

# ORAL HISTORY TRANSCRIPT

PAUL J. WEITZ  
INTERVIEWED BY REBECCA WRIGHT  
FLAGSTAFF, ARIZONA – 26 MARCH 2000

WRIGHT: Today is March 26, 2000. This oral history is being conducted with Paul J. Weitz in Flagstaff, Arizona. Interviewer is Rebecca Wright with the Johnson Space Center Oral History Project, assisted by Carol Butler and Sandra Johnson.

Thank you again for taking time to visit with us today and allowing us in your home.

WEITZ: You're welcome.

WRIGHT: We'd like to begin with you sharing with us how you first became interested in aviation.

WEITZ: Oh, first became interested in aviation. Well, as you mentioned before, I'm borderline actuarially challenged. I was an impressionable young lad during World War II. My father was a chief petty officer in the Navy and in World War II was in the Battle of Midway and the Battle of Coral Sea. I was biased toward Navy, anyway, and aviation in general, and just decided at that time, at a very young age, that I wanted to be a naval aviator, and that desire stayed with me. So it's from the time I was ten, eleven, twelve years old.

WRIGHT: You set your career path then. What were your first steps? What did you do after you made that decision?

WEITZ: I got an [N]ROTC [Naval Reserve Officer Training Corps] scholarship to Penn State and got a commission as an ensign out of that. I had an instructor, and perhaps misguided at

the time, I had intended to make a Navy career. I had an instructor at the ROTC unit there, who said as long as I was going to do that, I ought to go to sea first. So I did go to sea on a destroyer off the West Coast for about a year and a half, before I went to flight training.

It's one of those experiences you look back on, and I'm not sorry I did it, but I wouldn't do it again, because it put me a year and a half behind my contemporaries who got their commission either out of colleges or the [U.S.] Naval Academy and went directly into flight training. So when I got to my first squadron, V[A]-44, Al [Alan L.] Bean and I were squadron mates in that squadron, and Al had already been there for a year and a half by the time I got there, for example.

WRIGHT: Then what was your next step after that? How did you keep moving through toward—

WEITZ: Jeez, you want an autobiography.

WRIGHT: Yes, we do.

WEITZ: That was in Jacksonville, Florida. So I did four years there, and then I applied for test pilot school and was not accepted. Took classes and then orders to what's called an Air Development Squadron, at the time at China Lake, California, which is in the Mojave Desert. So we moved out there to China Lake. Then I also, after I got there, I was informed that I'd been selected for the next class at test pilot school. But Bureau of Naval Personnel, the people who detail people and provide them money for the move, said that I had just been moved from the East Coast to the West Coast and they weren't going to move me back to the East Coast again.

But the VX-5 was excellent duty, as far as I was concerned. I was a project pilot. Air Development Squadron 5 developed air-to-ground weapons delivery tactics for the Navy. I flew five different kinds of airplanes, which people don't do anymore, while I was there, four or five flights a day, albeit short flights, but they were four or five flights a day. So that was an excellent two-year tour for me.

Then I got unsolicited orders to the Navy's Postgraduate School in Monterey [California]. I did not apply for it. I didn't want to go, because I had what I thought was a good job. I had no desire to go back to school. That's one of those turning points, one of those branches, but I had no choice. So I went there, and I'm convinced now since I did not have a test pilot background directly, haven't been to [the test pilot] school, that the reason I got selected finally for the astronaut program was because I did have a master's degree in what was then called aeronautical engineering. Of course now it at least has to be astronautical engineering.

But I did two years when I got there. Jack [R.] Lousma and I were there at the same time. Gene [Eugene A.] Cernan was still there. Ron [Ronald E.] Evans and Jack Lousma and I were in the same group. Since I had two years with VX-5 I was only allowed two years at Monterey and their normal—you get the cuckoo clock. [Referring to clock in the background]. Do you want to stop it?

WRIGHT: No. It adds character.

WEITZ: In their normal program, the military's not that different from any other bureaucracy, including NASA, and that was a three-year program. Well, I didn't have three years. I didn't want to spend two years in Monterey and come out of there with nothing. As a matter of fact, Jack and I, we found a couple of sympathetic professors there, and by doing some extra

work we were able to get a master's degree in two years. So I did come out of there with a master's.

I then got orders, it's time for orders. The way the Navy ran it at the time, they had what's called a detailer. Lieutenant commander aviators had what's called a desk person who decided where people were going to go. So I wrote him a letter and I gave him twelve choices, types of airplanes and locations I wanted to go, but he picked number thirteen, which was flying A-3s, which I had no desire to fly A-3s. So I called him up and talked to him, but he said, well, if I didn't want to go to A-3s he could certainly—cockpits were hard to come by and, therefore, which ship would I like to go to, as ship's company. That's kind of like the guy who woke up with the horse's head in bed with him. It's an offer you can't refuse. So I then went to Whidbey Island up in good old Puget Sound [Washington] to an A-3 outfit, heavy four, VAH-4.

Made a Vietnam combat tour in 1965. While I was there, interestingly, I mean, if you're aviator, you're interested in what's going on in human space flight, but kind of peripherally. Because I was working on my own career, and, frankly, I hadn't given it a lot of serious thought to—because I really didn't understand what the application and selection process was at the time. Well, interestingly, again, another one of those strange forks in the road is while we were deployed to the western Pacific, I got a message from the Bureau of Naval Personnel that said that NASA is looking for astronauts and that I meet the Navy's criteria, and would I like to apply. So I said, well, my next tour of duty would probably be a ship's company somewhere, so it's got to be better. So I then sent a message back and said yes. So that started that process.

Then I went for interviews in Houston in 1965 or '66, I've forgotten now. I know we went there in '66, but I wasn't called off the cruise. Ron Evans was on another ship in the western Pacific at the time, and I think he left the ship and went to Houston for his interviews

while he was on cruise, and then he went back. I didn't do that, so I must have been interviewed later in the year or early in 1966.

WRIGHT: Had you ever thought about moving toward an astronaut corps before the Navy talked to you?

WEITZ: I really hadn't, no. It was one of those things. Frankly, I thought without a test pilot background that my chances were very slim. But as long as I was handed a free chance, I'd take advantage of it. But like I said, I didn't know how the process worked at the time anyway. I never knew enough about it to have applied, even if I'd had the desire. I guess it's one of those presuppositions you make that aren't always appropriate. As I said, the lack of a test pilot background would have basically negated my chances.

WRIGHT: What were the interviews like? Did you feel real comfortable as they were talking to you about it?

WEITZ: I don't remember much about those. We were the first group to go to Houston that didn't go there for interviews, I've been told, under assumed names. It was all very secret before then. So we all stayed in the Rice Hotel, which was one of the largest buildings in Houston at the time. I think they had like a ballroom or some sort of big room on one of the top floors, and the board was an interview board. I really don't remember much about the process. They paired us up.

I came back from my interview and my roommate had his interview the same day, and I felt that I had not done very well at my interview. He came in and said that he had really aced his interview. But I made it and he didn't. Having served on about three selection boards with Mr. [George W. S.] Abbey, there are little things that make a difference

a lot of times, and don't ask me what those are. But I mean, it wasn't an unpleasant experience. Deke [Donald K. Slayton] was the chairman of the board. Al [Alan B.] Shepard [Jr.] was on the board at that time, as I remember. I think Mike [Michael] Collins was, and Warren [J.] North, and a couple others. I don't remember if Frank Borman was on that board or not.

So it started. Then I got orders to Houston and we moved there in May of '66.

WRIGHT: Did you have any expectations of where you were going to be or how you were going to be moved through that program when you moved to Houston?

WEITZ: Before I got there?

WRIGHT: Yes.

WEITZ: No. No, except that it was advertised that what they were looking for was people to fly Apollo, so we all assumed that we'd be flying Apollo missions. The number went through twenty at the time. No. That was about the time Gemini VIII, I think, which was [Neil A.] Armstrong and [David R.] Scott, when they had a stuck thruster. Then shortly after we got to Houston was the unfortunate incident with [Elliott M.] See [Jr.] and [Charles A.] Bassett [II] at St. Louis. Shortly after that, of course, was the Apollo 1 fire. There were some hard times then.

