens. It had been a long struggle, the fellows working immense schedules of time, nobody working less than sixty hours a week during that time period. So having it happen was a really terrific kind of a cap on the program.

When we started the program, there was sure a lot of question about whether we'd make it in the decade. When we started clicking off those flights and having the success we had in each of those flights, you began to get the confidence that it might happen. We still had a little margin making it in July, when we were saying before December 31st. It's still a pretty good feeling when you're a little ahead of that sort of [unclear] schedule of the program. So it's a great feeling. Everybody cheered, you know. Nobody smoked a cigar, though, until they got back and on the ground. But it was great.

BUTLER: You achieved that goal, not only once by the end of the decade, but twice with Apollo 12.

MYERS: Yes, that's right. That was interesting. I was not involved on Apollo 12. I had left the program by that time. North American [Aviation, Inc.] felt that the Apollo Program was ending, they had to get on to the next program, whatever that was going to be, and so they asked me to move into advanced design. So I was working on Mars missions and shuttles and space stations and all that sort of stuff, rather than on the Apollo, or Apollo 12.

I think it was about the time, I don't remember when I was asked to come back to NASA as head of manned space flight, but it was in the October time period, I think, so it was close to the same time period as Apollo 12 flew. I went down and watched [the] Apollo 12 [launch] as a visitor, just an observer, because I was off the program. I'd never seen a launch, so I went down to watch [Apollo] 12, and thought that would be the last one I would

see because I was going to be off working on new programs with North American. [T]hen I got called to come back to be head of manned space flight, so I knew I would see a few more. [Laughter]

BUTLER: Having watched the launch of Apollo 12, did you see the lightning strike?

MYERS: Yes, yes.

BUTLER: That must have been startling.

MYERS: That's startling and really earth-shaking as far as your confidence is concerned, because none of us—I thought back, what have we done to test high-voltage effects on the grounding of this system, you know, and we hadn't. So we really wondered whether we were going to be able to sort out all that stuff or not. That was amazing to me that everything settled back in and settled down to where they went ahead and made that flight.

BUTLER: It must have been good to know that you had built it so well.

MYERS: Oh, yes. Oh, boy, you bet. It was a great comfort to know that the thing would take that kind of a beating and survive, you know. That's good.

BUTLER: You mentioned you did come back with Apollo 13.

MYERS: Yes, I came after I went over to work on these advanced programs, I got asked to come back to NASA. I came in—I don't know if it was in December of [1969]—no, it must

have been January of '70. I think it was January of '70 I came back here. Then Apollo 13 was in April, I think, yes. My first launch. [Laughter]

BUTLER: What a way to come in.

MYERS: Yes. We talked about that the last time we were here.

BUTLER: We did, we talked about Apollo 13.

MYERS: [Apollo] 14—

BUTLER: [Apollo] 14 had a few problems with the docking module, and you had mentioned that before.

MYERS: That's right. Yes, they had to do two or three tries to do the docking, yes. Yes, and that was just a very sensitive system. You had to really hit it just right or you were in trouble. We had never been able to open up those margins to make it an easier thing to do. But the guys then, from there on, did more and more practice in the simulator and never had a problem again with it.

BUTLER: It was a system that had to work; there was no backup.

MYERS: No backup, that's right.

BUTLER: Were there any plans, if, for instance, they had gone down to the Moon and then couldn't dock afterwards?

MYERS: Yes, there was an EVA [Extravehicular Activity] plan, but nobody really wanted to do it. But they did have one, yes. You would go EVA from one to the other. I think they had a cable involved. I'd forgotten that. But anyway, they did have that as a backup.

BUTLER: Luckily that never happened.

MYERS: Luckily that never happened, that's right, yes. Those guys in Mission Control were always thinking up good ways to figure out a different way to do it in case something didn't happen, and that was great. That's what their job was.

BUTLER: It took all those people to make it all come together and work.

MYERS: Yes.

BUTLER: You have to plan for all these contingencies.

MYERS: That's right.

BUTLER: Then you can have successes like Apollo 14.

MYERS: That's right. I don't remember much about Dave [David R.] Scott's, [Apollo] 15. I remember a political issue that was involved with [Apollo] 15, where they had some stamps that they took with them that were thought to be a commercial opportunity. If they took the stamps with them, the stamps would be worth something when they got back from the Moon.

So, therefore, it was a bad thing to do, so Dave got in trouble on that. Not really in trouble; he got criticized for it.

[Apollo] 16, I don't remember 16. [Laughter]

BUTLER: Okay.

MYERS: [Apollo] 17. I remember 17, because 16 and 17, they were really putting the heat on us, the scientific community was really putting the heat on us. Oh, that's what was happening with 15, 16, and 17. They took the lunar-based instrument stuff, and we had some instruments in the service module. So it was moving in the direction of more scientific activity and more geological work, seismic measurements and movement and so on.

The pressure was on to bring scientists and JSC [Johnson Space Center, Houston, Texas] didn't want to have scientists go. They thought that they were training their own test pilot astronauts to be scientists and they could do just as good a job with geology as the scientists did, so why would we want to take a chance of taking some clumsy scientist along and get in trouble.

I had to finally override. I had the final approval of the astronauts that went on the flights, but I had never used it. I don't think George Mueller ever did either. That was the first time I used it. I had some trouble with one of the guys down at Houston, I guess it was Chris [Christopher C.] Kraft [Jr.] at that time. When did Chris become the director?

BUTLER: I think he became—

MYERS: I think [Robert R.] Gilruth had retired before [Apollo] 17, yes. So it was Chris that gave me a hard time on that. So we had Jack [Harrison H.] Schmitt fly on the 17, only scientist who ever got on the Apollo Program. But we also worked the problem, because

Jack was a very eloquent speaker and did a good job. Fell down a couple of times and scared me, but spacesuit erosion, an abrasion problem, but he did all right.

BUTLER: He did, and the program went very well.

MYERS: Yes.

BUTLER: For Apollo 17, in fact, Jack Schmitt was quite enthusiastic about his job and even talked about having a landing site on the back side, on the far side of the Moon.

MYERS: Oh, yes.

BUTLER: Were you involved at all in those discussions?

MYERS: Well, we had discussions about it, but the Congress had already decided that the program was over, and there wasn't any question about it. So we had a discussion about it, it'd be a neat idea, you know, but there were a lot of great ideas, but we didn't have any money for it. So that was just another discussion.

Jack's been at it ever since, you know. He thinks that there is a commercial potential on the Moon with helium-3, that theoretically you can make nuclear power with very little waste products. So he's been pushing mining helium-3 and bringing it back to Earth and building this new special kind of nuclear power plant ever since, and I think he's still at it. I don't know what else he does, but I see his name every once in a while pushing that helium-3 idea. It's kind of an interesting point. We're going to talk later about the future, and that gets into the equation, the question of finding some commercial use on the Moon is going to be a very important thing to do, I think, in the next activities.

