ORAL HISTORY 2 TRANSCRIPT

PAUL J. WEITZ
INTERVIEWED BY CAROL BUTLER
HOUSTON, TEXAS – 8 NOVEMBER 2000

BUTLER: Today is November 8, 2000. This oral history with Paul Weitz is being conducted for the Johnson Space Center [JSC] Oral History Project at the JSC studio. Carol Butler is the interviewer.

Thank you for joining us today.

WEITZ: You're welcome.

BUTLER: To begin with, in our previous oral history you did tell us a little bit about your background in the military and how you got interested in aviation, and you indicated it was while you were with the Navy that you heard about the opportunity to get involved with NASA with the space program.

WEITZ: Yes.

BUTLER: Had you had a lot of interest in the space program beforehand? What led you to want to follow that path?

WEITZ: Well, no, I didn't really, because I felt since I hadn't been to test pilot school, I felt that I probably wasn't qualified. Then I think as I told you in our previous interview, that then I got a

message from what was then called the Bureau of Personnel, with the Navy, that said I met the Navy's criteria and would I want to apply. So, no, the answer to your question is, no, I hadn't really thought about it, for that reason.

BUTLER: What did your family think about the idea of you becoming an astronaut or applying for the program?

WEITZ: Well, my wife was supportive. My children were too small to have any comprehension of what it meant. Frankly, I didn't really have much awareness or comprehension of what it meant either.

BUTLER: Did you have any expectations going into, once you did apply and were accepted, any expectations of what the job would be like?

WEITZ: No, I really didn't.

BUTLER: Just kind of learned as it went along and fell into place.

WEITZ: Right. It sounded like an interesting, exciting thing to be involved in. Of course, I was very thrilled and honored, frankly, to be selected finally.

BUTLER: That is quite an honor. Very few people get to have that opportunity.

WEITZ: Yes. Especially then.

BUTLER: Oh, absolutely. Absolutely. You came in during the Apollo Program, as the missions were getting under way for Apollo and coming up to speed. You served—you went through the initial period of training, and actually, in our first interview you had talked about some of the aspects of the training that you went through, which included even geology training.

WEITZ: Yes.

BUTLER: What did you think about all the different parts of—that were going into this?

WEITZ: Well, it was kind of surprising to me, as far as the breadth of the classroom work that we received, both in geology—of course, we had a lot of field work associated with our geology course, too. But as I mentioned before, orbital mechanics, for example, and spacecraft systems and basic systems such as Apollo software that was being developed at the time. So mainly the thing that was exciting was, we were getting ready to go fly to the Moon, we thought at the time, and that was the main incentive and the most—you know, the goal that we all had that was out there.

BUTLER: During Apollo, you were assigned to the support crew for Apollo 12.

WEITZ: Yes.

BUTLER: And this was your first assignment to a crew related other than the general training.

WEITZ: Right.

BUTLER: You described a little bit about the duties of the support crew, but what did you specifically do for part of Apollo 12? What were some of the aspects of your involvement with that crew and their training?

WEITZ: You're asking me to go back a long way. The support crew, more than the flight crews themselves, really weren't that structured as far as what our duties and responsibilities were. Of course, a significant portion of our time was spent both at the [North American Aviation, Inc.] plant, at Downey [California], with the command and service module [CSM], and also at the Cape [Canaveral, Florida], once the command and service module was delivered to the Cape, for testing.

They said that the Cape kept time in imperial minutes. If they said a test was ready to start in thirty minutes, well, there wasn't enough time, at two o'clock in the morning, there wasn't enough time to go back to crew quarters and try to get a nap, so you'd sit around. It would turn out to be several hours instead of thirty minutes. Not that that's a hit on our friends at the Cape, but that's the way things went in those days.

So our primary function then was to serve as stand-ins for the crew, for the flight crew, and we also reviewed some of the test procedures beforehand, some of the in-flight procedures, but mainly the test procedures. We'd review them before we passed them on to the flight crew or the backup crew, depending on how it went with that particular group, for their approval and

awareness before we'd run a test. So it was that, primary testing, a little bit of systems understanding, some work in reviewing checklists, what we call desktop reviews, before you get into a trainer or a simulator, to evaluate a procedure.

Then the support crew had the primary function as capcom [capsule communicator], too, even though there were more capcoms than [the] three [people in the] support crew, but, nevertheless, we were involved typically in the most active phases of the mission.

That was not a five-word answer, but—

BUTLER: No, that's quite all right. That was a very good answer, good description develop—

Prior to—you mentioned having served as a capcom for Apollo 12 then. Prior to that, and even after that, during missions, where did you typically find yourself?

WEITZ: Well, we were all in the office, everyone, if you weren't assigned to a crew. Everyone had a responsibility. For example, one time—and don't ask me how it fit in with my—I think I probably was working on ALSEP, which was the Apollo Lunar Surface Experiments Package, I think, but Apollo 11, the basic scientific equipment that Apollo 11 placed on the Moon surface. We had various technical and operational responsibilities, and those changed, because that was considered by Deke [Donald K. Slayton], who was the head of the FOD [Flight Operations Division] at the time, FCOD [Flight Crew Operations Division], whatever it was called, it was considered part of the broadening of our background experience and understanding of what went on in the system.

But when you're assigned to a support crew, that was your total function. You were working for the primary mission commander, and whatever he decided to have you do, you went and did it to the best of your abilities. Usually satisfied Deke, but not always.

BUTLER: Talking about the variety of missions and working on the different technical aspects, and you had mentioned earlier that the goal was getting to the Moon and everyone was working toward that, do you recall where you were and what you were thinking when Apollo 11 actually achieved the goal?

WEITZ: When Neil [A. Armstrong] stepped out?

BUTLER: Yes.

WEITZ: Yes, I was in the viewing room at mission control. I remember that.

BUTLER: It must have been quite a moment for everyone.

WEITZ: It was, yes, especially because, as I'm sure you're aware, during the LM [Lunar Module] descent they had those alarms come up. It was Steve [Stephen G.] Bales, I think, that recognized what they were and continued the mission to land, because it was very, very close to landing when the mission was in jeopardy. And Pete [Charles Conrad, Jr.] often said Apollo 12, getting ready for 12 before 11 even launched, Pete figured that, in his estimation, he had as good

a chance of being the first person on the Moon as Neil did, which came very near to being the case.

BUTLER: Yes. They were certainly doing something that had so many complexities to it and something that had never been done before.

WEITZ: Yes.

BUTLER: Always chances of something happening.

WEITZ: You bet.

BUTLER: Absolutely.

WEITZ: You know what John [H.] Glenn [Jr.] said. He was sitting on that thing that's cracking and hissing and making all these strange noises, built by the lowest bidder.

BUTLER: [Laughter] Yes, I'm sure that's a thought that has crossed many an astronaut's mind, I'm sure.

WEITZ: You get confidence in it during the testing. The testing is very thorough. The crew office, anyway, has input into the test procedures and what tests are run also. So it's a little overstatement, but it sounds good to the public.

BUTLER: Sure. Well, I'm sure even just embarking on such a new and different—I mean, it's not something that's routine, it's not something that's common, so even given all the testing and you could have very strong faith that everything's going well because you did have such good testing, that there's always that reminder that people don't do this all the time.

WEITZ: Well, it's true. I don't remember if we talked about it before, but Apollo 12 was struck by lightning during ascent. That was a very hairy time. Fortunately, there were just enough of the basic systems, backup systems, in the spacecraft that kept it going until the crew could react and straighten things out again. You always try to be prepared to cope with something unexpected.

BUTLER: Talking about unexpected, the next mission was Apollo 13. You had, again, indicated in your earlier oral history that you worked a type of support for Apollo 13.

WEITZ: It was very short-lived. The Astronaut Office had a function then called "Stoney." That was a KSC acronym. I forget what it stood for, but Stoney was the person who sat on the console at KSC [Kennedy Space Center, Florida] in the launch support room and gave the final countdown to the crew. Basically that's all he did. Plus, I guess, just to keep little fingers busy, he also controlled the elevators in the launch, at the pad. Well, when the crew got off the top and then the guys put them in, closed them up, then they come in, then he positioned remotely some of the elevators for emergency egress. So that was a big job prior to launch. Then, as I say, give the crew the countdown.

BUTLER: That was a pretty important task.

WEITZ: It was okay. It was better than not doing it, I guess.

BUTLER: So where were you, then, during Apollo 13 when the accident did happen and the crew had to then move into the lunar module?

WEITZ: When we first understood what was going on, when Jack [John L. Swigert, Jr.] said, "Houston, we have a problem," I don't remember where I was. I know that we assigned a team, Deke [Slayton] assigned a team within the Astronaut Office and, of course, with the flight controllers, too, to figure out what was going on.

My function, we directed, as I remember, all the resources of the Astronaut Office except for possibly the [Apollo] 14 or 15 crew toward working this problem, then trying to decide what to do. But to make things like that work, you need to have one person in charge, and I forget who that was, although Ken [Thomas K.] Mattingly [II] did the most work and, I think, had a lot of input into the idea, for example, of using the LM lithium hydroxide canisters in order to get some of the carbon dioxide out of the air. But the rest of us were primarily go-fers. We were just springloaded to go, either call a contractor or anyone that we could, any company or organization that might help. So it really was kind of a mishmash. We were all just running around trying to get things under control.