WRIGHT: You came at a time where the enthusiasm was still strong, but yet almost felt a setback of what you were going to next. Were you starting to have doubts at that time that maybe this wasn't what—

WEITZ: Personally or from a corporate standpoint, you mean? I mean, I think most of us, us new guys, anyway, there was never any question that, especially if you come out of an aviation background, because military aviation used to be less safe than it is now. I mean, I couldn't tell you how many memorial services I've been to, not that I enjoyed any of them, that doesn't mean that you ever [stop] striving for a zero accident rate, even though you may think it unattainable. But I think that those experiences tend to influence you to accept those things as part of the price of doing business, to cope with them, decide what happened, what are you going to do to try make sure it doesn't happen again, and then get on with it.

Which is basically what we did after Apollo 1, because NASA took charge of the investigation, did a very thorough job and moved into the corrections and fixes, which we didn't do with *Challenger*. With *Challenger*, the agency, I think, just sat back too long and then Congress felt they had to step in, and that just lengthened the process and made it...much...longer, less effective, and then more politicized.

WRIGHT: Your first assignment was?

WEITZ: I don't remember what my first assignment was. Well, remember, in those days, in the Apollo days, we spent about a year and a half or two years of school work. It started out eight hours a day, five days a week, and then from then it gradually tapered off as we were given technical assignments. But we went to software school. I mean, we had instructors come in to tell us about Apollo software and then hardware. What's the aerospace professor's name from Michigan? Marv Brunning or Brueler [phonetic] or something like that. Anyway, orbital mechanics and, of course, good old geology field trips all over the world, which was a great part of our education. So the first two years was pretty much taken up with that.

Then people started dropping off and picking up technical assignments. The earliest technical assignment I remember having was responsibility for making the crew inputs into the early versions of ALSEP, which was the Apollo Lunar Science or Surface Experiment Project or Package. I forget. ALSEP [Apollo Lunar Surface Experiments Package], anyway. They were pretty basic stations at the time. But Apollo 11 and Apollo 12 used those and they got more complex and more sophisticated as we went on.

WRIGHT: When did you first learn of the Skylab program and that you would be involved as part of the first crew?

WEITZ: That's a good question. We did an oral history like this after Skylab, and I don't remember if my answer was a little more cogent then or not, so let's say—I was on the support crew for Apollo 12. So in preparing for Apollo 12 and during the mission and also assisting the crew in their post-flight debriefings and that, so that took us pretty much into 1970. Then I worked a little bit on the Apollo 13, kind of in a support crew status there also.

WRIGHT: As support crew to Apollo 12, did you first build up your relationship then with [Charles] Pete Conrad?

WEITZ: I guess so, yes. Yes. I didn't realize it, but, yes, of course we did. Are you familiar with the support group concept we used in Apollo? The primary and the backup and then the support groups, which were really a nice way of saying the gophers. They were the guys who get to run the stinky tests and go over the paperwork and do the desktop sims and that kind of stuff. But it was very useful as a training tool and in building up your background.

So, yes, I mean, we were all friends, good friends. Of course, the backup crew were those we went on to fly Apollo 15. The all-Air-Force crew was backing up the all-Navy crew.

I'm getting around—I can remember what your question was.

WRIGHT: That's okay.

WEITZ: It must have been about that time. I think Apollo 20 had been scratched before then, and about this time was when 18 and 19 were scratched. Then we started working on Skylab, so it probably was about 1970, I would guess, the middle of 1970. Deke had the Astronaut Office form a little Skylab Office, headed by [R. Walter] Walt Cunningham at the time. Joe [Joseph P.] Kerwin was in it, Jack Lousma. We went through the whole thing at Skylab originally.

Are you familiar with the wet workshop/dry workshop concept, where the workshop is going to have to be two launches? Jack and I spent many, many hours in the water tanks both at Houston and at Huntsville, because we had to take plugs down to put in the drains from the functioning S-IVB stage to make it habitable. So we did that.

The Apollo telescope mount was on a separate launch, so then we were investigating a feasibility of remotely controlled docking of the ATM [Apollo Telescope Mount]. Anyway, we went through all that, so I guess it probably was right after Apollo 13 that I was assigned to work in the Skylab Office Group within the Astronaut Office. But I couldn't tell you when the crews were announced.

WRIGHT: Were you surprised that you were put on that crew?

WEITZ: I don't remember. Maybe I thought it was about time.

WRIGHT: How were your feelings of knowing the first time you were going to fly, you were going to be there for a while?

WEITZ: Oh, that was all right. It was flying. These guys had it pretty easy. Bruce McCandless [II] had to wait sixteen or seventeen years for his first flight. By '73, I'd been there eight years, seven years, whatever it was. '66 to '73, seven years. So I think it probably was a general feeling of relief in being finally named to a crew and given something to do.

WRIGHT: Did you have a specialization that you trained for before you launched? Was there something that specifically you were in charge of, or that you felt—

WEITZ: Yes, the EREP package, the Earth Resources Experiment Package. EREP.

WRIGHT: Could you share with us some of the details?

WEITZ: No.

WRIGHT: Okay.

WEITZ: You know, Skylab, first launch, we were considered—they had this screwy system, they had a Roman numeral system and an Arabic numeral system, so we always went by Skylab II, the first manned launch, crew, first crew. They basically had three primary objectives since Skylab was medical, earth resources and solar. Of course, being the twenty-eight-day mission, then the prime on ours was the medical stuff. Joe Kerwin, being an M.D.,

obviously then he was the principal contact on the crew for the medical protocol, they called them, not experiments. They were called experiments at the time, I think.

We kind of all shared, the three of us, since we were all solar physics dummies, we all shared our non-expertise with the ATM, Apollo Telescope Mount. We were probably about equally proficient, whatever that means, whether it was good or bad, but at least we did get to record a solar flare toward the end of our mission, so we got that. Then, of course, the earth resources stuff. It just fell out that I was tagged to monitor development of the hardware and the crew interface with it, because they had the wide, I guess it was one-inch tape, probably, to record data for some of the sensors, some microwave sensors. We had multispectral cameras and a large five-inch format camera, etc. Plus we had the EVAs. We had a scheduled EVA also, of which we were only doing one, so Pete and Joe were prime on that one.

WRIGHT: But you were very much involved in the EVA, as well, isn't that correct?

WEITZ: Well, finally, the way it turned out, yes. But, I mean, had it gone according to the script, without damage to the workshop, I would not have got to do an EVA.

WRIGHT: That's the script just got rewritten right after it launched, didn't it?

WEITZ: Yes.

WRIGHT: How did you find out that there was a problem right after the launch of Skylab?

WEITZ: We went out to a secure area at the Cape to watch the workshop launch, which all looked pretty good from our standpoint. So we headed back to the crew quarters, because we

were supposed to launch the next day, and the backup crew headed for town for the parties. [Laughter] They were done, they thought. I guess it was when we got back to crew quarters that we then were informed that there was certainly an anomaly, at a minimum. If you look back, they really didn't understand everything they were seeing in mission control. The fact that during ascent one of the solar arrays was putting out power, which it shouldn't have been, but that's because they were both loose.

I suppose now, I'm sure by the next morning they had a pretty good handle on what had happened. At least they knew something was wrong. The primary thing was the increase in temperatures in the workshop, because the aerodynamics loads [had] carried away the thermal shield. I guess then that probably we flew back to Houston the next day as part of a general agency regroup to try to think about what to do, and that tentatively they had slipped our launch five days, because from a rendezvous standpoint we had acceptable launch days. They repeated at five-day intervals.

It soon became apparent that we could not meet five days. We weren't going to be ready to deal with whatever it was that was going on with the workshop. The mission control in the meantime was doing their usual wonderful things on coping with the temperatures inside the workshop.

So NASA as an agency, and industry in this country, I mean, the response was remarkable. We had more unsolicited proposals for how to deal with once we realized that the problem really was one of temperature to start with. We had to get the temperatures under control if we were going to salvage Skylab at all. So there were many, many different approaches that were brought in—inflatable things, expandable foam, all different ways of looking at the problem. I think probably our friends in the Air Force were also helping us, helping the agency out with some imagery to help.

So anyway, so soon, probably only a couple three days, we decided to then slip our launch another five days. I've often put it that we were fairly certain, 98 percent certain, we

were going to get to fly, even if we only got up and flew around, took pictures, flew around and then came back. But there were two crews, six guys, I think, were very, very nervous at the time, because the workshop was not habitable then. They had no place to go.