Okay. Anything more we need to talk about? Well, let's see. Let me talk about one other thing that was going in Apollo at that time. After Apollo 13, Senator [Clinton P.] Anderson began to lose confidence in the safety of Apollo. We had Apollo 18 and 19 scheduled, and when we started seeing budgets cut and cut and cut, we were trying to sustain more Apollos, because we had some really good science we wanted to do on Apollo 18 and 19.

We had two Skylabs at that time, so we had to look at whether we could sustain the Skylabs for 18 and 19. Both of those required keeping Saturn V be in place, which was very expensive. And we had to worry about the [Space] Shuttle and the Space Station. The Shuttle had already started into Phase A studies, which involved a two-stage fully recoverable system, which George Mueller wanted. The Space Station was a thirty-foot-diameter Space Station, beautiful, big Space Station that could be launched by Saturn V. And very simple, the kind I liked. So it was an excruciating problem that we had.

We didn't have [a chance] with 18 and 19, because Anderson just decided himself we weren't going to fly 18 and 19, and he got his committee to press on that. I don't know whether they ended up in legislation or not, but it was very clear we weren't going to fly 18 and 19, and so that program dropped out. I think that was the first that dropped out. That put the heat on Saturn V, because it was so expensive to hold, to fly, to launch the second Skylab. It would have to be held in place for another year and a half or so. And so that pressure came on. And with the budget going down the way it was, we had to make a choice between a Space Station or the Shuttle.

[If] we chose the Space Station, we would keep building command modules and keep building the Saturn [IB]s. It would be an extremely expensive program to finally launch the Space Station [with a Saturn V and resupply it with CSMs on Saturn Ibs]…You'd still be sitting there with an extremely expensive logistic supply system. So we [decided we]

couldn't afford it. With the budget cut in half, compared to what it was when George Mueller was dreaming of the future, we just couldn't do all that stuff.

So the Space Station went, Saturn V went, the second Skylab went, the Space Tug went, a couple of other things [that] George had [in] his programs. We had already shut down the nuclear shuttle. We finally ended up with a program that involved keeping the Saturn V until the first Skylab was launched and [then] shutting it down. We put all of our energy into getting the Shuttle going, because we really believed the Shuttle would make a major reduction in the cost of transportation. If we could get the Shuttle to fly, then the cost of transportation would be low enough that it would be clear that we'd go ahead with the Space Station.

So that was the arguments in the system that we used and that NASA embraced. So the program then became "Get the Shuttle going." That was all happening…[in the] planning [that] was going on from 1970 to '72. We modified the Phase A programs on the Shuttle to include the total of the booster and the orbiter. Those Phase A studies led to Phase B studies in 1971 and 1972, while we were finishing the Apollo Program, and we sold the Shuttle configuration in '72. So we had at least some continuity in the program. Apollo ended, the Shuttle began, and it gave us, NASA, sort of a guide to the future that was important at that time of terrible budget reductions.

BUTLER: What a struggle. What hard choices to make.

MYERS: Yes, it was tough, but I think we made the right decisions. I've forgotten how much we talked about Shuttle the last time we were here, but we probably should talk a little more about that.

BUTLER: Sure. Absolutely, we can do that.

MYERS: Let's go on down through these questions.

BUTLER: Okay.

MYERS: Well, you kind of get into it with the next question.

BUTLER: Yes. Looking at the end of the whole program, and moving into Skylab and Shuttle, as you've been talking, did you, at the time, realize that it would be so long before the next step came after the Shuttle?

MYERS: No. No, I sure did not. Even with these big budget cuts, we expected that the budget would go back up again, particularly when we got the Shuttle going, and that there'd be a new era of ebullience and interest of the public. You know, we get that from a lot of people that talk to us. They're usually people either in the industry, or people who write about space, or people who are close to the Space Station, and they're all optimistic. They all expect something to happen, and I did [too], I expected that we would certainly be on Mars by now, you know, and it's almost [thirty] years [we've been] working on it.

I was having trouble with George Mueller's view of how to get to Mars. He was using two Saturn Vs, and we were having difficulty with that. So we didn't really have—I didn't think we had a really good way to get to Mars at the time, but I figured that if we got the Shuttle going and we got a Space Station going, then we'd have all the building blocks to go to Mars, and that certainly if we got a Space Station by 1985 or something like that, we would in fifteen years or more go to Mars. So I expected us to go back to the Moon and then to Mars. I still expect us to do that, it's only a question of when.

I think there are a lot of things that are going to have to happen before we do it. I think we're going to have to have a mission, some reason to go, and that probably has to be commercial. That's why I bring back this thought of Jack Schmitt's on helium-3. It may not be helium-3, may be something else, but something's got to bring it back. I think we're going to have to have an easier way to get there, which means better, lower-cost systems, better propulsion, particularly to get to Mars. Going to the Moon, probably not. We can probably get to the Moon with something similar to what we have today.

I think we're going to have to find—and I shouldn't say this—I think we'll get there a lot quicker if we find there's really water that we can use. I think that Dan Goldin's approach of doing robotic building of infrastructure, send out robots, find out there is water. Send out robots, dig a well, you know, do whatever we have to do to get water. Send out robots to build the infrastructure, build the habitat, build the storage system to get oxygen and to get fuel. Build all that robotically. Then when you get the infrastructure…[you send humans.] That fits more into how Congress thinks about these programs now.

In the old days, we used to never accept the idea of Congress saying, "Just spend a billion dollars a year on this program." That's the least efficient way to do a program. Programs always have small starts, big efforts in the middle, and a drop-off at the end after you're [into] flight. This stupid approach of Congress saying 2 billion dollars a year on the space station just makes it totally inefficient. It, in itself, is probably one of the major increases in the cost of Space Station.

But, unfortunately, Congress is satisfied with doing that, and so a program like Dan talks about, of robotic increments that go up there, he can kind of bury those littler programs inside of a maximum that Congress sets and, I think, probably fits the pattern of how Congress is going to work in the future. It will be hard to do that with a Mars program, but it might even be the right way to do that…[with small] robotics [programs] first, building the infrastructure, and then sending man.

But for Mars, I think we're going to need new propulsion, a nuclear shuttle or something like that. George Mueller talked about some other type of propulsion that's faster, gets us there faster. That will be a long time. So I don't think we're going to be going to Mars very quick[ly]; I think it's going to be several decades. I know there's pressure to try to meet [President] George Bush's goal of 2019.

Incidentally, when I worked on the space policy with the [President Ronald] Reagan administration, we didn't put a date on going to Mars. We just said, "We want to go to Mars. We, the United States, wants to go to Mars."

When Bush got into it, for some reason he put a date on it, 2019. Well, Congress just didn't accept it at all. I know there's some new pressure, talking about, gee, there's a date out there we've got to meet. It's not going to be met. I don't think it's going to be. I think it's going to be several decades before we go to Mars.