BUTLER: And everything did come under control eventually, and everyone came together very well to make it all—

WEITZ: We got the crew back.

BUTLER: Absolutely. And that must have been—must have been quite a moment for everyone.

WEITZ: Yes. Of course, the main thing was when they jettisoned the LM prior to reentry, and then the reentry started well. But everyone was still hanging on until they came out of blackout.

BUTLER: As the Apollo Program came to a close, originally there had been more missions planned.

WEITZ: Twenty.

BUTLER: Twenty.

WEITZ: Through Apollo 20.

BUTLER: Unfortunately, canceled. What were—what was the general thoughts and the general feelings of NASA as that was coming to a close? Of course, Skylab was already being planned and under way.

WEITZ: Yes.

BUTLER: Were there any final thoughts on the Apollo missions and that it had been too short or that it was enough or any general feeling like that?

WEITZ: Well, we had a parochial point of view. We'd have liked to have seen more missions to the Moon. And at the time, Skylab, as a title and a series of missions, had not been settled on. There was a concept called the Apollo Applications Program [AAP], which included continuing building Saturn Vs and sending both manned and unmanned missions to the Moon, not necessarily to land on the Moon. The whole thing was still conceptual. But there was a big thing to map the entire Moon by putting a mapper in polar orbit around the Moon, so to get the front side, the back side, the whole thing, in preparation for, at the time, as I remember, building a lunar base to support a manned exploration of Mars. That was basically open-ended.

Of course, the political environment at the time, canceling the Apollo lunar landings 18, 19, and 20, and AAP, Apollo Applications Program then shrunk down, and finally was called Skylab. So that's what was left. I've been asked this before in an interview by one of NASA's historians. I should have reread that before I came out here, because I wouldn't want to lie or get mixed up or anything. [Butler laughs.] But, gee, I don't remember when the transition occurred in there, but it was very gradual.

BUTLER: That's all right. I'm sure we can refer back to that oral history if we need to.

Moving into Skylab, you had mentioned in your first oral history about the wet versus dry workshop, and the discussions on that, and some of the tests that were done both at Huntsville and at Houston, using the water tanks.

WEITZ: Yes.

BUTLER: Can you tell us more about what those tests entailed and what they were looking at?

WEITZ: Well, it was a combination. It was more procedures evaluation and hardware evaluation, so that makes it a test, I guess, if you're evaluating hardware, because when it was wet, of course, the workshop launched on one Saturn I and the crew launched on another, and then you had to do an EVA because the S-IVB stage had been a functional propulsive stage. So the primary functions were to make sure that the—of course, the crew didn't do that, they did it from the ground to make sure that all the gases, the oxygen, was dumped out of the workshop. But then primarily since they had feeds to the engine that came out of the hydrogen tank, that went to feed the engines and there were several large plumbing lines, as you could imagine, in the bottom of the stage, so the primary EVA or the water tank testing those and evaluation that was done was the method that we thought we would go about plugging those things because they fed right to the engines and you wouldn't want—and I think it's part of the shutdown procedure, they left some valves open on the engine. So you had to get those things plugged.

So that was the primary thrust of the water tank work that we did, plus some of the initial activation. I think the configuration at the time must have included multiple docking adapter on top, which is where a lot of the scientific equipment was. So we also evaluated the

procedures for bringing that equipment, boxed equipment, down into the workshop and installing it. So that went on for a couple of years until we finally decided the system was contracted to produce Saturn V, so now if you cancel three Apollo missions plus we always had a spare—I think the spare is the one that's laying out here [on the lawn at JSC]—so you had a Saturn V available, and that made it appropriate and easy to do a dry workshop, which reduced the crew's activation time from about a week down to a couple of days.

BUTLER: Did the Astronaut Office had a preference toward the dry over the wet?

WEITZ: Oh, yes, you bet. You bet, for a couple of things. The less activity you have, frankly, the less chance you have for something going wrong. What we were always concerned about, because we didn't understand at the time what it took in a large volume and weightlessness to handle large heavy equipment boxes, well, we didn't need to do that much with the dry workshop because they were almost all installed in the S-IVB or the workshop at launch. Basically it cut the so-called activation time down from, I don't remember, five or six days, probably, down to a couple of days so we could get on with the business of evaluating the usefulness of people in microgravity sooner.

Plus we had another untested thing, so the wet workshop, as I remember, did not launch with the Apollo Telescope Mount on it. That was brought up later. So then we had to develop a procedure and the wherewithal to carry it up on the manned flight, the flight for the first crew, and detach it, remotely fly it over, and dock it. So that was a significant cost then that was avoided, and risk, you know.

BUTLER: Very different.

WEITZ: Yes.

BUTLER: Seemingly it ended up all right, although there were a few incidents along the way. But before actually getting to the mission, once you were appointed to the Skylab mission, what did your training entail for that? What processes did you go through?

WEITZ: Well, it was the usual. Of course, we had to understand, first off, the main thing was to get up there, so you had to make sure the crew was properly trained in the ascent profile and all the procedures, including your basic and your emergency procedures. Same thing on docking and reentry. But the important thing was just to get up there and get going. So it was every aspect of the mission, and we didn't just focus on ascent for three weeks then and go do something else. The whole thing was interweaved because what we didn't want to is, you wanted to leave Houston to go to the Cape for launch day as current as you could be as a crew, with everything that you're going to be involved with.

So the whole thing was kind of a melded, interwoven schedule of training, and a lot of it, of course, the closer you get, the more it's a refresher. It's really verification and in many cases some revisions, improvements, we would like to think, but not always, in procedures, techniques, and experiment operation. So it was every aspect of the mission, which was launch and ascent, which had, of course, no EVA at the time, until the end of the mission for ours, activation, which was getting into the workshop, activating it, setting it up, because some of the equipment that was stowed in a certain way for launch had to withstand a launch environment,

which, of course, it didn't on orbit, so we did have to rearrange some of the equipment within the workshop.

Then basically we spent a lot of time just becoming familiar with and making sure we understood the procedures for all the so-called experiments we were going to be performing. Now, we did, since there were more than we thought three people could devote training time to, in many cases we had a prime and a backup on some of the experiments. Of course, Joe [Joseph P.] Kerwin, being a physician, was prime on all the medical stuff and I was his backup for some of it and Pete [Conrad] was his backup for the others. Pete, of course, he was the mission commander.

We had a thing called Earth Resources Experiments Package, EREP, on there, and I was prime in that. So that meant I went to the Martin [Marietta Corporation] plant outside of Denver, in Littleton [Colorado], and followed the development and testing of those cameras. Jack [R.] Lousma and I primarily were assigned responsibility of following development of the airlock module, which started out—well, anyway, most of the work was done at the McDonnell [Douglas Corporation] factory in St. Louis. So it really was an interweaving, but like some of the stuff, see, Joe Kerwin, for example, had nothing to do with EREP. I was prime on it and Pete was the backup. I can't think of any other specifics, but that was an example.

BUTLER: What did training for EREP package entail? Were you given specific things—training on how to recognize certain features on Earth, or were you just given certain time lines of when to take pictures of certain things or—

WEITZ: See, it depended. One of the sensors was pointable, and what you really wanted to do—and don't ask me what the sensor was, because I've forgotten, but we had a telescope up in the MDA [Multiple Docking Adaptor] and you would have to then—I think it had a different magnification, fields of view on it, so the responsibility, when you're operating that one, was to find the site. We called them targets at first, but it was decided, the cold war was still going on, it was a bad term. So we called them sites, which was more appropriate anyway. To recognize the site, even though you had help from the ground. They would say, "Pitch the telescope up to a certain angle on it and watch, and at umpty-ump time, you should have your test site in view." Then you were supposed to center it in the cross hairs and track it. So that was active crew involvement in that, where we had another bank of six Hasselblad cameras that had various wavelength-sensitive films in it, six different film, and that was fixed. It just pointed at the Earth, so all you did with that was start on your watch and you started it, and when it was time, then you turned it off.

So there were really two extremes of involvement with it. Most of it was really basically start and stop on a clock.

BUTLER: Were there times that if you saw something particularly interesting, that you were allowed to just take pictures?

WEITZ: Heavens, no. Except with the handheld cameras. We had typically—we flew 35-millimeter. I'm not sure if we ever flew the 35-millimeter in Apollo or not, but we had some 35-millimeter cameras on Skylab, and, of course, we had our usual 70-millimeter handheld, too. We had motion picture cameras, but they were only for documentation of some mobility,

basically some human factors-type things that we did, moving around in zero G, moving large and heavy volumes, equipment. So I think we didn't take any 16-millimeter movies out the window, targets of opportunity, but we had the usual, never enough film. No crew ever has enough film available to use for targets—excuse me, sites of opportunity. So we did take some of that.

BUTLER: I think that's pretty—

WEITZ: But other than that, with EREP, no, because resources were—most of the data were recorded on tape in, I think, one-inch or inch and a quarter, something like that, magnetic tape. And that limited how much data we could take with it.