So what we did, we wound up, we had three alternatives for managing the solar energy input into Skylab. One was the so-called parasol, which is deployed through a scientific airlock on the solar side of the workshop. It had two scientific airlocks, solar and anti-solar. So the science groups had to sacrifice that particular airlock.

We also had what was called the twin pole sunshade. I'll get back to that in a minute. Then a third concept for spreading a shade, which involved flying the command service module around and doing a stand-up EVA to hook up pulleys here and lines here, material. I'm so glad we never got a chance to use that, because I think you'd run a very great risk of being caught up in that darn thing. But anyway, we had all of these and there was no place to stow them in the command module, so all this stuff was tied down in the lower equipment bay with beta cloth line, very securely.

I started to get back to the twin pole sunshade. It turned out when we deployed the parasol, it had four extendable booms on it to put it out in a rectangular shape. Well, one of them didn't extend all the way. It's kind of like the old-timey legs on a tripod, where they click, click, click and they pulled out. One of them didn't extend that last segment. So it didn't cover the whole side of the workshop, but we could tell that, because you could tell once the temperatures got down, once we moved into the workshop, you could tell by feel. You could outline exactly where the shadow from the parasol was. There were warm spots on the wall, and that made the thermal control system—because the thermal control systems in Skylab, the thermal shields, should have kept a cold environment. So it was primarily designed to add heat. It was not primarily designed to reject heat from the atmosphere within the Skylab. We wanted to make that better, so the second crew, one of the first things they

did, Al Bean and Jack Lousma and Owen [K. Garriott], was to deploy the twin pole sunshade, which we had unstowed and left on Skylab, so that they did that.

There also was some concern about whether the increased temperatures, elevated temperatures in the workshop had caused any noxious gases to have been driven out of the insulation that was on the inside of the workshop. It was there from the time when, from the operable, I mean, as a functional S-IVB liquid rocket stage. So we had some sensors and we had equalization valves in the hatches. So we had some sensors we could sample the air. So that was the first thing we did.

Well, let me get back. Can I stop here and go back—

WRIGHT: Absolutely.

WEITZ: —to ascent. Then Pete says, "Tallyho to Skylab," and Joe was our navigator, so he was down in the LEB, the Lower Equipment Bay, looking through the telescope, the tracking telescope, to get the navigational data for the rendezvous. I'm just staying out of the way in my couch in the right-hand side. So we come up, fly around, take pictures, a bunch of pictures. It was very frustrating. I had a 35-mm camera with a 400-mm lens on it, and it barely fit between the couch and the window. So I think I said some nasty things on air-to-ground about trying to manipulate it. But we knew it was important to get coverage, in case we got to not stay. We did TV, we got some TV footage, we got some [35]-mm footage, some Hasselblad imagery also.

But when we first got there, so we flew around, took some pictures, and then we did a soft dock, which in the Apollo days was, you made contact with the docking drogue on capture latches. The drogue had three capture latches on the end of it that locked, clicked into place and held you there. That's called a soft dock. So we soft docked and just hung on the capture latches, and I think we had a meal, our lunch. We were going to undock and try

to deploy the remaining solar wing on the Skylab. So we did that and we went around, and, of course, we depressurized.

I did the stand-up EVA with Joe Kerwin hanging onto my ankles. We had a shepherd's crook that was designed to pull the wing out away from the side of the workshop. We also had some versions of tree-trimming tools like you see, a telephone lineman, or the people they hire to clear the power lines, telephone lines and what have you.

We had seen and could see that there was a piece of bolted L-sections from the thermal shield that had been wrapped up around top of the solar wing, and apparently the bolt heads were driven into the aluminum skin. We thought maybe we'd just break it loose. So we got down near the end of the solar array and I got a hold of it with the shepherd's crook. But what we really hadn't thought about was, in heaving on it, trying to break the thing free, what I was doing, in effect, I was pulling the command module, the CSM [Command and Service Module], in toward the workshop.

Also, surprising in a totally weightless environment, I was moving the workshop some, too, because we could see its thrusters firing to maintain its attitude. That hatch on Apollo opened out this way, because Pete is sitting over here trying to make sure we don't collide with the workshop, but at least a quarter, if not a third of his field of view, perhaps nearly a half, is blocked by the open hatch. So it made for some dicey times. We hosed out a fair amount of gas doing that.

We finally decided that wasn't going to work, so we [decided to] cut the strap. Well, it's one of those things that we were approaching it from the end of the solar array, the strap came up basically toward me. So I'm trying to put this cutter, which is like pruning shears, on it. See, rather than cutting it across the short way, we were trying to cut along the long way and just didn't have enough muscle with that thing, because it was about six or eight feet out ahead of me and I was pulling on a line to try to do it, and we just couldn't get it through.

Now, Pete and Joe later, because they could position themselves securely on the side of the workshop, did use the same tool and essentially the same attitude to get it, but they could put a lot more leverage on it. We were just having trouble with maintaining the proper relative attitude between the CSM and the workshop.

So we then decided—we collectively, I guess, Pete and the ground, and whoever—decided that that was enough of that, we'd fall back and regroup. So we got in, back in the command module, and repressurized and said, "Thank goodness that's over," and went back to dock, and the capture latches didn't work. We drove in and bounced out. Apollo 14 had a similar event happen on their mission. Pete tried it two or three times, each time with a little more velocity, each time with a little harder contact. So that wasn't getting us anywhere.

Now, here's another one of those interesting little turns. There was not a session scheduled in our training, our whole training period, to discuss what you did if you couldn't get a soft dock, if you couldn't get a capture. But whatever we were doing over in Building 5 at one time, one day we finished early, and one of the training coordinators, training agents there, said his expertise was the probe, the docking system. He said, "You know, if you've got time, let me just tell you about it. You've got time? What else have you got to do for an hour or half hour?"

We said, "Well, nothing really."

He says, "Let me tell you about this procedure to go through." Because what you had to do was, which we then started to do, so Pete and Joe, I was doing something else at the time, probably on EREP, but Pete and Joe paid attention to him, watched the mockups, and we had it added to our contingency checklist.

So we then got to suit up again, depressurize the command module, open the inner hatch, collapse the probe, bring it inside, cut some wires. So effectively the probe was out of the game anymore. We had no place else to put it, so we put the collapsed probe back in the tunnel, as I remember. But this meant then that the main function of the probe and drogue

system was to get you a line so that the capture latches, the final capture latches, which made the docking tunnel ring on the command module, the docking tunnel ring on either lunar module, or in this case the Skylab, went in a line properly so you could get a good contact. But you didn't have an alignment guide available, which meant you had to have a good steady hand at the tiller.

So anyway, we went through all this and then repressurized. Then Pete drove in and did an absolutely superb job, because there were twelve latches, capture latches, in the tunnel, and when we pulled the probe out, opened the hatch, pulled the probe out to check it, eleven of them were made. So he had made, I mean, just absolutely nearly perfect contact, so that they engaged automatically. So that was over.

So then we slept in the command module that night, good old ala going to the Moon. We broke out the beta cloth sleeping bags and stowed them, slung them in the—because it'd been a long day. Union rules wouldn't allow us to work that long anymore.

So then the next morning, I guess we got up and ate our Apollo meal and sampled the air, which was okay. At least the constituents we were prepared to measure, we didn't get any readings at all, so we then opened the hatch and I think I was the first one through into the MDA [Multiple Docking Adaptor]. It was also separated by two hatches, as a matter of fact, from the workshop, so it was cool. It was 55 degrees in the MDA when we got in there. The airlock module was cool, also. Command module hatch, MDA hatch, airlock module hatch, workshop.

So Pete and I said, well, why don't we strip down to our skivvies, because it's hot in there, because we were going to go down and extend the parasol through the scientific airlock. So we said, okay, we'll do that. Well, it didn't take very long until we figured out why people in the Sahara Desert wear a lot of loose clothing, because I don't remember if we have any movies footage or video or anything, but soon we had long trousers on and we had shirts and jackets and hats and gloves and the whole thing. We went through the process.

I don't remember if there was anything—no, there wasn't. But we had to carry down this large, as I remember, the container had been adapted from an experiment. It was originally intended to go in that airlock anyway, but it was probably five feet long, I guess, and as square as the airlock. It was kind of a cumbersome thing. So we got that down and hooked it up in that airlock and did all that. We could work down there, as I remember, for about fifteen minutes at a time, and we'd go back up. We'd zip back up to the MDA and cool off a little and then go back down.