BUTLER: Do you think going to Mars is going to have to have more than just the different propulsion and a different method of getting there? Is there going to have some [thing commerical] on Mars as well…

MYERS: I look at the Moon as meeting the commercial requirement. I think Mars gets back into the issue of exploration, again. I think human beings want to see what's on the other side of the mountain. The Moon thing, they've seen, and I think they're going to some day decide that they want to reach out again, and even if it's expensive—and it will be—I think that the world will decide that it ought to be done.

By the way, I hate to say that, because I think international programs are debilitating. We're in one in the Space Station, and I think it's a disaster. I think that the thing has every opportunity to become a really difficult problem, because, well, you know the problems with the Russians right now. Every nation that's involved, if they end up getting mad at each

other, they're going to use the Space Station as one of their levers. So you've got every opportunity to have troubles in that program, when you have that many people in the program that are diverse people. They have important things that have to be done to make the thing a success.

The European programs on the Space Station are not that way. If they're left off, it isn't going to kill the Space Station. If you leave off the Russian stuff, you're dead. You're out of business. So that's the kind of program you don't want to get into, in my mind, is to get a program where the other nation has a "critical path" in the program that has to be satisfied to be able to make the program complete. And we never did that [in previous programs].

On the Shuttle, we had a space lab built by the Europeans. We can fly without a space lab, do a program without the space lab. In our the other programs, we got into—well, I did get us into Apollo-Soyuz…but the hardware existed and [the U.S.] built the part that did the docking. So we still controlled our own destiny, as far as the success of the program was concerned.

What I worry about in the future, given something like the Mars program, the United States is going to take the attitude, "We can't afford it. Let's get all these other nations into it." They'll get everybody in the world involved in the thing and it will be a big complicated program and it could be a real disaster to operate the program. I don't know, I've said what I think about the Space Station process.

BUTLER: And they are in a challenge right now.

MYERS: They certainly are.

BUTLER: Why don't we go ahead and take a quick break here, and we'll turn over the tape and then we'll continue on.

MYERS: All right. [Brief interruption.]

BUTLER: We've talked a little bit about Apollo now, and a little bit about the future. If we could jump back toward, in effect, even tying in with what we've been talking about and budget cuts and changing program plans and looking at Skylab, and you were involved with that at the time, and trying to figure out how to make that work with facing budget cuts. How did you make it work, pull it together, figure out what could go and what couldn't?

MYERS: Well, the program was under way when I got there in 1970. [Skylab] was physically under construction, so the size had been set, the equipment involved had been kind of set. We had a few flaps between JSC and Marshall [Space Flight Center, Huntsville, Alabama] about who built what in the way of hardware inside the vehicle, that I was involved in. We got them settled amicably. The system, actually, I think we launched it earlier than what George Mueller's plan had called for. George had kind of spread the program out a little bit to save the Saturn V, or the Space Station. Because of the budget issues, we pulled it back earlier, because shorter programs are cheaper than longer programs.

Bill Snyder, who I mentioned, was the project manager and did a real great job of pulling it together. I can remember having some manufacturing problems with it at Douglas. No. Yes, McDonnell-Douglas [Corporation], right. It was being built out here, that's why I thought it was Douglas, but it was McDonnell-Douglas. It was being built in Long Beach [California]. I can remember coming out and working with their program people, with Bill on, what are we going to do to get these parts all put together. There were part shortages and difficulty in manufacturing…

So we did put a lot of pressure on industry to get that project finished on time. I don't remember him showing me anything as far as equipment [shortages]. It was a solar observatory, and it had scientific airlocks. There was a lot of emphasis on the science in that program. I don't remember shortchanging any of [the scientists]. We really wanted to have that be a scientific mission and a lot of emphasis on life science and long-duration man in space. So we were dealing with a new area that we didn't know much about, which is long times in space. We had to worry about what kind of exercise equipment we put on board, and what crew, what would be the consistency of the crew, who would be on the crew. So we ended up emphasizing test pilot astronauts for the first flight, but then we pushed very hard into the medical stuff on the second flight and science.

You know the story. We had almost a disaster on the launch. The micrometeorite shielding came off and tore off one of the solar panels, and it tangled the other one to where it didn't open. So the only power we had was from the solar panels that were on the solar telescope, which were very minor as far as overall operation is concerned. It sort of ran the light bulbs, but it didn't run the heaters. So we had to get up there quick. We calculated we had ten days to get up there. If we didn't get up there to it in ten days, the temperature would go so high that all of our electronics would cook.

So I spent that ten days down in Houston working with the guys day and night, trying to figure out what happened to it, how can we guess what tangled up those solar panels. We knew that the atmospheric pressure had blown these panels off, at least lifted them to where the dynamic pressure could get to it to pull them off. So that was done. The question was, what damage did it do. We looked at what cables were in that system that could tangle up the solar panel, and we tried to get pictures. Photographic evidence from the ground was not good enough in those days to really see anything, so we were guessing. So we guessed that we would need cable cutters…people kept bring us new inventions of tools that we had never seen before, [some of] which now are on the market. They have—I won't describe them, but

a lot of special tools were brought to us and offered to us by the industry. We tried them all out in the laboratory there.

Then it got to be a question of, how do we get the temperature under control when you get up there? The guys at Johnson [Space Center] invented this umbrella that went through a scientific airlock, just a little tiny scientific airlock. Went out through that and opened up over most of the Skylab. The guys at Marshall [Space Flight Center] invented what they called a twinpole awning that would cover the whole Skylab body. And I had to make the decision of which one we carried.

So we had a big review down there at Houston, both sides, and decided that the umbrella was easier to do because you could do it from inside the Skylab, you didn't have to go extravehicular to do that. We didn't know what the outside of that thing looked like, and so I didn't want to do an EVA.

So this thing looked like it would work, but it would not cover the whole surface. So we decided to go with the umbrella on the first [flight], and if the outside was clean enough, we'd go with the twinpole on the second…[flight of] the command module [with the second crew]. That's what we did, and it worked out great.

Pete [Charles C.] Conrad [Jr.] is my favorite astronaut. He went outside on the second day and cut the cables…that were tangling the second solar panel. That's a dangerous mission, because the guys were in an EVA suit, and if that cable had snapped and hit their suit, we would have lost an astronaut. So they knew that, and they were very careful about what they did.

They got [the cables] off safely and the solar panel opened, thank God, and with that, 50 percent of the power on Skylab. We did 100 percent of the instruments in measurements and experiments. So the [designers] were conservative about the power they needed.

Anyway, that's the way it worked out. That was a great program. The temperature came right back down, when they put the umbrella out. It didn't go down quite to where the

guys were perfectly comfortable, so we still…had the twinpoles on the next flight, and then everything was perfect, and they had a good mission, and it worked like it was supposed to.

BUTLER: It was a very successful program overall.

MYERS: Yes, very good program. Very good program. The only thing that disappoints me about that program is I never remember being involved in a discussion about how to get it back in. We never talked about retrograding back into the ocean. We never talked about why couldn't we use the command module or the service module some way to get some rocket power up there that could reenter the Skylab at our will instead of…[randomly].