Now, with the Apollo Telescope Mount, looking at the sun, that was primarily—some of that, well, it ran the same as EREP. Some of it was, you just took data on the clock, and others, we had an X-ray monitor, helium alpha, I think. We had a couple of displays on there. You could then point one or more of the instruments at a specific site on the sun to take data.

BUTLER: Did the experiments or the plans for when you should turn things on and off, did any of that change during the mission as—

WEITZ: Are you kidding? I'm sure it did. I mean, those guys in mission control are very busy. They come on for eight hours. They want to get something done while they're there, rather than just sit around. So, yes. But I overstated a little bit there. Yes, everyone had the accomplishment of the mission primarily, and if they could evaluate, which for some of the

experiments you could, and also if the crew would call down and say, "This didn't seem to work right," or, "We think there's a better way even yet." I was primarily responsible for the EREP procedures development, and I found out a lot of things in orbit that I didn't like about that. So we could change some of them. After we bounced it off the ground and they looked at it and evaluated, either desktop or in a trainer, make changes or modifications, you'd either go to procedures, a time line, or perhaps to a setting on the equipment.

BUTLER: I think you mentioned in the earlier oral history that one of the reasons you found things different is just the difference in working in microgravity versus working on Earth.

WEITZ: Yes, in many cases that was so.

BUTLER: That's the way you do things. In Dr. Kerwin's oral history, he mentioned that you were also responsible—you were the systems expert for the flight as well. Is that correct?

WEITZ: In the workshop, yes.

BUTLER: What did those duties entail? I think you mentioned the docking adapter that you were involved with a little bit, the airlock. What other things fell into those areas of responsibilities?

WEITZ: Oh, gee whiz. I'd forgotten about the systems stuff, but, yes. And of course, we had the environmental control system, the electrical system, and not much hydraulics. But it was a

relatively complicated control panel, because we wanted as much flexibility and adaptability as we could get into it. So I mentioned before Jack Lousma and I, and that was part, even though it controlled systems in a workshop, that was part of the airlock module, so we were involved in the layout, for example, of the control panel and which functions were capable of being crew-enabled or not, you know, crew-activated.

BUTLER: I imagine that some of those duties changed a bit after the launch and when you had to then reevaluate how the whole activation was going to go.

WEITZ: To a certain extent, yes. Yes, and also we had some trouble, problems early on with our cooling system in the workshop. It tended to freeze up. So, yes, because we didn't have the thermal shield, which is what caused the problem, not by design nor implementation, but because of the loss of the thermal shield. Even though we shaded the top side from the sun, the other sides of the workshop were still colder than they were intended to be by design. And I think we had problems throughout the mission, although we learned to cope with them. Primarily the good folks on the ground learned to cope with them and those problems did diminish both in frequency of occurrence and also in significance. But I think we had to cope with that throughout all three missions, as I remember.

BUTLER: Well, it certainly was quite a change to things when the launch did occur and when the shield was ripped off and when the solar panel went and the other one was jammed. Obviously there was quite a time there when everyone was trying to pull together again, almost like Apollo 13, to save the mission and make it all still possible. Your crew was pretty involved with that

process, since you had to be the first ones to go up and do some of the repairs. You did tell us about that some in the first oral history, but I was wondering if you could go over it again briefly for us here today.

WEITZ: Well, of course we watched the workshop launch and it went in the clouds. Then we headed back to crew quarters in preparation for going back to Houston, not that day, the next day, as I remember it. The backup crew, our backup crew, which was—let's see. Who was on that? I think it was Rusty Schweickart and Bruce McCandless and Story Musgrave. As far as we were concerned at the time, it was a good launch. And if it's a good launch, then backup crew has nothing more to do, and they were free from quarantine, which we weren't.

They were free from quarantine, so some or all of them went into—there was always a round of so-called parties. Some are more party than others at KSC around the launch. So they all headed to town and proceeded to live it up, but we went back to the crew quarters. Then we realized what was going on. Oh, that's right. [Laughter] How soon you forget. We had to stick around because we were supposed to launch the next day. That's why. And we weren't yet aware of what was going on.

So, anyway, what was your question?

BUTLER: I was just wondering if you could walk us through how—just like you are, talking about leading up to—

WEITZ: Right. The whole time line. I don't remember when we were notified that there was a problem. I don't remember. It must have been in a couple of hours, because the ground knew it

right away, because the electric guys started seeing output from one of the solar wings during ascent, which you shouldn't see, because the thing is supposed to be totally stowed. So it was a little mystifying. Things fell together later.

But as I remember, the solar array was made up by several panels, I think five or six different panels of solar electricity machines. They were developing a little more voltage or current or volt as they got out closer to the end of the arm that held the solar array, the wing, and it fit with what we found out to be the case, in that remaining solar array was partially deployed because the arm had come loose and was away from the side, so they were having some sunlight on it. They saw that during ascent, so I'm sure that we were probably hardly back at the crew quarters when we were informed that there was a problem.

Well, due to orbital mechanics and rendezvousing with the workshop is our launch opportunities repeated on a five-day interval, so if we didn't launch the next day, we had to wait five more days. So we went back to Houston while things kind of settled out and activities started on first trying to figure out what was wrong with it, then what we understood of what the problem was, was coming up with fixes for that. So we weren't really sure. As I told you before, you know, we knew we were going to launch, even if it was just for a day or two, to take some pictures, fly around, come back, and they'd tell Congress and the public what went wrong. So there were two other crews that were very, very nervous. Their opportunity to go fly a mission may have gone away.

Then as we learned more about what the situation was and didn't have a total grasp on what we were going to do to fix it yet, then they slipped our launch another five days, so that we launched eleven days after the workshop. By then things had come together enough that we had what we considered to be a reasonable plan of attack for fixing the situation that was the case.

The backup crew was then back in quarantine and they did a lot of the developmental work in the water tank in Houston, as far as Huntsville, the big water tank. We didn't have a big one then. Huntsville had the big one, which is where we did most of our water tank training for Skylab, by the way, at Marshall [Space Flight Center, Alabama]. So they did a lot of the stuff, and then once they developed the procedures, as we understood the problem, then, of course, the people—and I forget what our approach was now to EVA responsibilities, then we would get in the water tank there and go through to make sure we understood the procedure and that it sounded and looked okay to us.

We launched with three different applications for shading. We knew by then that the thermal shield was gone, so we launched with—I'm trying to remember if we took additional food. Anyway, there was a lot of stuff tied down in the bottom of the lower equipment bay in the command module with beta cloth line at launch, because we launched, for example, with three different methods, approaches to shading the solar side of the workshop.

And I think maybe we launched with some extra food. I don't really remember, because there was a question—we knew how hot it was in the workshop, 140-some degrees, as I remember, but we didn't know what effect it would have on the food, for example. Did the freezer still work? I think we launched with some extra food, but I'm not sure about that.

We also then, due to the heat, there was a concern at one time that there was perhaps some noxious or even toxic outgassing from the insulation on the inside of the workshop, which is part of the normal S-IVB, which was considered to be very good for insulation, but was never intended to see those temperatures. So then we launched with an adapter that plugged into—we had an equalization valve in the MDA, so this adapter plugged into this equalization valve and it would then sample the air in the MDA to make sure. It's like ones that used to be used in

propeller-driven airplanes to sample for carbon monoxide in the cockpit. We had different sensors, tubes, as I remember. It was a glass tube with some sensitive chemical in it, and if it would change color, then it was bad.

But there were no noxious gases in any element of the cluster when we got there, so then we basically opened up the MDA and spent the night once we got through the standup EVA. Did you want to go over that again?

BUTLER: Actually, even before we get there, if it had detected gases, would that have ended the mission there?

WEITZ: Well, they had a capability, which the ground had done—see, it had dumped the workshop and repressurized it a couple of times, if there were any bad stuff in the workshop, that they would have got rid of it. So we could have done that some more, but, of course, then you're eating into your reserves and potentially mission lifetime. So I don't remember, but I would guess that was probably going to be a real-time call.

And we didn't expect it in the MDA anyway. It didn't overheat. It had its own thermal control system. It was in the same configuration it was designed for, so it was okay. As a matter of fact, in attempt to keep the workshop cooler, as I remember, the temperature in the MDA was about 55 degrees when we got there, so it was quite comfortable.

BUTLER: Great. Yes, if you could go into the—as you've been going along here, into your standup EVA.

WEITZ: Okay. Well, we went up there and saw what the situation was as far as configuration. The entire thermal shield was gone and so was one solar array, except for a piece of the thermal shield that was trapped under the partially deployed wing that remained and a piece of the thermal shield had been wrapped up around and embedded in the top of the wing, which was why it wouldn't deploy.

So we tried the standup EVA and we put our helmets and gloves on and depressurized the command module, flew in, and we had this thing called the shepherd's crook, which was what it was shaped like. The intent was to pull out on the bottom of the wing and have it deploy. So, of course, Pete had to drive the command module, and the hatch opened out toward his window, so his field of view was significantly restricted by the hatch.