Joe took some video and watched it from the command module. He could see the parasol through one of the windows in the command module, because as you extended it, it was kind of like a big patio umbrella. The thing comes out all folded up, as it goes up this way [Weitz gestures]. Then in the process it had some tethers on it that were pulling these telescopic sections out, although one. Then so once it got up, then Joe's job was to tell us the thing—and then it was spring-loaded to deploy out into the parasol-type shape. Of course, he couldn't tell from his vantage point that the one leg hadn't deployed properly.

Then once that was done, then we pulled it back in until, I think, it [stood] off from the side of the workshop about a foot or two or something like that. I don't know. I think the ground noticed the temperatures coming down. Within an hour they could tell.

How many days until we moved into the workshop, I don't remember, but I think two or three. Pete and Joe continued to sleep in the command module, and I moved my sleeping bag into the MDA, because it was cooler there and you had a lot more room besides.

I had mentioned the beta cloth rope that was holding the various shading devices down because good old Joe Kerwin wants to get things done. So when we got in orbit, the first thing he did was start cutting it. Well, beta cloth shreds, so as he's cutting all these pieces of the line and rope that are holding this stuff down, the air in the command module is filled with these little particles of beta cloth. But we had a relatively efficient filtration system, so it got rid of it. Then we moved all that stuff down into the workshop eventually.

Then the so-called workshop activation took us, I don't know, two days, three days, because a lot of the stuff was hard-mounted for ascent loads and then had to be moved to their on-orbit use location. So the three of us were busy for a couple days doing that, setting up lockers, moving stowed items from their launch position to their use position, things like that. Then we got on about the business of working within zero G.

WRIGHT: First two weeks was pretty demanding schedule with all the repair work that you had to do before you could actually start your routine, I guess, is not a good term for it, but it—

WEITZ: Well, no, once we got inside, there wasn't any repair work that we could do. What we had to do, the ground had to go through busily, because we're on reduced power, because all we had was solar panels from the AT[M], which was about 40 percent of the planned power available. So, I mean, we were running around turning lights off behind us, not using all the lights. We were eating cold food, weren't heating water, and things like that for the first couple of weeks, and just getting used to living and working in large free-volume in zero G.

WRIGHT: I wanted to ask one question when you were talking about the parasol unit. Did you and your crew have much involvement in making that decision on which of the options that you wanted to do?

WEITZ: As I remember we did, and big players in it, too, was the support crew of Rusty [Russell L.] Schweickart. Who was on it? Rusty and Story Musgrave and I think, Bruce McCandless. But they did a lot of the preliminary work in the water tank at Huntsville. Again, it was the engineers. Jack [A.] Kinzler had a great hand from an engineering

standpoint in deciding which was a doable thing and which wasn't, and then the backup crew and the prime crew, and the other crews, also.

I mean, we were ready and did use any resource we had from anyplace, it didn't matter. I mean, there was no pride of authorship, as I remember. Nobody said we've got to have a NASA design, although I think it was, but that wasn't a criteria. At least, it wasn't in our minds. I'd like to think it wasn't in the Washington area either.

WRIGHT: Although the script wasn't followed line by line, the crew still was able to launch with confidence that the mission could be fully successful?

WEITZ: No. No, I wouldn't say that. No, because the whole thing was what shape is the workshop in, was it inhabitable. I mean, it was holding pressure. It was responding to commands. I mean, the attitude control system was functioning. It was an atmospheric system. They flushed the atmosphere a couple of times, so we knew that we—but still 100 percent? No, because we had to get the temperatures under control. The whole thing was whether these things—that's why we launched with three. The plan was if the parasol didn't work, we would jettison it and then lay the twin-pole sunshade over it if we had enough consumables on the CSM. But we didn't know how that would turn out.

It's not that we ever said, sat down and said, "Hey, Pete, what do you think our chances are of going for twenty-eight days?" We never did that. "Oh, it's 92.4," or something like that. We never did that. But certainly in my mind it was less than 100 percent that we were going to go for 28 days. It was less than 100 percent in my mind that we'd get inside the workshop because of the uncertainty.

WRIGHT: Sure.

WEITZ: How about the outgassing? We didn't know whether or not it innocuous stuff in there.

WRIGHT: You did settle down into some type of routine once that you got some of those situations under control.

WEITZ: Yes.

WRIGHT: Can you share with us what those were and how you all fell into that—

WEITZ: Let me fast forward into getting ready for the midway EVA to extend the solar wing. Primarily again, the efforts from the video that we sent down and our descriptions, hopefully, were worthwhile, and I think again perhaps some spook imagery from either DOD [Department of Defense] or CIA [Central Intelligence Agency] or whoever at the time if they had a pretty good idea on the ground of what was going on. The backup crew was busy work. They spent a lot of time in Huntsville, spent a lot of time in the water tanks.

Then it took a couple of days, we had the teleprinter on board and it was a noisy thing, and it used thermal paper. We all brought back some pieces of teleprinter paper as mementos, and over time, I don't know if you know anything about thermal paper, it all turns black, so you don't have any teleprinter mementos anymore. [Laughter]

Us reading through the procedures, sending down questions, answers come back up, then we say, "Well, how about doing it this way?" I think it took like three days, and then we'd dry-run it in the workshop. We didn't actually suit up, but we kind of went through, we put these pole sections together on this cutter to make sure that everything worked okay and what we were going to do and went through the whole smash.

Then came the day, I think it was day fourteen. I think it was just exactly halfway through the mission. Then Pete and Joe did the EVA, and I went into the MDA to try to document. Well, that's another case. The MDA was relatively large, it was about ten or twelve feet in diameter. So I was trying to take video footage and 35-mm imagery. Kind of the same thing, except in this case I couldn't stabilize my body position, so I didn't get very good documentation either.

They had a little problem. It turns out the exterior of the workshop was—I think they make mods on the floor as they build those things, little improvements that don't show up in the drawings that NASA had, because there were footholds and handholds where there weren't supposed to be any, and there weren't some where there were supposed to be. So Pete and Joe had a little problem at first getting himself stabilized out there, but they finally did.

Are you going to talk to Joe Kerwin?

WRIGHT: Yes.

WEITZ: Somebody is, I hope.

WRIGHT: Yes. Yes.

WEITZ: Because he can give you, obviously from his vantage point, but I think he finally tethered a line from the front of his suit down to some portion of the structure of the S-IVB. Fixed Airlock Shroud it was called, FAS. So he could have a relatively stable position and then Pete went out and hooked a cutter on, and then Joe pulled it, and that didn't work. Oh, that's right. See, it didn't work pulling on it from Joe's end, like it didn't work for me.

So what Pete did then, as Joe pulled it as tight as he could, cinched it off, and then Pete got underneath it and had stood up to put more tension on it. Then when it did cut through the aluminum strap, then that's when Pete did his whifferrill nearly out into space, because all the tension's relieved and the thing gave way suddenly. So Pete got a little thrill there, of course. I mean, he wasn't at risk of floating off to going to orbit around the sun, because he was tethered to the workshop.

It had a fluid-filled damper that was meant to deploy the solar wings and also it was spring-loaded to deploy it, but it has a viscous damper to keep it from going out too fast. Well, it wasn't designed to be exposed to a space environment for any period of time, because that was supposed to happen shortly after that thing got into orbit. So that the fluid in there had frozen. So one of the things that they had to do then also, and maybe that's when Pete went nearly into orbit, was when they broke the damper, rather than when they cut the strap. You need to clarify that one, too.

WRIGHT: Okay.

WEITZ: Then the thing just gradually of its own volition over a period of hours, finally they deployed the wing all the way, but the solar arrays then took several hours for solar warming to loosen them up and let them deploy. But then after about the next day then we had 70 percent of our available power instead of 40. Then we could turn lights on, we could have hot water for washing and shaving, we could heat our food, the foods that took hot water, because some of the foods are just heated electrically. So that was a highlight then.

Then we got down to the business of really learning how to work and live in weightlessness.

WRIGHT: So you went into some type of routine after that, because you each had actual duties that you were going to be performing at that time?

WEITZ: Yes, the ground sent up, each night they sent up on the teleprinter, so we measured our next day's activities in feet of teleprinter paper. They would spell out who was to do what by each crew person. We pretty much shared activities, but not completely.