So years later when it came in, I really worried about that. I didn't know where that thing was going to land, and I felt a responsibility for not having dealt with that issue while I was there. I really still don't know why we didn't. I think people thought it would burn up. I think I may have thought it would burn up at that time, too. But as time went on, we really recognized that big, heavy things can make it back to Earth again, and, sure enough, pieces of the Skylab did get back to Earth. So that was a little residual bother that I had about the Skylab program, sorry that we didn't do something about that at the time.

BUTLER: Luckily, the pieces came down without injuring anyone.

MYERS: That's right, no damage to anybody, but still scared me in the process.

BUTLER: That's got to be quite a challenge today with International Space Station.

MYERS: Yes, but they're set up to retro the thing, as is Mir [Russian Space Station]. The Mir's set up that they have rockets aboard that whenever they want to, they can choose the place to land, pick a piece of ocean someplace and land it there.

BUTLER: Make sure nobody's out there fishing, I guess. [Laughter]

MYERS: Yes.

BUTLER: You talked briefly about how Skylab was such a scientific-oriented mission, and you talked previously about having Harrison Schmitt on Apollo 17 to get the science really going. What discussions were you involved with about having possibly two scientist astronauts on the Skylab, rather than just one on the last two missions, not the first?

MYERS: I don't remember being specifically involved. I really didn't want to insert myself into that choice of the astronauts, because if I got into it, it would become a politically pressed issue, because Congress leaned on us so much in Washington [DC] that it would appear, at least, that we were bringing politics into the choice of the guys. So I just tried to get a policy across that we were going to do as much science as we could on this thing and that that's what Skylab was all about and we ought to be emphasizing that part.

Once we had—thank God we had chosen test pilots for that first flight, because, boy, we needed them for that extravehicular activity. But once Skylab was in being and operating, I just wanted to be sure that the guys chose people who could really work, the science issues, but I still left it up to [JSC] to choose one. I signed off on whatever they said. And that's the way I think it should be. They're big boys down there. They knew that they were getting pressure from the scientific community to do something.

I think they were interested in—well, particularly the medical issues. They were very interested in what they could learn about man's long duration in space. They were getting stimulated by some very good scientific people that were working in committees to help them choose instruments and so on. So they got steamed up about science, too.

BUTLER: They did.

MYERS: As they are today, by the way.

BUTLER: Yes. And Skylab did return a lot of good science.

MYERS: Yes. In fact, I don't think it got enough credit. As time has gone by, you see more and more about the real science that came out of the Skylab program. Some of their solar science was really outstanding. I just don't ever remember seeing a lot of kudos going to that solar telescope that they had on board. But as time has gone by, you see more and more of referring back to Skylab solar telescope and what it did. That's the way, I guess, history gets written.

BUTLER: That's right. That's right. Well, following on Skylab came Apollo-Soyuz.

MYERS: Yes.

BUTLER: In our first interview, you talked about the dinner party that you had and how that kind of expanded.

MYERS: Yes.

BUTLER: But I thought maybe we could go into some further details of Apollo-Soyuz and what your roles were with that in helping it come together.

MYERS: I'm not sure, but I think I started it. I'm not sure. It was either me or George Low, but we were talking about Russian involvement and the idea of a docking came up. We knew—both of us had confidence in space and in docking activities, and someplace along the line we together were talking about this idea and then it gelled. I think it came from discussions with the White House that said, "Wow. Great idea. Let's go ahead."

We didn't have that in our budget at all, and so we were really struggling with trying to find out how to get the money to do that job. It looked like it was going to be a hundred-and-some million dollars, and we didn't have that money. So I was trying to figure out ways to reduce the cost of the program, and one of my bright ideas to reduce the cost was to give the responsibility totally to Johnson [Space Center] and to not have a program office in headquarters, and let them do the budgeting and we would accept their budgeting up to limits that we could put on, sort of like a fixed-price program.

I talked it over with Chris [Kraft] and he thought it was a great idea, and so we did it, we gave them what was called lead center responsibility, and that said that they ran the whole program with the Russians and kept us informed. It worked very well. Glynn [S.] Lunney and his buddies did a good job with the Russians, kept us informed up at headquarters. I would hold off the Congress, you know, from getting the details. So they did a great job with the program.

I went through some odd things that occurred, but the fact is that they had a lot of serious meetings in the United States and in Russia. The Russians got behind schedule and that was going to cost us money, so Glynn Lunney and the guys went over there and really beat them up like we would with our contractors, you know, and got them back in. The

problem was that the Russians were compartmentalized. You may have gotten this when you talked with Glynn. They had guys who worked on structures, guys who worked on aerodynamics, guys who worked on electrical stuff and so on, and they didn't like them talking to each other, because they were so secretive about what they do, that they don't want anybody else to know about it. They're afraid if any one person knew a lot about it, he might be the guy that spills the beans to some foreign country. So they just kept everything compartmentalized. And you can't do a job well that way in this program.

So they were beginning to find that the electrical guys were doing something [that conflicted] with what the structures guys were doing and then they had to go back and do it over again, and that was costing time. And so Glynn actually convinced them that they ought to do more of an integrated design, and kind of taught them how to run projects, in my opinion. I've often said, if there's one thing that the Russians learned out of the program, it's how to run the programs. They didn't learn anything technically from us; they were about the same level we were technically. So they learned how to run projects and they got back up on schedule and met our schedule, so we had a good program. A great program.

BUTLER: It was a great program.

MYERS: Now, I wasn't there when they launched it, I had left by then, so I wasn't there at the culmination for that activity.

BUTLER: I'm sure you followed it on the news.

MYERS: I sure followed it, yes.

BUTLER: You talked a little about some of the engineering challenges there. Were there political and cultural challenges as well?

MYERS: Oh, yes, I'm sure there were. Again, as I said, this job was Johnson's job, and I can remember the frustrations that the guys at JSC were having because of the different ways that the Russians did things and the different ways that they reacted to problems and things of that sort. But I didn't get into that very much and wanted to keep that lead center responsibility and have them do the job. So we tried to keep sort of at arm's length on the job.

I had to battle a bunch of people in headquarters to keep them out of Johnson's hair, because I kept reminding them that, "We gave them a lead center responsibility and they were to keep us informed. You're not supposed to be in there nitpicking them on details." Lots of people want to do that from headquarters. So we kept them out of their hair and they did a good job. That was the idea.

BUTLER: At the time, were there any discussions of an additional program with the Russians?

MYERS: None at that time, no. No, in fact, it was very clear that we, NASA and, I think, the White House, wanted to have that be it. At that time there was no discussions. I went later…[in] 1987 or '88—I went to the Security Council and recommended that we have the Shuttle dock with the Mir, and they turned it down.

BUTLER: Oh, really?

MYERS: Yes.

BUTLER: Oh, that's interesting.