So we opened the hatch and then I stood up in the hatch and Joe Kerwin held onto my ankles, because the hoses in the command module weren't really designed for EVA, so you didn't want to put tension on the hoses for fear of something breaking. Well, that didn't work, and it gave Pete fits because I'd haul on the shepherd's crook on the bottom, and it would pull the command module and the workshop toward each other, and then Pete's trying to keep this thing under control. So he's hosing out a lot of gas.

Surprisingly, for something that weighed 100 tons, just by doing that, we were actually moving the workshop also, because we could see—it had cold gas thrusters at the base, and we could see those things firing. So that was moving around, too. So we decided to forego that. It wasn't working.

So we had to try Plan B, which was, we had flown a set of basically what amounted to these instruments that tree trimmers use, one of which was a cutter. But we didn't really try it from a different attitude, but from our position at the end of the solar array beam, the angle that

you could get with the cutter on that piece of joint from the thermal shield that was embedded in the top, I couldn't put enough force, even with Joe helping, as I remember, on the lanyard to activate the cutters to cut through it. So we had to give up on that.

Before then, we had soft-docked, which, in Apollo terminology, you had capture latches and then you retracted the probe to pull you into a hard dock. Well, we had soft-docked and just hung on the capture latches while we ate lunch. It was a late lunch that day. We ate lunch, so we went back then to make a hard dock with the workshop at the end of the MDA. That's when then the capture latches would not function properly. We couldn't get a soft dock.

That's when, as I think I said before, close into launch, we were doing some training in Building 5, and one of the trainers came over and he said, "You know, we've never used this procedure, but you guys might want to know how to retract the probe if you had to so it could be basically gotten out of the way for backup approach to docking." So Pete and Joe went through that. I was doing something else, and Pete and Joe went through that. And, sure enough, we had to do that.

So that meant suit up again, depressurize the command module, get out the procedure which was in there, and they had to cut some wires, as I remember, manually retract the probe some way. I think we left it in the tunnel just to keep it out of the way, because you didn't want it floating around loose inside. That's when, as I say, old "Steamboat Willy," Pete, he drove in and made a perfect—which is difficult, you know. The probe-and-drogue system, you hook it up and then you retract the probe, and basically that pulled you in and did your alignment so you could then make the—they had twelve latches, called capture latches, that joined the two parts of the tunnel between the two vehicles. He drove in, made a practically perfect hookup, because when we got the hatch out of the way, the command module hatch, and the probe out of the

way, then eleven of the twelve capture latches had been made at contact. So all we had to do was manually engage the other one.

Then we tested the air in the MDA, went in, looked around. It had been a long day by then, so we went in, looked around, and basically then it was time to eat supper, which was Apollo-type food as opposed to Skylab food was all down in the workshop, and sleep in the command module. I think I'd have to go back and look at the as-flown flight plan. I don't remember where I slept the first night. I slept in the MDA a couple of nights because it was just nicer. The plan in the command module was just stretch out a sleeping bag and you laid under your couch, and that's just not a very neat way to sleep, in my mind. So Joe and Pete stayed—I think they wound up sleeping on top of their couches, and I moved my bag into the MDA and slept there.

Then the primary plan for shading the solar side of the workshop was to—it had two scientific airlocks, one on the solar side, one on the anti-solar side—was to extend a so-called parasol from the equipment package, through the solar-side airlock, deploy it like an extendable umbrella, but made up of several sections. First of all, it had the center pole that extended, and then you had four other poles that shaped the rectangular parasol as it went out.

So Pete and I went in and did that, and we had to make several trips because you'd overheat in the workshop. We went in in our skivvies first, or nearly to it, and that's when we discovered that the folks who live in the African desert have the right idea, because we wound up wearing trousers, jackets, gloves, the whole thing. We found we could stay in that—it's like Phoenix, it's hot, but it's a dry heat. But still we had to come out occasionally.

Then Joe monitored it. He could see, pretty much see the parasol being deployed from the command module. So we extended it up until the four arms were free, and it deployed into

its deployed position, and then we pulled it back down until it was so many inches off the side of the workshop, then unscrewed part of the pole that stuck into the workshop, and it was ready. It turned out later, one of the four arms didn't deploy all the way, so it wasn't a rectangular shape and size as originally planned.

The ground, as I remember, saw temperatures dropping within an hour in the workshop. Then after a day or two, that's why we spent—because it took a while for it to cool off, and that's why we spent a couple of nights in the command module on the MDA.

After a while, after a couple or three days, whatever, we could tell just by feeling the side of the workshop where it was shaded by the parasol, there was a significant subjective difference in the temperature of the inside wall. But we got things under control.

Of course, since we still were down—as I remember, the ATM, the Apollo Telescope Mount, generated 55 percent by design of our original electrical capability, so that's all we had. So we were basically using a minimum amount of lighting. I think we didn't have any hot water for a while. No, that couldn't be, because we ate regular meals for the two weeks before we deployed it. But it basically was a conserve of electrical energy. I'm sure that what happened was that the ground reduced some of the experiment operations that were high power users. As I say, lights drew a fair amount—we had a lot of lights—until the EVA at the end of the second week. Pete and Joe were then successful in deploying the solar wing, and then the arrays deployed, and now we're back basically, with some curtailment, but back to near normal operations.

BUTLER: What was—given the fact that your power levels were so low, what was the motivation for waiting so long before doing that EVA to extend the solar array?

WEITZ: Gee, I don't know. I think you're probably asking the wrong person. I think the main thing was just development of—we shipped some TV photos back, of mainly the flyaround, so the ground had to then dress them up a little bit so they could really understand what was going on. I think basically it just took that long for an appreciation of what the situation was and for, again, the backup crew to get in the water tank and develop procedure, given the tools we had on board, and how do you do an EVA on the side. First off, the question is, can we do an EVA? Okay. The answer is yes. Well, should we do an EVA? And you go through that whole logic process.

Then they also shipped up the procedures, as they understand them, a couple three days before they were planning on doing the EVA, and we kind of walked through them in the workshop. We didn't actually suit up, but as far as getting equipment out and talking about taking it up into the airlock, making sure we could get those tree trimmer's tools back outside through the airlock hatch this time and, I think, the whole process until it was agreed by both mission control and Pete that it was time to go do it.

BUTLER: Okay. So this second EVA, then, hadn't been tested on the ground before you guys came up.

WEITZ: That's correct.

BUTLER: Well, that certainly would be a good reason to take time and make sure it's all going to be safe and have a good chance of succeeding.

WEITZ: You bet.

BUTLER: Absolutely. You had mentioned on your EVA, this was a chance that hadn't been planned for in the initial schedule for the mission. You weren't scheduled to do an EVA. Did you have a chance to enjoy the opportunity, even though you were trying to save the station at the time? But—

WEITZ: Oh yes. And then also with Pete's—I whined to Pete, since the original plan when we were planning this flight, was we did one EVA, and that was at the end of the mission because some of the data from the Apollo Telescope Mount were recorded on tape out at the ATM itself. So there was a planned, scheduled EVA at the end of the mission to retrieve those tapes and bring them back. Pete and Joe were scheduled to do that. Then I went and whined to Pete, because Joe had already had an EVA, and all I had was that crummy standup EVA. So how about if I went out with him at the end of the mission? Because the second guy just stayed close to the workshop and operated. We had those extendable booms then to bring the large, bulky equipment back in film canisters, primarily. So there wasn't much to it, really.

First I approached Joe, because I didn't want to cut him out of something, and he said, "Okay, sniveler." And then I approached Pete, and Pete said okay. Then the ground agreed. So I did get to do another EVA, but that was a pretty busy one, too. I really didn't have time, not at all on the first one, to enjoy the view. And on the second one, I was watching Pete and he was doing a couple of things. That's when he hit the charger battery regulator module as part of the

electrical system, used the old trick, it wasn't functioning properly, so he hit it with a hammer and it worked again.

He also had made up a sample of the material of which the parasol was made, and he attached that to a sunny side of what we call the trusswork that supported the ATM, for either the second or third crew to retrieve, just to see what the effects are of exposure to primarily ultraviolet, but sunlight and vacuum did to it. I was watching him and operating those extendable booms, so, as I say, I don't remember having had much of a chance to stand back and enjoy it.

BUTLER: Your mission did go very successfully, and it kind of went in three phases: your initial phase with getting everything activated and with the low power, then there was the EVA in the middle to extend the boom, and then there was the phase afterwards, where everything was up to as full a power as you were going to be able to get.

WEITZ: Ops normal, basically.

BUTLER: What—and you've talked a lot about the activation stage of things. Afterwards, how did, or did the day change much as to the way you would go about things or—and could you walk us through how your day would go? Not necessarily a typical day, but just from getting up and then walk through some of the things you would do before turning in.

WEITZ: I don't remember significant changes. As I say, we had more power available, so we operated more equipment, more experiments. We launched with a schedule of things to

accomplish. Then each night the folks, the daily activities planners, would get together and during the night—we had a teleprinter of sorts on board, and then they would send up the detailed schedule for each of us the next day as to what we were supposed to do.

That varied from day to day. Although, for example, there was a bicycle ergometer run every day, because each of us subjects did it every three days and we did one person a day. Other things weren't—I think we did EREP passes on each—not each day, but perhaps every second or third day. We did ATM work, solar telescope work, every day. But, you know, I may or may not have been assigned a watch on the ATM control panel on a given day or not. We kind of rotated that around, too.