We all took part in the medical data collection so that every day someone was riding the bicycle ergometer for science. We typically would ride it each day for just to make you feel better anyway, but for data tests we'd do it every three days. So somebody was doing that every day. So we did the medical stuff every day.

Pete and I, we did a lot of—Joe, he was an M.D., so we didn't allow him to do anything with earth resources stuff. I forget what frequency, but we didn't do that, we didn't earth resources every day, but we did medical and the ATM, the solar telescope, we did every day. EREP was incompatible. Doing EREP passes was incompatible with taking solar data, with the solar telescope, because you had to be pointed, you had to have the ATM and they're pointed toward the sun. When you took EREP passes, then the workshop was what we call local LVLH, Local Vertical Local Horizontal, where it maintained the same attitude relative to the surface of the Earth. But I think we did those about every two or three days probably, or some part of the day.

Then there was other small stuff, too. We had a manned maneuvering unit to free fly in there, but they didn't know what the elevated temperatures did to the batteries, so we didn't get to do that. They later decided the batteries were okay. Maybe they took up new batteries on the second flight, I forget. See, Pete was scheduled to do that first, to fly around, and then I got really whiney with him one day, and I said, "You and Joe are doing the EVA. At least you can let me fly the maneuvering unit." So Pete said, "Okay," but I didn't get to do it anyway.

WRIGHT: It became your home away from home for twenty-eight days.

WEITZ: Yes.

WRIGHT: With any home you have housekeeping chores.

WEITZ: Oh, yes, that was a large part of our function. We wanted to keep the thing neat and clean. So we wiped down the wardroom every day. You'd look for food spills and stuff you didn't notice at the time. We had betadine, however the medics pronounce it, wipes on board for that purpose. So we would keep that relatively clean. You'd lose things inadvertently, they'd float out of your pocket, or you'd just lose track of them.

At the top of the workshop, the air would recirculate through the workshop. Well, it was recirculated through the entire cluster, but the workshop being the largest volume it was recirculated, so it had a plenum chamber at the top of the workshop with a screen on it. We soon found out that give something anywhere from an hour or two to a day and it would show up on that screen.

We have pictures of it if you want to go back and look at any of the archive photographs of stuff collected, which includes a syringe, a hypodermic about five inches long. We don't know how the doctor lost that. We give him credit for it. But a lot of trash.

Interestingly, one thing we did lose, and we knew we lost it, I forget who it was, we lost a Swiss army knife. Said, "Tomorrow it'll show up on the plenum screen." Well, it didn't. Never did. Never did. On entry it came out from behind the instrument panel in the command module. That wound up being presented to either President [Richard M.] Nixon or Mr. Gorbachev [correction later: Leonid Ilyich Brezhnev]. Who was the guy in 1973? Oh, I can still picture him, the really jolly, bad-looking Russian. We can get to that later, because

that was post mission. But we wound up giving that one away, but how it ever migrated that 100 feet or so, clear up into the command module, we never did figure out.

WRIGHT: Well, at least it showed up.

WEITZ: Yes.

WRIGHT: That's good.

WEITZ: Yes, without hurting something. But, yes, housekeeping was an important part of every day's activities, and we shared that. We were all qualified, as it were, to work on it.

WRIGHT: You've each had your space that was, I guess, yours, your sleeping area, or tell us—

WEITZ: We each had a sleep compartment, yes. We made a point, and I don't say what's good or bad or anything, but we made a point of eating all our meals together, all three meals together. We also found that, of course, you get used to working in a new environment, and then we could do things quicker and easier, though we thought if we started asking for more work to do, that that had the potential to load the next crew up too much. I think that came to pass with the last crew, when they had the so-called mutiny, mainly because the ground just did not appreciate how much work they were giving Jerry [Gerald P.] Carr and his crew to do at the beginning of the mission. So we got to loaf a little more toward the end.

Did you ask me a question?

WRIGHT: Just talking about individual, you were sharing a living quarters, but yet trying to have an individual space or your own, own area that was yours and how you—

WEITZ: Only for sleeping. There was another interesting thing. There was a big discussion in the early days within the Skylab group in the Astronaut Office about some of these, for example, the toilet, the waste management compartment, as we called it. You could seal it off. It had a door. There was a doorway into the wardroom, as we'd call it. You had to, as I remember—well, anyway, so what shape? Do you shape them like doors on Earth, or do you make them round like portholes? Because you're in weightlessness, why wouldn't you just float through it like you would in a water tank?

Well, it turns out that when you train in one G in a trainer that is always in this attitude, even in zero G, that is your attitude within the real one of those vehicles. So if you go back and look at any of the movies, most of the footage is that people moved around with their head up. It didn't matter if they were going up, they'd sometimes come head-first, but if you move, when you moved around down on the lab part, which was the lower portion where the medical experiments were, you see people almost always moving around. This was the same thing in Spacelab. Of course, Spacelab's a little different, because you don't have as much free volume. But you don't see people moving through Spacelab head-first much either. They'll translate this way.

But as far as your own space, you know, we had 10,000 cubic feet or something like that, and I never got tired of looking out the window. So I could always go find a window somewhere, and depending on the attitude of the spacecraft, we had a nice, big, round window in the ward room, which took a lot of arm-twisting by the crew to get it. Because windows make your structural analysis and your design complicated. It'd be much nicer if you didn't have windows, but we got a window in the wardroom.

But there's a thing called beta angle, which is as the Earth moves around the sun, the position of the sun, our orbit relative to the sun changes. So there are times when to point the ATM at the sun, the workshop was rolled up enough, you really couldn't see much of the Earth out the orbiter window. But the MDA had four windows in it, 90 degrees apart, and they were fair-sized. As I remember, they were about that long [Weitz gestures], foot and a half long, and ten inches wide, or so, so you could always see some of the Earth from there.

I'd go up there. If somebody was on the ATM console, then they're busy doing their thing, and if you had some free time, you could go. But as far as my space, your space, we didn't do that. We didn't have that. The sleep compartments were, of course, separated, segregated, whatever you want to call it.

I'll let you in on a little secret, since 1973, it's now been twenty-seven years. To get back to this verticalness, like I told you, and I know—intellectually I know the weightlessness it doesn't matter, but if you've been in the workshop trainer—well, we don't have it anymore. Yes, we do, it's over at SCH, Space Center Houston. The compartments were relatively narrow, so we had a sleep restraint, we called it, which was make-believe bed that mounted on the wall.

Well, I tried that for a couple of nights, and it was zero G, I know. Intellectually I know, but emotionally I was hanging from the wall and I could not sleep hanging from the wall. It got to be a joke for a while, and I think a lot of people still don't know. So every night I'd unbuckle my sleep restraint, which had a metal frame, and I'd take it out and I'd take it up above in the big open area and I'd stretch it across the place so I was sleeping horizontally.

WRIGHT: And slept well?

WEITZ: Yes. Yes, quite well. But none of us needed as much sleep as we did on Earth. I think that's generally found to be true. How much less? About an hour and a half to two hours. I think Pete or Joe, one of them, would stay up reading. Pete, his nightly routine was he would read a western paperback listening to country and western music in his earphones.

Then each morning I'd get up and unhook my sleep restraint and carry it back down to the sleep compartment, because you didn't want it up there. It'd be in the way, because we did have some activities up at that level.

But I like to think we were a very compatible crew, and part of that, I think, is due to our military background. Pete was the boss. I mean, he was the commander, he was the boss. The good thing about Pete, though, is that he would listen to you, and if you had a better idea, he would adapt it. The other thing was that even if we, as a crew, didn't agree with a decision, once the decision was made and what Pete figured was irrefutably or irrevocably, then let's put that behind us. We'll accept that decision and we're going to get on with it. We didn't carry any battles on and on and on and on about it.

Plus, I think we were of the personalities that we got on well together, probably due to our background. Joe, as you're probably aware, besides being a medical doctor and a flight surgeon, was, in fact, a naval aviator. Most flight surgeons are not. They do get some modicum of flight training, but they're not what are considered—they don't wear regular wings, where Joe did. The Navy didn't have many of those and he was one of them. So due to common background, and for whatever it took, like personalities or compatible personalities, anyway, we got along well.

WRIGHT: You mentioned decisions and you also mentioned every day that the ground support crews would send you this long list of activities to do. Once you were out on the mission, was the crew able to give information to the ground so that you could make

decisions together, or was most of the orders still coming from the ground for the duties of every day?