MYERS: Yes. Flat. And that was interesting to me, because I really thought, at that time, that there was a developing interest in doing something with the Russians, not necessarily in space, but doing something with the Russians. See, that was getting close to the end of the Communist regime and things were kind of breaking down in Russia. [President Ronald] Reagan was feeling victory, kind of, so I thought there would be a real chance.

I talked to a fellow whose name you know, his name is Colin Powell, and he was head of the Security Council at that time. That's the guy I went to see. I sat down with him and told him, "You know, we're in a position where the Shuttle can reach the Mir, but the Soyuz cannot reach down to our Space Station, when we get a Space Station." When we get a Space Station. "So we can reach them, they can't reach us, just mechanically it works that way in orbital mechanics, and it costs us payload to do it, when we can get up to their inclinations."

He listened very intently, very politely, and he said, "I'll let you know." And about two days later, he let me know. [Laughter] "We're not interested." So that disappeared.

BUTLER: It came up again later.

MYERS: A few years later. Quite a few years later, as a matter of fact. Yes, it had to be a different—it was in the [President Bill] Clinton administration, I guess. Yes. So it didn't even come up in the [President George] Bush administration.

BUTLER: What at the time caused you to start thinking about such a program? Was there something you were working on, or was it just watching the political arena?

MYERS: I think it was just that, yes. I think I just felt that the administration was beginning to get to the place where Apollo-Soyuz had gone well. Everybody said three cheers and then quit. I just thought, well, here's another opportunity to try something like that. I didn't really put a lot of effort in it, and I don't think I even had anybody—well, I think I did, somebody gave me enough information that I knew that they couldn't reach our then Space Station inclination. You know, we were going to go at 33 degrees and the Mir's at 65 [degrees] or something. They can't reach down to 33 from where they launch, but we can reach up to them. Somebody did do a calculation that confirmed that, that I was sure that was the case. They also told me that we had about something like a 30 percent loss in payload going up to that 65 degrees. So I had somebody do that. I think it was done in headquarters. I don't think I ever went out to the centers to get that data. But I just got enough that I could be sure that you could do it, before I went over to get something done.

So I went over and talked to Colin Powell. I'd never met him before, but he's really a nice guy, obviously sharp. He was able to understand conceptually what I was talking about, and, obviously, didn't like the idea. I don't know who he talked to, but he didn't talk to very many people when he got back to me in two days and said no. [Laughter]

BUTLER: I wouldn't classify it as a dumb decision on your part, because it obviously did come true later.

MYERS: Yes.

BUTLER: Someone else was receptive to it.

MYERS: As a matter of fact, I knew enough about it that when the administration starting talking about working with the Russians and the Space Station, I knew we were in trouble

because we were going to be losing advantage by having a big payload reduction going from our Shuttle launch sites up to 65 degrees, because we had to move our Space Station to the Russian's inclinations and [unclear] with the Russians. You can argue objectively and properly that by doing that you get a bigger swath of the Earth, you cover more of the Earth with your Space Station. We were going to cover 33 degrees, they cover 65, so that's an advantage to being at 65 [degrees].

The big disadvantage is that we will always be at a disadvantage as far as payload is concerned. They can put a payload up easier than we can, and that means, if you think in terms of dollars per pound, we're going to be in a competitive disadvantage in putting stuff up to our Space Station. So in that sense it was a bum decision…

Let's see, where are we?

BUTLER: I think we've covered a good bit about that.

MYERS: Yes, we've been through that.

BUTLER: I guess moving along here, Apollo-Soyuz. You did leave for a while, and you talked about some of the other things that you went on to. Then you came back as deputy administrator after *Challenger* [STS-51L]. We talked a little bit about this last time. When did you did come back, how did you help reorganize and get things back on focus and back on track?

MYERS: Well, yes, probably two, maybe more than two. Several things. First, I had a big problem with a previous decision. After the Apollo-Soyuz program being so successful as a lead center, we had gone through this crunch with [President Richard] Nixon about the

Shuttle's cost, and he had given us 5 million dollars, I think it was. Finally got him up to 5.2 as the budget for the Shuttle Development Program, and that was not enough.

I had made a deal with Jim [James C.] Fletcher that he would [talk] to the administration and get another 20 percent as a reserve. That would be another almost billion dollars as a reserve, that he could keep and dole out if I got in trouble with the Shuttle. He made that deal with the administration and came back very happy that he had that reserve. He never got it in writing, and somehow they just never got around to thinking of that, you know. So after he left, that disappeared. But even while he was there, I didn't see that as my budget, so I had a tough time with the budget.

So I came up with this idea of having Johnson being the lead center on the Shuttle. We'd had great success with it on the Apollo-Soyuz, and even though we had more involvement with Marshall and the Cape [Kennedy Space Center, Florida] on the Shuttle than we did with the Apollo-Soyuz, it wasn't a huge involvement. The rocket engine looked like sort of an encapsulated development program for Marshall and so it could be managed by Johnson.

So I talked to George and Jim Fletcher and they agreed, and we set up a formal system that would involve what they reported to us on and what they didn't. They had the budget responsibility for…[JSC, Marshall Spaceflight Center (MSFC)] and KSC [Kennedy Space Center] and…that budget then would…be reviewed by the Manned Space Flight Group, but [JSC] were the ones that put it together.

I had a program director in headquarters, but he did not have the budget responsibility; Johnson did. So he was more a coordinator of the program. That [organization, the lead center,] turned out to be a mistake. As time went by, there was a breakdown in communication between Johnson and Marshall particularly. I had left and John [F.] Yardley came in, terrific guy, probably more hands-on than I am in details of what goes on, had done a superb job on Mercury and Gemini. He came back in for this program

and, I think, allowed the lead center concept to—I'm not sure what word I want to use—to soften. He got really involved. He would find a problem at Marshall and would then go talk to the guys at Johnson, and he either talked them into or directed them to increase the amount of the budget to Marshall. So it ended up with Marshall ending up with a connection to headquarters that I would never have allowed in this lead center approach.

In any case, the communication, particularly in quality control, broke down between Johnson and Marshall. There were problems that were developing on that solid rocket booster that Johnson didn't even know about. That was a problem. I think that could have been one of the major problems we were involved in, because it appeared to me that there was a feeling on the part of Marshall that they didn't want to reveal a lot of the problems they were having, they could fix their own problems, and that they didn't want to reveal them. Of course, that's totally inconsistent with the way NASA does business.

So they had troubles with those O-rings, and they did not reveal them even in flight-readiness reviews, because they were, I guess, afraid that then Johnson would know about them and they'd have trouble with the lead center. Anyway, for whatever reason, the *Challenger* happened.

So when I got there, Jim Fletcher got Sam [Samuel C.] Phillips back to look at the overall organization of the Shuttle Program. I sat down with Sam and agreed that the lead center wasn't working and that I didn't know whether it could work [even] if you had a guy that was totally dedicated to making it work…and that the cultural differences between Marshall and Johnson were so strong that I felt that the lead center probably wasn't the right thing to do now.