Then we had chores we called housekeeping, which was basically check the wastewater tank, how full was it, switch freshwater tanks if necessary, clean up stuff, vacuum the screens, take the trash off the screens on the recirculating system, because our environmental control system recirculated most of the air in the workshop as opposed to running it through the scrubbers and the chillers and the whole thing. So we could clean up trash and check the wardroom, make sure you didn't have any—liquid floats around in zero G, and sometimes a little drop of gravy would get away from you. So we had Betadine wipes that we could clean up the workshop with to keep it shipshape.

Some days we had our individual—we each had a drawer where we kept our food, but there was a large locker in which all the food was stored. So on a given day someone was assigned the task of moving food for the next X days, whatever that was, from the stowage locker down to our wardroom pantry. It basically was just—you know, that combination, the ground had a score sheet of what they wanted to accomplish for the different missions, and they interweaved that with basically your day-to-day activities.

Does that answer your question?

BUTLER: Absolutely.

WEITZ: I mean, you know, there wasn't any, except for the medical stuff, the bicycle ergometer, there wasn't anything else I remember, and the ATM, those are the only things that were done every day, as I remember.

BUTLER: Sounds like you had enough variety to keep things always interesting.

WEITZ: Well, yes, but it's no different from here on Earth. I mean, you don't do the same thing in your house every day. You do different things.

BUTLER: And you mentioned in the first oral history that you had plenty of time in your free time to look out the window and enjoy the view.

WEITZ: After the EVA, primarily, because we got more accustomed—you know, there was three or four days and we were getting ready to do the EVA, and that was on day fourteen. Now, we'd spent two or three days getting into the workshop and letting things cool down, assessing the effects of the temperature. We had some hand cream on board, for example. At 140 degrees, most of those tubes of hand cream had basically exploded. Of course, they were in a container, fortunately, but they had popped open because of the temperature.

What was your last question? I was visualizing.

BUTLER: You were building up to working—being able to look out the window.

WEITZ: Yes. Right. So there was a lot of unexpected stuff in the first two weeks and then it became more routine. We learned how to do things quicker and better. You moved around more rapidly. If you want to get a good example of what it means, you can look at the videotapes from the entry into Spacelab on STS-9. You can see the difference between Owen [K.] Garriott, who did a stint on Skylab, and the folks who hadn't been in weightlessness before, just by their actions and the way they handled themselves when they went into the Spacelab.

So we got better and better, but Pete figured that we don't want to overload the second crew as soon as they got up there, so we didn't ask for any extra stuff from the ground. I mean, if we finished a thirty-minute task in ten minutes, we didn't tell them that till later in the day, if ever. I don't remember. Not that we were trying to keep anything from them; it's just that we were trying, as I say, trying to avoid a potential problem with the second crew, which did come to bite us. That's because we were up there—we basically had two weeks of the real mission.

The second crew went up for fifty-nine days. They had fifty-nine days to go. They didn't want to be standing around, just killing time. So Al [Alan L.] Bean asked for other things to do, and the ground obligingly sent them up other things to do. But then with the third crew, they forgot that there's a learning curve associated with it, and people got with it and they overloaded the third crew for the first week or two, whenever—what some people call the strike by the crew, which they said, "We're going to take a day off," which at that time they needed. Then they had a conversation with the flight director, and, as I remember, the center director, and things got squared away and it went better from there.

So we did have more free time. I spent most, if not all, of my free time looking out the window. I don't remember what Pete and Joe did. I would typically go up—the best windows were in the MDA. Even though they were small, you could always see some of the Earth out one of the windows. So I spent most of my time up there, my free time, which really wasn't a whole lot. You're talking about a cumulative total of somewhere between one and two hours a day.

But we did make a point of always—we ate all our meals together as a crew, all three meals, so we would always meet in the wardroom, just to talk things over, see how things were going, because sometimes the guy on the ATM perhaps didn't see the other two guys for three or four hours, half a day, because they were doing something down in the workshop itself and he was up busy at the ATM control panel.

BUTLER: You certainly need that human interaction.

WEITZ: Oh yes.

BUTLER: Are there lessons learned from—well, you sort of mentioned one here with the time, how you ended up having extra time at the end and how the second crew asked for extra duties and then the third crew kind of got overwhelmed. That's obviously one lesson learned. But other things as well that might be applied from Skylab to the International Space Station?

WEITZ: There were things that should have been applied, but haven't been necessarily, just basically certainly the hiatus between ATSP [Apollo Soyuz Test Project] and the beginning, the

actual launch of the Shuttle mission and everybody's focused on the first four flights. What did they call those? They had a special name for the first four flights.

BUTLER: On the Shuttle?

WEITZ: Well, I mean for that phase of it. We tended to forget. As we went into [Space Station] *Freedom*, post flight, during the flight people were taking a lot of notes, recording a lot of information and data, both anecdotal and hard data, and coming up with, I think it was about a twenty-volume—by volume, I mean document that thick, three-eighths of an inch or so, and it was entitled *Skylab Lessons Learned*. I think there were twenty of those publications.

But you could go through them now and find out a lot of things that we're probably going to find on *Freedom* that weren't applied, and that's just because you get a new crew in. By "crew," I mean everybody who's working on Shuttle and *Freedom*. Of course, *Freedom* has been through so many different groups of people and managers and configurations and what have you, it's easy to lose sight of those old lessons. Frankly, everybody thinks they have a better way of doing things anyway.

BUTLER: Would you have imagined that it would be so much time between Apollo and Skylab and then on to Shuttle and Space Station?

WEITZ: There really wasn't that much time between Apollo 17 and Skylab; 17 launched in December of '71.

BUTLER: '72.

WEITZ: Was it '72? And then we launched the workshop in May of '73. So, see, from Apollo to Skylab to ASTP wasn't that much. But then after ASTP, when nobody really knew what we were going to do next, AAP was fading at the time, Skylab was kind of hanging on like Space Station has for the last lots of years, and that's when I remember Cocoa Beach [Florida] really was almost a ghost town. I mean, there were businesses, banks, and restaurants and condos that were boarded up, basically, in the last seventies until we really started getting some hardware, some equipment to test at the Cape.

So that was a long time. A lot of people left the Astronaut Office, a lot of people left JSC, time to move on because they were just the type of people who wanted to be associated with a program or an undertaking that they thought was challenging. So a lot of people left. Lots of people left the Astronaut Office.

BUTLER: Do you have any final thoughts on Skylab or anything you'd like to say that we didn't cover last—

WEITZ: It was worth doing. It's unfortunate that they couldn't find a way, a practical way, to keep it in orbit for longer, or that we used a fully functional—didn't use—and I understand the budget considerations, but from a personal point of view, it'd have been nicer to have the backup workshop, which was ready for flight in all respects, in orbit rather than at the Smithsonian. It gives people an appreciation and understanding when they go through that display at the

Smithsonian of what that aspect of space flight—now with *Freedom* in orbit, it gives them perhaps a little better appreciation of what's going on. So, yes, those two things primarily.

BUTLER: If we could pause here for a minute and take a quick break.

WEITZ: Suits me. [Tape change.]

BUTLER: We were talking—we came to the end of Skylab and, as we talked about, there was quite a break between Skylab and Shuttle—actually, between ASTP and Shuttle and a lot of changeout of people leaving NASA for various reasons, and a lot of changes just going on within NASA trying to get geared up for Space Shuttle, which was such a different program, such a different vehicle. What were some of your thoughts on the Shuttle itself?

WEITZ: Are we ever going to get STS-1 off the ground, basically, because we went through the same thing in Skylab. One time for Skylab we scheduled a launch and we were losing time. I mean, because a month would go by and we were more than a month behind schedule. Of course, it goes up in peaks and it drops off. But it seemed to take half of forever to get STS-1 ready to go. I don't remember now, you can't pin that on any one thing. The new programs, new development, a lot of things had to come together, the SRB [solid rocket boosters], the external tank, the main engines, the Shuttle, the whole thing.

BUTLER: During this time you were working in the Astronaut Office.

WEITZ: Yes.

BUTLER: You mentioned in your earlier oral history that part of the jobs there were training for the astronauts, part of your duties. What did that training entail, since this was such a different vehicle and since there were things still being developed?

WEITZ: Well, it's some training, but also so much development, both developing the moving base—we, JSC and NASA, were developing the moving-base simulators that we had in Building 5. All the Apollo simulators were fixed-based; they didn't move. So the crews were involved in that. They were involved in the layout of the crew station, which was a big job then. I remember [F.] Gordon Fullerton had these foam core—foam core is the sandwiched styrofoam—because he had drawings of instrument panels and then you'd put up with push-pins, you know, to lay things out, label it. Just labeling switches can at times be a significant chore, especially in an approach we had in Apollo, for example.

Let me give you an example. You could control—at the time, anyway, I don't know if you still can—you could control the lights in the mid-deck on the Shuttle from either the flight deck or down in the mid-deck. So it's just like in your house, two switches. Well, how do you label? Every switch has to be labeled, right? You can't just put "on" and "off." At one time, as I remember, they had switches labeled, one position was on/off and the other was off/on. You get focused on some things a little too much sometimes.