WEITZ: What came up was more a scheduling problem, and I think the response to your question is that we would debrief. If we found a problem with the checklist—and I was responsible for the EREP checklist. Man, once you got up there and started doing the real thing, I said I couldn't believe it. Who made up this checklist? And I had a large hand in it.

We would make checklist changes, especially for those things we were going to do again. I mean, if we made six passes with the multispectral cameras, you can make a change, and then you can adapt it after that. So it was more to that extent, where you could change procedures or change the order, and say, "Hey, you guys gave us these two things to do at the same time. We tried it and it just doesn't work out."

But as far as discussing, no, we didn't take an active part, because that was a whole separate section on the ground to use the computer to decide what the schedule ought to be.

WRIGHT: Did you find the days demanding, or were they just full?

WEITZ: Well, the demand skill went down as the mission went on, as I mentioned before. We had more free time. More what we call in the Navy bulkheading time, which means you're not really doing anything, but you don't tell anybody about it, except enjoying it. I still think NASA got a return on their investment in us. We did everything that was asked of us, so it's not that we didn't do anything. We probably could have done more. The second crew proved that, because about a week into their mission, Al kept saying, "Hey, send us up more to do." Which for fifty-six days is the right thing to do, or those guys wound up fifty-nine, I think. It was the right thing to do.

But remember ours, we had two weeks of really scaled-back operations, and then three or four days devoted to the EVA, and we had to do an EVA at the end to retrieve some of the recorded data from the Apollo telescope mount from the ATM. So we really only had about ten days in there, so why upset the apple cart?

WRIGHT: Did you find your time that was your free time, did you find that to be enjoyable? Did you read? What did you do to fill that free time? You mentioned Pete Conrad would read.

WEITZ: Glad you asked. I spent my free time looking out the windows.

WRIGHT: You'd mentioned that earlier. I was going to ask you, could you determine where you were by all those views? Did you know where you were at each time?

WEITZ: Oh, yes. Plus we had what's called the orbital slider on board. Have you seen one?

WRIGHT: No.

WEITZ: It's a little—I can show you one, if you want to shut that thing down for a moment.

WRIGHT: We sure can.

WEITZ: You want to do that?

WRIGHT: Yes, let's take a break and if you want to get that, we'll come back and you can show us how it works.

WEITZ: All right. Sure. [Tape recorder turned off.]

WRIGHT: We're ready, yes. Please.

WEITZ: [Referring to orbital slider board] Well, anyway, this is a training article, not a flight article, so I don't want the Air and Space Museum to get mad at me, because I have something that really belongs to them. But the ground would send you up a longitude of the ascending node, which starts here. This is our ground track. So then you'd set this up here and then you could, see, and it rolls. It doesn't work so well anymore, because it's old. So you can line this up at any time, it's time-tagged here, so you could set your stopwatch to it and you go around. Then you could just see at any given time what your position was on the ground.

WRIGHT: How wonderful.

WEITZ: Well, it was convenient. It was handy.

WRIGHT: Yes.

WEITZ: Yes. But you could basically tell by looking out the window, too. I mean, Earth geography ought to be familiar with most everyone.

WRIGHT: Do you have a favorite spot?

WEITZ: No, not really. The Caribbean, you've seen those photos. They were between the shadow and the deep areas of contrast in the blue. The impressive thing to all of us, being naval aviators, was as you come down—as a matter of fact, I looked at this thing. See, this isn't even a Skylab thing, because this only goes to 30 degrees inclination. But as you come down off of it at 50 degrees, which is what we went to, so 50 degrees north latitude or 50 degrees south latitude. You come down off the east end of Asia, the Kamchatka Peninsula, basically, the Bering Strait, and you head southeast then, descending that way down across the Pacific for nearly half your revolution to about forty, forty-five minutes, until you come across the southern tip of South America. Then you look at the vast expanse of the Pacific Ocean, and you wonder how in the world we ever fought naval surface engagements there in World War II. I mean, it's mind-boggling, the size of the ocean.

WRIGHT: Wow.

WEITZ: But anyway, we were talking about off-duty activities, and there was a set of items on board, and don't ask me why I remember this, but it was ODAE, Off-Duty Activities Equipment, which we were going to evaluate. That included playing cards. I think they had Velcro on them, for goodness sakes, so they wouldn't float off. We had a Velcro dart board. Couldn't have pointy objects, which you really didn't want, so it was Velcro. Our crew is noted, because in our office, and we had a crew office and we had a dart board, and we'd oftentimes have games of darts over the lunch break. So we had a dartboard. We had books. We did some reading. As I had said, Pete probably did more than others. We got the cards out, looked at them, put them back in the box and put them away. I mean, who wants cards when you can look out the window?

For the sake of science and general interest, we evaluated the dartboard. Interestingly, for all that we tried it, being three dummy aviators, I guess, you're throwing at

dartboards as far away as say to that duck over there, and you know you're in weightlessness, but you still compensated for gravity drop. So every time, I'm not sure we ever were able to hit the dartboard. They would always go high, because, of course, they didn't drop.

That one thing that was in there that we did use, and, again, if you look at any archival footage you'd see that the off-duty activities, we had a rubber ball, a blue rubber ball. You would just take—I mean, it was the craziest thing. Just throw it and that thing would bounce and carom and then ricochet and go all around the workshop.

Then we also had a thing, we had a trash airlock, which was in the middle of the bottom level of the workshop. It was almost 100 feet from there up to the bottom of the command module. So the great thing was to see if you could stand next to the trash airlock and bounce the rubber ball off the top of the airlock and get it into the command module.

We also—you may have seen pictures of running around the food lockers. So some people still claim, even some of my scientist friends claim that centrifugal force is what held [you] there, but I don't think so. There were just a series of small delta Vs you'd apply to go from one position to the next. But that was a lot of fun, just to prove you could do it, and games you could play in zero G.

Al Bean was a gymnast in college, so we had this firemen's pole that they wound up taking down, but Al did some gymnastics type of stuff, which zero G makes it great. I mean, he was good. At the time Olga Corbett was big at the time. I mean, she was a little girl, but she was big news. So Al was pretty fantastic.

You could just try different things of moving from one place to the other in zero G. You learned that relatively quickly, too, I mean for business, I mean, just for getting around.

WRIGHT: You, of course, couldn't dine out while you were up in Skylab. You were pretty much held to the diet that was sent up there with you. How was the food?

WEITZ: The food, I thought, was pretty good.

WRIGHT: Good.

WEITZ: It repeated every six days, as I remember. Five or six. No, six. Every six days. Which was a great improvement, because that, of course, was part of a medical experiment. Let me say experiment, even though they weren't. There was an interest in how your body processed different foods, down to the elemental level, I mean potassium, phosphorus, calcium, niacin, all that stuff. So the principal investigator on that came in when he first proposed his test, his experiment, was going to have the crew eat the same meal three times a day, every day. Well, you can imagine that didn't go over very well. Also we had a very low number of calories. I forget what it was, but Jack Lousma would have come back dead if he'd have been limited to the number of calories.

But through negotiations, as we got—see, people think—they still do, when you talk to people, that we ate foods, something squeezed out of a tube, some stuff squeezed out of a tube, where we had this old-time airline-type wardroom tables with the little depressions in them, with heating elements in the bottom, and the food to be heated came in aluminum cans. We had concern, for example, about the foods with liquids in them, and soups, and, for example, prime rib.

Our meals repeated every six days. Every other day for the evening meal I had prime rib, and lobster Newburg one night, which was quite good. Pork and dressing another night. It must have been chicken or turkey another night, but prime rib every other night. But it was relatively juicy. We soon found that they had kind of a—I don't know if it was Teflon, but a Teflon-like material lining these things, so the food didn't absorb any of the metallic taste from the containers. So the liquids would come up, they'd just gradually move, of their own volition, up, but when they got to the edge towards bare metal now, because we pulled the

zip-top off, the fluids would stop. So you didn't have to worry about them oozing out by themselves. You had to be careful if you tried to take a spoonful, that you didn't knock something loose. That's how you get splatters around the ward room, careful as you are. I mean, a drop of beef juice would come off a bite of prime rib and you may not know it.

So I thought the food was quite good. Plus, we had frozen strawberries, we had ice cream. Pete had ice cream and cookies every night. We also had what they called empty-calorie snacks. They were only calories, in other words, they didn't contribute to this elemental thing. It was like mints, hard candy, sugar cookies, that kind of stuff.