So we reverted to the old Apollo system and put in all the overhead and structure that's involved at headquarters to run the program, and went back to the system of headquarters budgeting, headquarters negotiating with each of the centers individually,

isolation from a budgeting standpoint, but recognizing at the same time that we had to have a major improvement in the communications across and between the centers.

So that's what we then put all our emphasis on, was how do we get the guys to talk to each other. They all wanted to, there was no question. There were those at Marshall who were just as embarrassed as I was about that breakdown in communications. It didn't really take a lot of effort to get people to start working back and forth, body guys talking to body guys, engine guys talking to engine guys, propulsion, structures, everybody communicating and being perfectly open about what problems they were having.

So when we finally got to that first flight-readiness review, it was a real pleasure. I had really struggled getting those communications going again, and it was a real pleasure to see how totally above-board guys were on everything that could be a problem. It was like the Apollo again, where people really talked to each other about problems they had. So it was a very satisfying thing to see that happen and see people bringing anything that could be a problem to the surface to where they weren't the only ones dealing with that problem. They had minds, other minds associated with it.

So that's it. Went back to the Apollo system of management. Sam Phillips recommended it, [Jim Fletcher accepted Sam's recommendations] and I recognized the problems that we'd had with lead centers and I agreed with him, and so we did that. And it's been a successful activity [for shuttle], and kept from having those kinds of problems.

BUTLER: Let's take another brief pause here to change the tape. [Brief interruption.]

The pulling together that happened must have been similar to what, after Apollo 1, had happened.

MYERS: Yes, it was.

BUTLER: Just everyone wanting to make it—

MYERS: It was. Yes. I think I mentioned last time that Apollo 1 probably is why we made it to the Moon in that decade, because my experience in aircraft development had been that you always had problems in first flights. At North American, when we used to build airplanes, it was a joke that the landing gear wouldn't come up on the first flight on the airplanes we built. We had a guy that was a great landing-gear designer, but he always had something wrong in that first flight. And here on Apollo 7 it was so good that Wally Schirra had to hand me a little piece of plastic with a little piece of nylon inside it, saying, "That's what I found floating in the cabin."

BUTLER: That's all that was wrong.

MYERS: That was all that was wrong. I had not had that kind of experience. I'm sure it was Apollo 1 and its influence on all the engineers and all the people purchasing things, all the subcontractors, everybody had this idea that we've got to do it exactly right. That same thing happened after *Challenger*. It was that same kind of incentive, I guess, is the word that we use, to say that everybody in the system wanted to do it right. If there was anything they didn't understand, they would try to find someone else who really understood it and bring it up to the top if neither one of them understood it.

So we didn't have a lot of unknowns in the program at that time. The Shuttle was a spectacular machine, and we were just amazed at how it has done everything that we set out to do, and more. It's put things in space and gotten them back in and out of space. It's repaired things—the Hubble Telescope. We pressed the guys to design [Hubble] so it could be maintained, and, by God, they maintained it. Shuttle is just an incredible machine. It's

just unfortunate that we were not able to get the operational costs down. That's the one thing the Shuttle wouldn't do…Did we talk about that?

BUTLER: We did. We talked about that the first time.

MYERS: Okay.

BUTLER: Hopefully, if the Shuttle continues to be successful [unclear] Space Station, it can begin to work into a more cost—

MYERS: Yes, but they're never going to get it down very far, because one of the things that we missed was [that] the involvement with man derives so much tender loving care, you know, in the operations of the vehicle, that we never get very high flight rates on the Shuttle. So much has to be done in between each flight that you just can't get high-flight ratings, unless you set up two or three more pads and about ten or twelve vehicles. That is a real limitation on a reusable vehicle. If you can't get high-flight rates, you can't give low prices, because you've got an infrastructure involved for even getting one flight off a year that is almost the same infrastructure if you get ten or twenty or forty. The problem is, if you can't turn them around fast enough, you can't get high-flight rates. So the Shuttle will continue to reduce in cost, but it won't be major reductions. There will be incremental reductions over time. Going to have to do something different to get a real major break in launch costs.

BUTLER: You're sort of working in those directions with your work at Kistler [Aerospace Corporation].

MYERS: We're working on that, yes.

BUTLER: Hopefully we'll see some good progress there.

MYERS: Yes, well, that's another subject we can talk about.

BUTLER: As deputy administrator and working to get the Shuttle fleet back on status and back up to flight, were there any other things that you concentrated on, as well, at that time?

MYERS: As far as the Shuttle was concerned, yes, we had a lot of work at KSC. I'm having a little trouble with why it was such a big issue. It had to do with what sort of technical competence, technical understanding that they had at the Cape. I think they felt that they did not have enough technical strength to be able to override the inputs they were getting from the centers. "Override" isn't quite the right word, but understanding well enough to be able to be on the same level with them when they were talking about a problem. They didn't feel like they knew enough about the O-rings to be able to be operationally correct in the actions they took, and they sort of said, "Tell us what to do and we'll do it."

They wanted to know more about that stuff, and there was a fair amount of discussion about that, and we ended up with an increase in the technical level at the Cape. It costs money, you know, and it's one of the things that we really struggled with, as to whether this was the right thing to do. But I can remember having a lot of discussions about just how much detail the guys at the Cape need to know to be able to say yes or no on a launch.

We did increase the technical level at the Cape. I think they ended up with some kind of a tech-support contract or something that brought some more engineers into the Cape just for shuttle operations. That was one of the things we worked on.

We did a lot of things, the same kind of things we used to do in industry, get together off-site meetings with people to sort of stimulate their thinking about how to do a better job

in communications and in the planning of their activities. So we brought some of that kind of ideas in the picture.

They all needed a few "attaboys!" They were really in bad shape when I got there. The problem is that Congress had made enough dumb statements that they acted like they wanted to indict somebody and put them in jail. So everybody began to be fearful about, "How can I do any work without being in the position that some guy's going to put me in jail for it if it fails?" Well, we had to get across the idea that, "You guys are doing the very best you know how to do, and you're not going to get put in jail for it. If something fails, it's going to fail because we all failed, not one person failed."

It took about a year to get Congress off that kick. So I had a lot of discussions over in Congress, with the staff and the congressmen, about what it takes to do the kind of adventures that we're involved with. How do you allow people to take the chances that are involved in this kind of a world if you're going to slap them in jail if they fail? They finally got the idea. But, you know, you're talking to a bunch of lawyers when you go over to Congress. What do you expect? [Laughter]

BUTLER: So it all did come together.

MYERS: Yes, it all did, that's right. I got a great picture of the Shuttle coming in to land out there with the astronauts at the landing.

BUTLER: That's great.

MYERS: Okay. Where are we?

BUTLER: You've worked as both contractor, you've worked at NASA, you've worked in the headquarters area. How did you see the role of the contractor change, and what do you see for that with NASA in the future?