But I really don't remember much about that. STS-1 launched in 19—

BUTLER: '81.

WEITZ: '81. So we went from '74 to '81, seven years, gradually phasing up to that, and I don't remember, it was slow times, basically, and we didn't have a lot of people in the Astronaut Office then, because the first group of so-called Shuttle astronauts was '78, as I remember, were selected then. So it was a few people doing a lot, with a lot of help from mission operations and working together on how systems should operate.

You could still get an input into basically what should a given system accomplish. For example, the thermal control, for example, what do you want it to accomplish? Payload bay doors. That was a big thing, because you can't make a successful reentry if they're open. So there a lot of crew involvement went into the design of the actuation system on the doors with the primary goal of closing the darn things.

At the time, the radiators deployed when you're on orbit. If you had anything in the bay, if you closed the radiators, then you could puncture a line in your freon system or whatever we used as a coolant. So it was a lot of crew involvement with a relatively few people until about '79, when the '78 group came on board, got through their first year, then were starting to be assigned, given technical assignments. But it really was a mishmash and nothing much comes to mind. It turned out to be the first six crews were assigned somewhere along in there, and I don't even remember when that was or whether we were assigned all at one time or in a couple three installments or what. For whatever reason, that's pretty cloudy in my memory.

BUTLER: There certainly was a lot going on at the time, getting everything ready.

WEITZ: Yes, there was.

BUTLER: Were you involved with the ALT test, the [Shuttle] Approach and Landing [Tests]?

WEITZ: No, no, I had nothing to do with ALT. I had forgotten all about ALT, as a matter of fact. Deke [Slayton] was in charge of that. Of course, we had the—I guess there were just two crews that flew the ALT missions. It was [Joe H.] Engle and [Richard H.] Truly and [Fred W.] Haise and [Gordon] Fullerton, as I remember.

BUTLER: I believe that's correct.

WEITZ: That's right. That took up a lot of that time prior to the launch of STS-1.

BUTLER: It must have been good to see STS-1 finally come to fly.

WEITZ: Oh yes.

BUTLER: And go pretty well.

WEITZ: Yes.

BUTLER: Of course, there was—on the launch there was some question on the tiles that had come off, that they noticed when they turned the cameras on, but everything did go very well.

WEITZ: I guess we don't drop tiles on launch anymore.

BUTLER: It doesn't seem to. I think a variety of things still happen on launches that aren't expected, but tiles seem to be pretty good now, but the tiles, of course, had been one of the big issues leading in.

WEITZ: It was. It was. As a matter of fact—the center directors kind of run together, too. I don't remember who it was, but JSC basically had a team at the Cape "helping," in quotes, our friends at the Cape get on with both the procedures and the materials before attaching tiles. Kenny [Kenneth S.] Kleinknecht, from JSC, and FOD [Flight Operations Directorate] or Flight Crew Operations [Directorate, FCOD], whatever we were called, you know, we went through that period, too, when mission operations and flight crew operations were combined again, called flight operations. Anyway, from the Astronaut Office, Bob [Robert F.] Overmeyer went to the Cape as Kenny's deputy, as I remember, to work on the problem.

BUTLER: It certainly was a very different aspect, a completely different way of doing things again for Shuttle.

WEITZ: Yes.

BUTLER: During this time frame and as Shuttle was coming on board, somewhere along the way the decision was made to have payload specialists as part of the crew. Do you recall any of the discussions surrounding that and how that came about?

WEITZ: Well, to a certain extent, but I don't remember the timing. Early on, it was considered for a while you would basically have, we thought, two people. Some people referred to them as "the dumb guys in the front," whose only responsibility was to launch, keep the Orbiter running, and fly it back to Earth. They would rotate fairly—perhaps every six months they'd go fly, until they got some time off.

At the time it was felt that the best way to get the most bang for the buck, as far as experiment—we call everything experiments, you know, whether it's an evaluation or data-gathering or on-site analysis, whatever—was to ideally—let's say you're going to take up this new astronomical sensor, whatever. It's spectrographic or radio emissions or what have you. And that some guy in Palo Alto [California] had spent from the time he was a graduate student through his ten-year tenure at the university, and he developed this detector. The most reasonable thing to do was to take him up with it, him or her, to take that person up with it, then let them operate it.

So that was kind of the basic approach to payload specialists as to why we need them, and each time we flew that package or some version of it, then that person would go fly again. But it wouldn't be a NASA employee. We wouldn't have to keep him. All we did was train him to not touch anything, any switch or any control in Orbiter, you know, that kind of—simplistically that approach.

And that's still basically what payload specialists are, although then we had mission specialists, and the concept for that was, well, you have three of these people who have different requirements as far as perhaps pointing or precision of pointing or how much time they need in a given day to take, and you really need a so-called scientific person to be what amounts to the

mission commander as far as payload operation is concerned. So that was felt that, for lack of anything else, we called them mission specialists. Because in every other airplane operation, the pilot sits in the left seat. Well, in the Shuttle, the pilot sits in the right seat. Then the guy who's really the pilot is called the commander. The guy who's really the co-pilot is called the pilot. So there you have it.

Over time, a lot of that has evolved, where we really basically have a three-person crew for ascent and entry. At least we did six years ago when I left. And the third person, MS-1 [Mission Specialist 1], sits behind but between the two seats and is basically a third set of eyes and a third brain, to help you with any anomalies that may occur during ascent and entry.

So that's kind of evolved into—I don't even know how many payload specialists are flying anymore, because they fly a ton of people, none of whom I've ever heard of before anymore. Well, a few I have. We're still flying payload specialists? I guess we are.

BUTLER: A few, but not very many anymore. I think John [H.] Glenn [Jr.] was the first one in a while.

WEITZ: He doesn't count.

BUTLER: I think they don't fly quite as many as in the early missions, but they do still have them.

What did the—your core of astronauts that had come in from Apollo and Skylab, what did you think of this transition into the more scientifically oriented and bringing in people from a variety of different areas? Was it a natural progression or was there some question there?

WEITZ: Let me back up and clarify my comment on John. John deserved a flight. I didn't mean to put that down.

BUTLER: Oh sure.

WEITZ: It's just that in the sense in which I described it, he wasn't really a payload specialist.

BUTLER: Right.

WEITZ: But he wasn't a mission specialist either.

BUTLER: He certainly falls into a unique category, I think.

WEITZ: Right. Yes. So, no, I think it's evolved into a workable and appropriate arrangement as to what we have. Perhaps the commander, the guy in the left front seat, has from that basic approach that I described to you, the commander has more involvement in the conduct of the mission itself than was conceived with the mission specialist-commander approach. So therefore we don't fly those people as often. We don't fly them every three to six months. It's probably good from a certain point of view. It's nice to have—let's just say you took that approach and you only had six crews, front-seaters of commander, pilot, and MS-1. Well, then you may have, for whatever reason, a new system, a new method of operation, whatever, that you really want. Let's say it pertains to one of the abort modes. Well, you need some

experienced folks to get involved in an evaluation of a proposed change to an abort mode, whether it's hardware, software procedures, or what have you. So it's nice to have extra crews around those guys.

BUTLER: Do you anticipate—and this is just conjecture or opinion on your part, but as Space Station gets up and running and they are making more regular trips with the specific idea of going to station, do you think it might progress back to that, having the key flight crews on a more rapid circulation like the three to six months, or do you think it will stay kind of the way it's gone?

WEITZ: I don't know. That's totally up to the center, to JSC, as to what approach they take to that. You really could do that if you know you're going to do an EVA as part of a crew delivery or crew retrieval, crew delivery/crew retrieval mission, and a commander really has to be involved in that. I mean, you could do it if you wanted to, but I don't know if the system will go that way. My guess is, it won't.

BUTLER: I guess it'll all be based on the process of learning and seeing what fits and what's needed.

WEITZ: Well, because the way we're doing it now works, so why change it.

BUTLER: If it's not broke, don't fix it, right?

WEITZ: That's right, basically.

BUTLER: And it does seem to work pretty well now.

Moving into—toward your mission on Shuttle, you talked about the first crews being assigned somewhere during the process of building up to STS-1 launch. When—approximately at what time did you start fully training as your crew for your mission and what did that entail?

WEITZ: I don't remember. I don't remember the time frame. STS-1 launched in '81, but it was originally scheduled around '78 or '79, so we were probably assigned a crew without being anointed as a crew. We were a group of people, myself and Bo [Karol J. Bobko] and Story [Musgrave] and Don [Donald H. Peterson], that were put together [for STS-6] and were told basically to start working together as a group, for whatever reason.

Ask me the question again.

BUTLER: What did your training entail as you did get into it?

WEITZ: Well, of course, we were involved early on. For example, Story Musgrave, who was MS-2 on STS-6, was assigned the primary responsibility from the Astronaut Office to monitor the deployment and retraction mechanism for the payload bay doors that I mentioned. So it really was a mix of working as a crew and still having an office responsibility that was outside what you would normally be doing as an assigned crew. So we eased into that.