We had a body-mass measuring device on board. You can't stand on the scale because there's no gravitational effect. I mean, they're balanced out. So Bill [William E.] Thornton, the astronaut, had designed—he's a very smart guy. But pretty elemental is that you can also tell the mass of an object by making it part of a pendulum assembly and then measuring amplitude or the frequency. So I thought I was actually gaining weight and it turned out I was losing weight. So I didn't eat ice cream and cookies in the evening, while Conrad is stuffing his face. I come back and I'd lost eight pounds or something like that. See, I could have had some ice cream and cookies along with Pete, but I didn't.

WRIGHT: What type of routine did you have for exercise? You mentioned the ergometer earlier.

WEITZ: That was about it, the bicycle ergometer. It was mainly just for cardiovascular. Then we found out when we got back, riding a bicycle does not do anything for the large muscles in the back of your legs. We got back on the ship, and all of us, all three of us, the backs of our legs were sore, very sore, almost sore as boils. I don't think the second crew had anything, but the third crew had a poor man's treadmill. I don't know if you've seen the footage of Jerry Carr.

It's another interesting thing, to me, anyway, if you want to hear about the restraints for the bicycle. This bicycle ergometer, you're riding it in zero G, you got to be careful or you'll fly off. Right? So we have to make it like one G, so we had a seat and we had triangle shoes to hook into the triangular grid that was part of the workshop floors, as it were. That design evolved because when it was going to be a wet workshop, we had to have these floors, as it were, but you had to allow the oxygen, the hydrogen, to flow through it. So they made this open grid and we carried that over into the dry workshop.

We had these different attachments that fit on the soles of your shoes to hook it in. So we had one of these triangles on the pedals, where the pedals would be, and then we had a seat, and we had this belt with a shoulder harness and bungies that went to the floor. That was the most ungodly, cumbersome, unwieldy, unworkable device, so we soon threw that out. We took the seat off, because you could maintain position by hanging onto the handlebars and just having your feet fixed to the pedals.

I was getting somewhere and I was led astray. What was I talking about before that? It's up to you to keep track.

WRIGHT: We were talking about exercise and how much you had to do, and that's when you started talking about possibly the difficulty that you had had with it and how that changed.

WEITZ: But Jerry Carr then, when they launched their crew, they decided—I think the second crew complained, so they took up a piece of a sheet of Teflon. I think it was Teflon. It was a slick surface, anyway, some sort of plastic. He used this restraint device that no one had used for the bicycle to then hold himself in a position where he could basically simulate jogging or running. So that he hooked that into the grid, the triangular grid. So it did pay off to a certain extent.

The one thing is we passed on enough information and the medics picked up on it enough that each crew came back in better shape from a cardiovascular and a strength standpoint than the crew before them, even though each crew went longer. Part of it on the third crew was this pseudo treadmill and that's why they use—I guess they still run the treadmill on the Orbiter. They did a rowing machine for a while. I don't know if they still do a rowing machine in orbit or not.

So we would do that each day, is ride the bicycle ergometer. But other than that we did have—Jack Lousma used it at least for a funny film clip on board, Exer-Genie, I think it was called. It was that isometric, isotonic thing. You could hold isometrically for a while and then you could—I forget how it worked. But being basic naval aviators slobs, we didn't mess with that. So it took a Marine to break it out and at least use it, put it on film. I don't know how much he used it.

WRIGHT: When we were doing some background information for this interview, I found the comment that Kerwin said you were the proud father of a genuine flare as part of your observations. Can you tell us how that happened, where you were able to find that flare?

WEITZ: No. [Laughter] Joe gave me credit. I mentioned earlier that we did get to record a relatively small, but, nevertheless, the only flare that occurred during our mission. But I was just—it was my turn at the ATM. We had an observing protocol, assuming that you had a quiet sun. If you did get some activity, then we could go into these alternative modes, and recognize that early enough that we did get not an absolute birth, which another crew, I think the third crew got one from the very start, all the way, serendipitously, I think, which doesn't take anything away from them. So we did get to get data, observe and get data on this relatively small flare.

WRIGHT: Did the twenty-eight days seem to go by quickly?

WEITZ: The Russians have had people up, I think their record is almost 400 days, and I have read some statements by our folks who've flown on Mir that they like flying for three or four months. But the people I've compared notes with, [and] we agree, it's on the order of two to three weeks. Ours was broken by the EVA in the middle. I just can't imagine spending much more than a month.

The simile I use when I talk to people about it is, you pick your favorite recreational activity, your favorite trip, whether you're a hunter or a fisherman, a skier, a scuba diver, a what, and if you ever got to go on it for two or three, I think you'd be ready to come home. But if you're home for two or three weeks you're ready to go again. I've compared notes with our folks and with Russians also, and most of us agree, not all, but most of us agree that that's about the right length of time.

WRIGHT: How did you prepare yourself before you left, mentally, for being gone for so long on this type of flight? Is there any way you could have done that?

WEITZ: We come from a Navy background. I'd made cruises before. My wife has loned it for seven months at a time. I mean, that just comes with the territory, so there was no special or unique requirement to cope with that.

WRIGHT: Well, twenty-eight days passed and you came back. Can you tell us about the reentry phase?

WEITZ: Yes, but let me get back to one other thing about in orbit. As a youngster, I also read a lot of science fiction, Isaac Asimov and all those, [Robert A.] Heinlein, and all those guys,

back in those days of the pulp science fiction magazines. I remember from a long, long time ago, one story about, we've sent off this ship, this immigration ship, and it is now its third or fourth generation that's been born on this spacecraft. I forget where they're headed, Alpha Centauri or somewhere, you know. The thing I remember about it is that even though it's a third or fourth generation born on their spacecraft, is that these people still had some attachment to Earth.

The thing that impressed me, and it's been said by many other people many times since, but after about some time in the third week I felt this desire to go home, but home was Earth. It wasn't Houston, it wasn't Texas, it wasn't the U.S.; it was Earth. There really is, I think, something to be said for the proposal, which will never come to pass, is that you put diplomatic discussions in orbit and let people see that these blue and green and yellow lines don't show up on the Earth, you see natural features. You see coastlines and mountains, snow, things like that, but you don't see these artificial boundaries, for whatever that's worth.

WRIGHT: I think that's a good statement and it has been said by many of the passengers of the Shuttle/Mir program when you're up there, we're all one, and it is Earth, and it is home.

WEITZ: Yes. So you always spend a couple days cleaning up, shutting down, leaving things ready for the next crew.

We did a two-burn deorbit. I'm not sure the other crews did, because Skylab was at 240 miles, nautical miles. We did a fly-around again, more documentary pictures, the ones you see with the parasol in place. Pete did the fly-around of the workshop, and then we separated from it and then did our burn. The thing that surprised both Joe and me was the first burn of the SPS, this something [Service] Propulsion System, SPS, anyways, the engine on the back of the service module. You know, that gave you a force of eyeballs in, which shouldn't be very stressful. Joe and I both experienced about one G, so it's just like lying on

your back. Joe and I both experienced some tunneling of our vision after twenty-eight days, which surprised us mightily. Pete didn't at all, but we did. But just for the first burn. We did the second burn and we didn't notice it at all, so whether maybe we grunted, did a grunt maneuver, or whatever, but we didn't notice it.

But the first burn dropped our perigee down to about 100 miles, as I remember. I know on Apollo—what was Cernan and [Thomas P.] Stafford? Was [Apollo] 10. Yes, they got about 10 miles to the moon on that one, and the 100 miles for us seemed like we were really streaking. We were ready to go through the cloud puffs is what it seemed like after we'd been at 240.

So then we did the second burn, and then we started seeing—see, Joe was in the middle seat, he doesn't have a window. So Pete has one on his side and I have one on my side. You can see an ion [wake] start to form, and then pretty soon are these burning pieces going by the window. Well, I knew that as the heat shield ablated, you've got vapor and hot gas, but nobody told me that burning pieces came off. I was a little startled, to say the least, and I'm sure that I asked Pete about what the heck was going on here. But that got my attention, I'll tell you. Joe was in the middle seat. He didn't snap to any of that. So Pete wasn't surprised, but I was.

Everything went like clockwork, and the drogue came out when it was supposed to, and then the mains. We had a good old—we wanted to maintain the Navy standards, so we wanted to stay in Stable One to make sure we didn't roll over upside down to Stable Two once we were on the water, like Air Force crews tend to do, you know. So we did, and that was my responsibility, so as soon as we hit the water, I either hit the circuit break or the switch or something and then the chutes came off and we stayed upright.