MYERS: Yes, I've been on both sides of it. I know when I was in the industry, in the Apollo Program particularly, I felt like we were getting micromanaged by NASA. We had people swarming all over us. In the early days, an engineer from Johnson and an engineer from North American would decide they ought to change something, they'd change it, and we'd be in deep trouble because that part didn't fit with something else up in the system. So they had to get some discipline there.

So I worked with George Low on this one, and ended up with an arrangement where we had a change board that was run by George Low and Deke [Donald K.] Slayton and Chris Kraft and all the top guys at Johnson. I would go down to Johnson once a week to be in the change board. We stopped all that changing down at the lower levels and got some discipline in the system.

So I always had a little trouble with the difference between industry and the government, because we're a team. It has to be a team working together. The industry has its role and the government has its role. I found that it's more a matter of a lot of good communication between both sides to make it work, and if there's a lack of that kind of strong communication about the management and the problems that are involved, you're going to get in big trouble.

I ended up calling George once a week, whether I had anything to say or not. I'd go to his board meetings once a week. That was hard work, you know, going down to Johnson once a week, but it was absolutely necessary and the way to make it work. I found that industry knows how to manufacture things, they know how to design things for manufacturing, they know how to reduce the cost of things in manufacturing. NASA usually

is the stimulus of the technologies and the bright ideas. If you can get the right balance between the two, you get tremendous work done.

I've been a little concerned, I guess—I'm not sure that I'm worried about it, but at least I am a little surprised that NASA is tending to get into actually building hardware. You know, they're building the X-38. The test articles are being built down at Johnson, and engines are being built at Marshall. I don't particularly like that idea. I have the feeling that they should be still in the preliminary design stage and have industry support them, because I think industry can always build it cheaper than NASA can. That's the bias I have probably from being in industry and being at NASA. There's a place for both of them.

I found it fairly easy to work on either the industry side or the NASA side. I think I found that it was a team effort in either case and it's a matter of which side you're on, you're still working with the guys with the idea of communicating where you understood each other's needs and could work accordingly.

BUTLER: What are your thoughts on the USA [United Space Alliance] involvement on the Shuttle?

MYERS: I think it's a good idea. When I was at NASA, we were getting too much into operations and it was beginning to distort the sort of technical basis of NASA, I thought. In other words, you were getting these things where you do things over and over again, and if you have a very bright entrepreneurial engineer doing those things, he's either going to get bored and leave or he's going to do something wrong, you know.

So you get people in operations who are very aware of how important it is to do the same thing over and over again. So I thought NASA needed to sort of pull away from the operation stuff, and by having USA come in, you get that group that's involved in operations

more like operating an airline, and you let the bright entrepreneurial people get back to the things they ought to be doing. So I'm all for it. I think it's a good idea.

BUTLER: Looking back over your career with NASA, what would you say was your most significant contribution?

MYERS: Probably the Space Shuttle definition itself. That's where I think my own individual knowledge and my strategic planning about how to get that thing done and sold [in a] really a big program that I felt that I…was responsible for and made happen. I got people to help, a lot of people to help, but the planning that led to getting something sold to the administration was what I did, and I'm very proud of it. I think that there are not too many other people who had the premonition, the background, and the facts and understanding of the issues that could have done it.

George Mueller, I've had many discussions with George, and he thinks I should have held out for a two-stage system, you know, but that's okay. That's good.

MYERS: He wasn't there, and he didn't know what we were going through. We were right on the verge of not having anything, and not having anything would have meant just [a] disaster for NASA. If we hadn't gotten something started before the end of the Apollo program, I think we would have had just a major breakdown in NASA.

I could have said the success of the Apollo Program, and it was a huge satisfaction, but I think I have the feeling that I probably was—that was so much a team effort that it's a little hard for me to say that that was a major accomplishment of my own, as compared to the Shuttle. We had a lot of guys helping on the Shuttle, but I think the issue on the Shuttle was to get a program that nearly satisfied the cost-effectiveness issues that the OMB [Office of Management and Budget] was raising. The idea of continuation of the space program

appealed to [President] Nixon and yet [the shuttle] was…in the direction of doing the things that we wanted to do in space, which was to support a Space Station that had all this up-and-down capability that we needed. So with the help of Charlie [Charles J.] Donlan and a lot of really good guys that supported me on this thing, that probably is the thing I would most want to tell my grandchildren I did.

BUTLER: Definitely something worth being proud of. Definitely. In retrospect, also, what would then be your biggest challenge?

MYERS: Oh, Apollo 1. The recovery from Apollo 1. Boy, no question about that. That was eighteen months of the hardest work I have ever put into anything. There are lots of challenges, like we had to get an increase in weights for the command module. One of the reasons we didn't have any wire covers on these wires was the weight problem. It was considered too heavy, closeout panels [to cover] the wire.

After the Apollo 1 fire, we had to go down and beat up on Johnson, then have them and us go over and beat up on Wernher von Braun to get another thousand pounds of weight for the command module so we could do the things that we had to do to get that thing fire-safe. We had to change the hatch, [from inward] opening, [to outward] opening. We had to change the gas mixture in the thing. We had to go test everything again in fire. We had to change a lot of the hardware inside the vehicle. And we had to do it very quickly. Even as it was, it took eighteen months. So it was a huge program. Nothing I've ever done has had that kind of pressure or day-to-day decision-making and direction. So that's the biggest challenge.

BUTLER: It came though all right.

MYERS: It came through okay. It came through great.

BUTLER: Absolutely. When you first got started working in aerospace industry, and there wasn't even a space program at the time, and then you came this far, did you ever think about where it could lead you, or imagine what would happen?

MYERS: Sure. Sure. I told you I started because I shook hands with [Charles] Lindbergh, so I wanted to be an airplane guy. When I was in high school, I wrote a short story on a spacecraft, all about a guy that had gone through a fire in a spacecraft, and he was having trouble with his commander in another spacecraft. So I wrote the story and won the first prize in short-story writing in high school about the space program.

BUTLER: That's great.

MYERS: My wife tells me, I don't remember this, but when I was courting her, I remember telling her that I was going to go to the Moon some day. So I was on the way in high school and college.

BUTLER: That's great.

MYERS: When the V-2s started hitting London, I was working on airplanes at the time. Our company [North American Aviation, Inc.], Lee [J. Leland] Atwood, the then-president of the company, decided that we should set up a little group to start looking at rockets. It didn't get started right away, but I got over there as soon as it started and started working on rockets. That was in 1945, and so we had a little rocket to be launched in 1946. I worked on a program called Navaho, which was a cruise missile, but it…[wasn't like today's] cruise

missile[s]. It was ramjet-powered and it had to have a rocket to launch it [to], Mach 3, and so we had to develop new rockets. I didn't set it up, but Lee Atwood set up a group called Rocketdyne [Division of North American Aviation, Inc.] that built these big new rockets that we used. Those rockets became the rockets for the Thor and the Atlas, and really were the basis for the big rockets that we used for the Apollo program. So I had a lot of background in that kind of stuff by the time I got into the program.