Then you'd always try to go scam some simulator time if you could, or trainer, or whatever was available, to start working, on the off chance we were going to be assigned as a

crew to a mission and get to fly it. But that was an evolutionary type of thing, and I couldn't tell you, when we were announced as a crew to fly STS-6, where that fit into the overall schedule. It turned out to be the first six crews were first assigned as A through F, and we were crew F. Of course, we then assumed the title of "F Troop," which became our theme.

BUTLER: That's a good theme. A good theme.

How was your crew and the dynamic between all of you? Had you worked very closely together before or did this bring you together more?

WEITZ: I had worked with Story more closely before, because he was Joe Kerwin's backup for our Skylab mission, and, of course, we would get together with the backup crew and compare notes and things like that. So, yes, I was quite familiar with Story. I'd worked with him a lot. As far as Bobko and Don Peterson, they had come from the MOL Program, the Air Force. MOL stood for Manned Orbiting Laboratory, as I remember. I don't remember when those guys came on board, frankly. It was sometime. Sometime.

BUTLER: Yes.

WEITZ: So I really wasn't that familiar with those people, with Bo and Don. I think one thing is that Story was a little different, but he had been in the military. Story had been an enlisted Marine, so he had been in the military. And, of course, Bo and Don were former Air Force pilots and were Air Force officers. That's one good thing about flying with military people: they understand chain of command. I'm not saying that everything I said was God, because those

guys would go off and we'd have crew discussions, and I think we used a reasonable approach to accommodating different points of view on a certain aspect of getting ready to go fly. But I was glad to have Bo and Don. I mean, they both performed, in my mind, admirably.

BUTLER: Did you have any indication beforehand, since you were the commander, did you have any input into your crew assignments or did it all just come at once?

WEITZ: No, no, no. I mean, the four names were just, "There they are. This is the F crew." It was Weitz, Bobko, Musgrave, and Peterson. So, no. As opposed to in Apollo, I think—it's my understanding that the commanders, once they flew, well, they had to fly before. Typically they flew before being assigned as commander, and they had strong input into crew makeup.

For example, Pete Conrad's first flight was with Gordo [L. Gordon] Cooper. After that, Pete's crew was always all Navy. He obviously had a strong input into the crew makeup. Because I wasn't a mission commander; I was the head of this F crew, but if we did fly, then the people were going to fly in these positions. I was going to get to fly. I never did care that much, and I had confidence in the other three guys. [Recording interruption]

BUTLER: We were just talking a little bit about your crew dynamic and how everyone fit together, and talked a little bit about the training. As you came closer to the time for your mission, if you could walk us through the—kind of like you did with Skylab—up through launch and through the mission, just some general thoughts on that.

WEITZ: Well, basically, you start out, we were F crew, so we had sixth priority on any trainers or simulators. As you get a crew out of the way, as STS-1 flew, then we all basically—you could get a little more time. So the main thing was to get in the simulators or the trainers and practice the things that you thought you would be going to do, and until you're officially assigned to a mission, you don't really know what your payload is going to be.

So the main thing was ascent. We spent the most time early on, on ascent and primarily the abort modes, and we had a fixed-base trainer. It was interactive, but it was still, by NASA definitions, a trainer rather than a simulator. So we'd get in there, the three of us.

We basically flew uphill and did entry with a three-person primary crew, so Story was off doing some other things, and I don't remember when we were assigned our payload, which was TDRS-A, Tracking and Data Relay Satellite, the first TDRS. I don't remember the gap between 5 and 6, but through STS-4 we were only two people and had ejection seats in Columbia. Then STS-5 was the first four-person crew, and they were to do the EVA in the cargo bay, nonspecific, but to evaluate the new suits, because it was a totally new design on the pressure suit that we had for Shuttle. Well, they had some suit problems and they didn't do an EVA.

So then I was able—we had a five-day mission schedule and were going to deploy the TDRS on the first day, and we had all this other penny ante stuff, as I saw it, to fill up the four days. So when they didn't do their EVA, then we were able to add suit evaluation EVA to our mission, which Don Peterson and Story Musgrave did.

But, you know, it's kind of an evolutionary type of thing, much like it was in Skylab, except I didn't have the early-on responsibilities from the office for any—like EREP, I didn't have the equivalent either an Orbiter system, and our Shuttle was designed to carry any mix of

payloads, so we didn't really—the so-called scientist astronauts—and I say "so called" because they were really more than that. They were involved in crew activities and uphill and downhill stuff to a certain extent.

So really it was bagging more simulator and training time as early crews flew, and then getting ready to go do your own mission, which a lot of time was spent basically learning how to land the Orbiter. Bo and I, Bo Bobko and I, spent a significant amount of time in the Shuttle Training airplane that we flew, a modified Gulfstream 2, we flew out at White Sands [Test Facility, New Mexico] out near El Paso [Texas].

We also went out to the West Coast and flew T-38s and we flew our entry ground track into Edwards [Air Force Base, California], and a couple of abort ground tracks, too, just to see what they were like. We flew STA [Shuttle Training Aircraft] flights into Edwards, too, because that's where we were landed at the time.

BUTLER: How did the STA fly in later comparison to the Shuttle? Was it pretty—

WEITZ: It's an excellent simulator. It's an airborne simulator. It's much, much better than the moving-based simulators we have in Building 5, because you're moving. You're not trying to fake yourself out by emulating or simulating accelerations by just moving the fixed base up and down and around. So I think the STA training was invaluable.

Also on STS-6 we flew the first rudimentary HUD, Heads-Up Display, which helped in the landing. Other than that, it was all out the window and using your instruments, where with the head-up display you had information depicted on the reflector in the HUD that was a great aid, in my mind, of performing a landing.

BUTLER: When it came time for the launch and for the mission, if you could walk us through a little bit of that and how things went and progressed.

WEITZ: Well, our launch was delayed because basically they had, at the time, a requirement to do what we call the flight readiness firing, in which they got the Orbiter out, tanked it up, and lit the main engines and ran them for, I forget, some period of time until they stabilized and the engine folks could look at the data. They had to do, as I remember, two of those on our mission, so we were delayed three or four months from the time—I think we were supposed to originally launch in January, and we didn't go till April.

So you're getting ready to go, and then you're not until they change out an engine or did different things. And then you argue about—there was a big argument if you need or want a second FRF [Flight Readiness Firing], because it's money. I mean, that's program costs. So, a lot of discussion on that. Yes, you're just getting closer. I don't remember when [STS-]5 flew. Then, of course, once 5 got out of the way, then we were had first call on the simulators, whatever our training coordinator scheduled for us, with our input, of course, but whatever he was able to get.

I don't remember how soon we moved to the Cape. I don't remember before the launch. Then we had a TCDT, Terminal Countdown Demonstration Test. I'm not sure we do those anymore either, with crew involvement. I just don't know. But basically you go down there, you suit up, you go through the whole launch-day process, short of firing the engines. You get into the vehicle, you get strapped in, they get out, they close the hatches, and they leave the pad, the support folks. If the test is a success, then you get out.

We had a daytime launch, nothing out of the ordinary on that. We had a daytime entry and landing. Really, you know, it just doesn't—the memories aren't as strong as they were for Skylab. It was more routine, I guess. I had been involved in it from the beginning, watching the evolution of the procedures and the process.

BUTLER: That's interesting that it would be—that it would seem more routine and yet it was still a new program.

WEITZ: Yes, for whatever reason, that's the thought that's left with me.

BUTLER: That's certainly—you certainly had been very involved with it, so it does make sense that it would be—it's just part of your life and part of your career and your day.

The mission did go very well and did get to launch the TDRS. Of course, it later had some problems.

WEITZ: Which weren't our doing, of course.

BUTLER: Right. Absolutely. Absolutely.

WEITZ: The ground did a tremendous job on getting that TDRS up into orbit. They had a main propulsion system failure. But they worked it out.

Yes, we did the EVA and the EVA was successful. We learned some things on that. Don and Story did a good job evaluating that. Then we had daytime entry, so we didn't get to see all the sights, the ion wake that folks were later able to see through their top window.

We landed on the concrete at Edwards because the lakebeds were wet. Had a lot of rain in California that winter, so I'd almost liken it to there was so much water in the lakebed that landing on the runway was almost like a carrier landing because we were making the approach and flying in over water.

BUTLER: Well, that certainly is slightly different than—

How did it all compare to your Skylab flight? Did you find yourself at any points comparing things as you went along?

WEITZ: No, not really. I mean, they were different enough. I was in a different position. It really was an evaluation flight, pretty much a test flight, obviously not the first one, but, nevertheless, it still was, and we flew the first flight on *Challenger*, so it was a vehicle shakedown flight also.

BUTLER: After your mission, you came back and worked again in the Astronaut Office for a little while, but then moved up into the Center Director's Office as deputy center director.

WEITZ: Yes. This was after the *Challenger* accident. I was John's [W. Young] deputy chief of the Astronaut Office. Then there were significant changes made in upper management, especially within Code M. I'm trying to remember what the title was, Code M's title. Manned

space flight whatever. And at that time, then, I was offered the opportunity to move into upper management, as I said, as Aaron Cohen's deputy. That would have been '86, late '86.

BUTLER: At that point, did that give you some opportunities to be involved in the recovery process from *Challenger*?

WEITZ: Oh yes. I hesitate to call it "an opportunity," but, yes, I was involved in that, but again from an upper-management point of view, the main thrust on that with engineering flight crew and the missions operations folks. I was not involved directly—well, several of us were called to testify before the Rogers Commission. Bob [Robert L.] Crippen was. I remember John, of course, since he was chief of the Astronaut Office, and I was his deputy, so that's why I was called. There were a couple of other folks, too.

BUTLER: That certainly was a hard time for everyone, for NASA. You told us a little bit about that in your earlier oral history.

WEITZ: Yes.

BUTLER: And it did take time to bring everything back together. What were some of the changes that—obviously some were made to the vehicle itself, but some of the general changes either around the center or in the way of doing things that you recall being involved with or—

WEITZ: I really don't remember. I mean, we were involved in so many different aspects. Even after I returned to flight, we were involved. "We," management was involved. It was still a developmental kind of thing. I mean, every flight we flew had some anomaly or anomalies you had to deal with, and then we had the flight readiness reviews at the Cape that I was actively involved in and so was Aaron. But again, it was so broad a spectrum of topics and issues, that I don't remember any single thing that stands out, except, of course, satisfying everyone at JSC and at Marshall that SRBs were really ready and safe to fly again, and a lot of changes made to the SRB assembly process and testing, how you tested the O-rings and what the test criteria were. I mean, everyone was involved in those discussions.

BUTLER: You had—in your earlier oral history, you had mentioned a little bit about Apollo 1 and the recovery from that and the rebuilding and comparing it with *Challenger*, obviously very different environments at the time, different political situation, different things just even going on within NASA as well as the world. Was there any specific things that you can think of that made those two processes so different or—

WEITZ: Well, see, it was a time of change at headquarters. The person—what was the title for Code M? Office of Space Flight is what it was then. I don't know what it is now. It was Office of Space Flight. And the person who was the director of that office had been tapped and slated to come to JSC as the new center director, because Gerry [Gerald D.] Griffin had decided he was leaving. He announced his retirement. So there were personnel changes in the mill and made public at the time, and then with those changes, I don't remember, but Congress got involved in it.

NASA, frankly, as I told you before, NASA just didn't move fast enough. That was the difference between Apollo 1. I mean, the agency immediately appointed an investigative body and they moved out to Downey to look at what occurred, to try to determine the reason for the fire occurring, and basically there was no outside body necessary. And we convinced Congress and our administrator convinced the President or Vice President that it wasn't necessary, where that didn't happen with *Challenger*.

The agency, for a combination of reasons, just didn't start soon enough, so Congress and/or the White House decided that something had to be done in order to get on with it and basically to save the program. So they appointed the Rogers Commission to look into it. So the ball was taken out of NASA's court in that case, and we just had to report to this group. It took longer, I think, because it became more political.

BUTLER: It must have been rewarding to an extent, if that's the right word for it, when everything—in 1988, when everything did come back together and the Shuttle got back on line again and flying, with the successes now that have followed. Terrible to build off of such an event, but good that they were able to recover and get back and running.

What after that—what did your—as you got back up and running, before you retired, what were some of your duties then?

WEITZ: Well, Dan Goldin came in as Administrator, and from his previous experience, he recognized that he needed some help at headquarters, so he called up a couple of people, one of them being Aaron Cohen, director here, and another one, Jerry Hlass, who was director at

Stennis, basically to work with him full time, to keep him pointed in the right direction, to answer any questions he may have about the agency, how they operated.

So I was off and on, because Aaron would go to Washington and stay there for weeks at a time, and basically was the acting center director without really being anointed as such, and I still communicated with Aaron a lot, because he was still the center director. So my days were primarily taken in that position, unfortunately, dealing with budgets, primarily, as opposed to technical matters, so it really was seeing to the overall function of the center.

BUTLER: Eventually you did retire. You changed positions slightly during that time frame, but then you did retire from NASA. Looking back over your career with NASA, you worked with a variety of people who had varying levels of impact probably on you and definitely on the space program. You've mentioned a couple of times, actually, one I'd like to talk about, is Pete Conrad, and hopefully everything's going to go well with the tree-planting ceremony for him tomorrow. I'm wondering if you could tell us a little bit about him as a colleague and a friend and astronaut and—

WEITZ: Well, you know, I really don't know how to respond to that. People always ask me for anecdotes regarding Joe or Pete or Bo, and I don't remember a lot. I mean, we just got on. We got on well, I think again because we were all military, we understood Pete was the commander, he had the final say.

A thing I always liked about Pete was that if we had a difference of opinion about something or we thought there was a better way to do something, we'd have discussions with it, and some people in the office would never let go of a topic. If it didn't go their way, they kept

ragging it, kind of like a terrier with a rat, I guess. But we'd make our best shots through Pete, typically, and then we'd talk about it and have good, frank discussions with people. Once it was decided, even if it wasn't what the crew wanted to do, we accepted that because that was Pete's way of doing business and we got on with it. So we didn't spend a lot of time rehashing stuff, unless there was good reason.

Pete was a good friend. He was sort of a happy-go-lucky character, but that doesn't take anything away from his professionalism and his devotion to duty. He was a very professional person. He didn't have a closed mind on anything. I told you about whining to him about doing an EVA, and also I whined to him about—on Skylab we flew up the first of the manned maneuver units, developmental model, and we were going to fly it around inside the workshop. That was assigned to Pete. Well, even before launch, I whined to Pete about, you know, "You guys are doing EVA and I don't get to do anything, so let me fly, please, please, please let me fly the manned maneuver unit around in the workshop." So without much thought, he said, "Okay. Why not." Of course, they were afraid the batteries had been damaged on the thing, so we didn't get to fly it on our mission anyway, even though subsequent crews did. But that's the kind of person he was. I mean, besides being professional, he didn't get locked into a certain way of doing things and "That's it. It's never going to change."

So, you know, other than that, what can I tell you? Not much.

BUTLER: Are there any other individuals that you worked with, that impacted you personally or you think that made a valuable contribution to the space program that you'd like to mention?

WEITZ: Well, a name that comes to mind, of course, is Gene Kranz. It evolved I was a capcom and Gene was a flight director, and we didn't have much personal interaction. We had more when I was the deputy chief of the Astronaut Office, and we had more management-type dealings with Gene. Then, of course, in the Shuttle system, and especially when I was Aaron's deputy and Gene was the director of mission operations. I came to have, and still do have, a great admiration for Gene.

I'm not putting down any of the other flight directors, because they had a good group of flight directors for Skylab and for STS-6. Those guys are as competent, qualified, and dedicated to their job as any of the flight crews were. You couldn't get by without them. Sometimes you might not hear as much from the ground, but Skylab—well, we didn't have TDRS then, so STS-6 we had long periods of silence when we couldn't talk to them and, of course, they couldn't talk to us.

Also Aaron Cohen. I have a great deal of respect for Aaron. He's a very, very competent, dedicated individual.

BUTLER: We've been lucky enough to talk with both Aaron Cohen and Gene Kranz for this project.

WEITZ: I'm sure you have, yes.

BUTLER: That was very nice.

Looking back over your career again, is there any point that you would consider your greatest challenge, and then in respect also your most significant accomplishment?

WEITZ: No, nothing really comes to mind. The whole thing is so evolutionary. I mean, there were no divine revelations or breakthroughs that I was personally involved in. I think that's the way the human space flight thing has gone; it's been an evolutionary type of process. I mean, there are milestones. Al [Alan B.] Shepard's flight is one. Apollo 13 is one. STS-1 was another. Apollo 1 fire. Those were more blips. But the whole thing was, in my mind, was more evolutionary and part of a progression. It was pretty much orderly, not without those spikes that I've mentioned. Those were anomalies. It was pretty much orderly, and I like to think that I made some input to some things along the way, but I don't have this thing that I have written down that says "This was my day, my shining hour."

BUTLER: That's quite all right. It certainly was a very unique program to be involved with, and, like you said, there were a lot of challenges and accomplishments along the way for everyone. Would you ever have imagined where your career would lead you, that it would take you through all these—even though you hadn't originally thought of being in the space program, but then when you got in, could you see where you might end up?

WEITZ: No, because even once—I mean, anyone who says they're going to do this or do that, you know, when they enter college, I mean, look at your own career. Things just don't go—you can't plan it, because things happen along the way. Once you realize that and recognize it, then you just kind of do your best to do the job and perhaps point towards something else you think you might want to do, would like to do better, with conflicting emotions. You have "the grass is greener" syndrome and you also have the—which is why some people get killed in airplanes,

because they don't eject when they should, from military airplanes, because the cockpit is a very comfortable place, despite all the red lights and problems that you're having. It's not a fear, but a hesitance to enter an unknown arena. So again, I think things just happened. I did the best I could in the job I was assigned and let things happen.

BUTLER: Well, it seems to have happened and turned out pretty all right.

WEITZ: Yes, it did. Yes, I'm—sure. Like we mentioned before, I've been privileged to participate in a great adventure that very, very few, relatively speaking, people have had that privilege.

BUTLER: Well, I've been privileged that you shared with us your experiences. Thank you very much.

WEITZ: You're welcome.

[End of Interview]