I didn't get into the space program until [19]'64, but I sure had been through a lot of the development of the…elements for it, though this Navaho Program, [that] went from about 1950 to 1957. I sort of always had the idea I would end up in space sometime. I didn't know when. Then it just happened.

BUTLER: It certainly happened, and you got to the Moon.

MYERS: Got to the Moon. Right.

BUTLER: If you would, tell us about what you're doing now with Kistler.

MYERS: Sure, be glad to. George Mueller always wanted to build a two-stage fully recoverable launch vehicle. It turns out a guy named [Walter] Kistler, who was in the instrument business, started in 1993 to put together a design for a two-stage system. It wasn't a very good design. He was a physicist and he didn't know much about these things, but he was a very smart guy. So he decided he would go find somebody who knew something about recoverable launch vehicles, and he got a hold of George Mueller. I ran into George at an AIAA [American Institute of Aeronautics and Astronautics] Fellows dinner, and he invited me to get with him, because he was going to redesign this thing.

He got me and Aaron [Cohen] and Henry [O.] Pohl, and the four of us all sat down and looked at a blank piece of paper and said, "What do we think it ought to be?" And over a period of time, we developed the idea of the concept of a two-stage fully recoverable system, privately financed, that would carry low Earth orbit communication satellites. Turns out these things are sensitive to altitude. If you're going to go to very high altitude, you generally go to three stages. When you went to go to medium altitude, you got to two. You want to go to very low altitudes, you might barely make it with one. So we chose to go to two-stage, because the big market is going to be [low Earth orbit] communication satellites.

Over a period of about six months, we settled on the size, we settled on the engines, which was a key issue. As you know, the engine from the Shuttle was the thing that really were what we call the long pole in the tent, you know, the critical path for getting to the Shuttle. [Kistler] chose a staged combustion engine that ran on kerosene. [NASA's] staged combustion engine runs on hydrogen for the Shuttle. Stage combustion gives you about 10 percent more efficiency than the regular old-fashioned turbo pumps. So the Russians, in 1956 or something, decided to go to the stage combustion for kerosene, and they built an engine that was used on their lunar program, which had some problems. Their lunar program, as you know, failed because they lost three boosters in a row.

Well, as is usual in things like this, when they had this trouble with the engines, they started a new version of the engine and beefed it up and requalified it. We saw the data on that beefed-up engine, which by the way, was never flown. It was put into their lunar vehicle in 1972 and was going to be flown on a lunar flight. The Russians got embarrassed, because we had just shut down our Apollo Program and completed the whole thing, here they were still trying, and so they got embarrassed and canceled the program.

So here were all these new brand-new engines that had been qualified without a failure, [one] of the engines had been run seventeen times without any problems, and they were sitting in a warehouse over there. So we worked a deal where Aerojet got these engines

for us, and we have an engine which is reusable and proven to be reusable, and they have eighty of them or something. So we got plenty of engines for the program. We expect them to last, I think from a business-plan standpoint we've said ten flights [without overhaul], but we think they'll last at least twenty. So we've got a terrific engine, and that's the fundamental of it, a thing like this.

The rest of it, the idea is to have, as simple as possible, automatic check-out equipment, health-monitoring equipment where the flights are autonomous. The Mission Control consists of two or three people. I think we're still arguing about the third one, maybe a PR [Public Relations] guy. But [unclear] two people to run the thing and they're really just observing, because if the health-monitoring system says we're ready to go and get a green light, and we push the button.

It's got a lot of safety features. It uses new technology, but nothing brand new, stuff that has been used by other people. For example, the use of the electronics, the guidance equipment, it's almost identical to that which is in the X-33, so we were able to sort of bootstrap on what had been done in that program. The guidance system is well-proven. The engine is well-proven. The recovery systems is parachutes, and we're all pretty familiar with parachutes in the Apollo Program. There's been a lot of work done by the Army on parachutes and landing bags, so we have a known technology there.

The system is about two-thirds complete. We have tanks built, structures built, engines are available, electronics is available, software has been run interminably. [Brief interruption.]

And we're about two-thirds complete. Got a lot of hardware around. We're going to launch in Australia, because Woomera has a huge restricted area way out from it, and for our first flights we want to be sure that it's an unpopulated area that we launch over, and we want to make sure there's a big flat area to land in, and they've got it. They've been very helpful, very cooperative in setting up the program…

Aaron and Henry are still involved in the program, Aaron more than Henry now. I've been up there about every other week for a couple of days and getting involved all kinds of different things. George is still charging just like he always has. So it's a lot of fun.

We're going on a fund-raising trip in a couple of weeks, overseas, and we'll see how it goes. We're trying to collect a couple of hundred million more dollars. If we get that, that's enough to finish the program and get operational.

BUTLER: That's great.

MYERS: All of us recognize the problems that the Shuttle had in manpower, so we put an inordinate amount of time in finding systems that reduce the number of people required in the field. Of course, just being unmanned helps a lot. That just reduces a lot of the people that are involved in making it work. You're willing to accept 99 percent liability instead of 100 percent. Got to have 100 for the manned program. You can operationally do with 99 percent on an unmanned vehicle. So we have a great advantage right there for starters. That's going to be the name of the game, is to reduce the number of people involved. That's what we're working on.

So it's a real challenge, but it's a very important challenge because it's a privately financed launch vehicle that cuts the costs to a third or less of what's done today will be the beginning of the real support to things like the Space Station and to eventually go back to the Moon and Mars. That's what it's going to take, is to reduce the costs dramatically on the launch vehicles themselves. So that's why I'm doing that.

BUTLER: We look forward to hearing about your further successes with this thing.

MYERS: We hope to be flying next year in 2000.

BUTLER: Should be a good program. Sounds like it.

MYERS: Got a lot of good people working on it. Lots of good young people working on it, too. That's one of the great things about it, is we've been able to sort of mentor young people, some of who are right out of school, and have just become really important guys in the program. That's what's fun, is to see that happen.

BUTLER: I surely that's fun for them, too, to get to work on such a new program and help bring it—that's great. Is there anything that we haven't covered that you wanted to expand on?

MYERS: No, you did a pretty good job giving out questions this time around. No, I guess, I don't know, I probably have sort of [unclear] said it as we went along, but I always had a great time working with the guys at Johnson. They are a super bunch of guys. I always felt that they have done everything in their power to do the right thing as far as this space program is concerned. Having come out of the Langley [Research Center] group, you know, the task force and Gilruth, Bob Gilruth was such a great leader himself, that he just instilled that theme in his people. Chris Kraft and Aaron Cohen and these guys just all followed in that pattern. They just turned out to be superb leaders and managers and guys you could work with from the industry side or from the headquarters side equally well. We used to have terrific fights with each other, but always with full recognition they were doing the best that they knew how to do.

BUTLER: I want to thank you again for taking the time to talk with us. I certainly appreciate it.

[End of interview]