Then, see, Joe gets credit for coming back in very poor shape physically because he got sick, which obviously, to a lot of people's minds, was because we then went from zero G

to one G. I mean, it wasn't personal, but he also exercised the least, I think, and Pete exercised the most. I was kind of the dummy in the middle.

But see, we'd gone on the water and then you turned on your fan that brings in—you open the valve and you bring in outside air and it's humid out on the Pacific. It's hot. It's like Houston, it's hot, it's humid. Joe says, "You know, we've got to get some fluid, you guys, so what we need to do is get some of these drinks." So then Joe unstraps and gets down in the LEB, which is now, we don't have anymore of that stuff down there, and he's filling up drink bottles, these flavored fruit drinks, for me and Pete and himself. The command module is doing all this [Weitz gestures]. I know what happened, Joe got seasick. It was unfortunate. It probably would have been better from a scientific standpoint if he had just stayed in his couch. But if you want to see a sick puppy, I mean, somebody who's not feeling good, there's a photograph of Joe Kerwin.

And, you know, we did this thing of how much calcium was in our elbows and our heels, and Joe was sitting down on the ship, he's got his foot in this thing here, and he's got the most dejected look on his face. He's holding his head in his hand. But he was seasick is what it was, I think. He does, too.

So then we're on the ship and they picked us up in the middle of the ocean. It's now like four or five days on this ship back to San Diego, which is why they extended the second crew for three days, from fifty-six or fifty-nine days, so their splashdown point would be closer and they wouldn't have to do it.

But [Leonid] Brezhnev was the guy. In the meantime, Brezhnev is with [Richard M.] Nixon at San Clemente, his California retreat. So somebody decides it would be a good idea for the Skylab crew to go hold the NASA flag up at San Clemente, and the White House is all for it. Don't forget this is post-Watergate. This is '73. Nixon was already—I mean, those Watergate hearings were going on before we launched.

So we get in this helicopter, and you've seen pictures. We were on the ship around Houston, and everybody else had to wear these face masks to keep us from getting germs. That was supposed to continue. See, we continued the in-flight protocol for ten days, I think ten days post-flight, which included the people wearing face masks and eating Skylab meals. But we couldn't ask the President and Mr. Brezhnev to wear them, so when we left, we were supposed to wear them. Then we got closer and Pete said, "We're going to be with the President and the head of state of Russia, of the U.S.S.R." He says, "I ain't wearing that damn mask."

I said, "Okay," so we didn't.

That's when the ship did an excellent job, [USS] *Ticonderoga*. They made it. Once we found out we were doing this and then we got together, we cut name patches off of our flight suits and U.S. flags, and that's where our Swiss army knife went, got on one of those presentation items. As I say, I forget whether it was to Brezhnev or Nixon. So we spent a couple hours there standing around for photo ops primarily.

Then we got back in a helicopter, now we're in California, see, but all the people are taking this medical data post-flight around the ship, so now we're already in California. So we get on the helicopter and we flew back to the ship so we can ride the ship for a couple more days to come back to California.

Is that it?

WRIGHT: How long was it before you actually got to see your family after you got home?

WEITZ: We got to San Diego, and then went on to a C-141 that was configured to—I think it had a little separate compartment for us, so not everybody else had to wear the darn masks. We got home that night. We did get a dispensation and we could then sleep at home, so we

did, as I remember. So it was that same day, so it was five days, four or five days after the end of the mission, after splashdown.

WRIGHT: You had different responsibilities for NASA once you got home. Did the crew stay together for a while and do all the debriefings?

WEITZ: Oh, yes, sure. It was a significant debriefing process. We had no overlap. There was a gap, and rightfully so, I think, between each mission, so we still had some things to do. For example, we had some recommendations to make the ATM simulator better. It didn't quite show you the right thing in the X-ray frequency. And a lot of debriefings, everything from just the general hygiene, housekeeping, personal stuff, down to the operation of equipment and the data quality. I forget how long that took, but it was some number of weeks we spent, because we didn't have any more responsibilities. Every other scheduled flight, which was two Skylab flights and an ASTP [Apollo-Soyuz Test Project], was already crewed-up, so we're getting ready for the big slowdown, the big hiatus. I think nobody was in a hurry.

After that, then, I got to thinking about what it was I wanted to do. I wanted to stay with the agency, but I was thinking about doing something else other than staying in the Astronaut Office. I did work for about a year and a half or two years, I think, on an—I'm trying to think of the name of the project. LACIE, Large Area Crop Inventory Experiment. It was run out of whatever the division or directorate was then over one of those buildings toward the west side of campus, one of those two-story buildings, in cooperation with NASA and U.S. Department of Agriculture.

It was basically using LANDSAT data to predict and evaluate crop production. They didn't have anybody who—they were all remote-sensing specialists or data processors or ground specialists, and they didn't really have anybody who had experience in operations. So

I went over and worked on that for about a year and a half or so, two, maybe. So '75. There's kind of a gap in there, I guess. Maybe it was an uninteresting period of my career.

WRIGHT: What was the mood of the astronaut corps and of the—

WEITZ: We were probably considered, those of us who hung around, were probably—and I considered going back to the Navy. I was still active-duty Navy, but I mean, obviously one of my options was to go back. So I talked to people and I had the distinct impression, unsaid, but the impression I had was, yes, they'd give me a good job to see how I'd perform for a couple three years, but by then it'd been '66 to '75, now, nine years, I'd done nothing directly for the Navy in nine years. All these other people had done their time aboard ship and in staffs and all that, and I just felt that my best opportunities were probably within NASA, rather than back with the Navy.

There weren't many of us left in the Astronaut Office. We each had our own offices. Those offices were on the third floor of building four. When was the first group of Shuttle astronauts? That was '78, wasn't it? I think it was '78. Joe Kerwin was on that selection board, I wasn't. I really don't remember what I was doing or even what the Astronaut Office was doing. Well, obviously we were working on Shuttle, weren't we?

WRIGHT: Yes.

WEITZ: Yes, sure, because I remember now, it came to me. [Charles Gordon] Gordo Fullerton had this foam core mockup of the—he was working on the controls and displays. I was working on the CRT, the Cathode Ray Tube controls and displays for quite a bit of that time. We had folks, then you'd go to the factory and work through some mockups and do stuff like that. So it was the preliminary crew involvement with Shuttle that was going on

then. I didn't have anything to do with ASTP. Or [the Shuttle] ALT, unfortunately, Approach and Landing Tests.

Then they named, they didn't name—well, they did. There was supposed to be pseudo crews, A through F. These crews, with no assurances of ever flying were assigned just to exercise the whole system so that we'd have—we pretended "A" was going to fly first. "A" happened to be John [W.] Young and Bob [Robert L.] Crippen. "B" was going to fly second, and that happened to be Joe Engle and Dick Truly. I was on "F." I flew STS-6. It's funny how those things work out. It was all kind of a cooperative thing at first. John may have known what was going on with the crews and we had some ideas, but there were no assurances that "F" was going to fly the sixth flight.

WRIGHT: Were you back or when you were in the Astronaut Office during that time as a deputy chief?

WEITZ: Sometime in there I moved up. Sometime between officially assigned to STS-6 and coming off the LACIE Project and working on the software stuff, then, yes, I was John's deputy for a while, before he flew. They needed to fly continuity within the office. I forget who was deputy before then, but whoever it was probably left.

WRIGHT: Part of your role there was that to hire other astronauts?

WEITZ: No. No, that was a separate process. The Chief of the Astronaut Office basically is responsible to his boss, depending on whether you're flight operations or flight crew operations, for providing trained crews. So it's seeing that the needs of the assigned crews are met, that the needs of the agency as far as what training is required and what types of

people are required for specific missions. Then that's the chief's responsibility, and the deputy aids him to the extent that he wants it or will accept it and take it from there.

But the selection process was different. That was headed up by the director of—it was George Abbey, and I forget what his title was, because he went between FOD [Flight Operations Directorate] and FCOD [Flight Crew Operations Directorate] a couple three times in there. Maybe even MOD [Mission Operations Directorate] once, I don't remember. Probably not.

Of course, all the board members, not all, but most of the board members were out of the Astronaut Office. The Astronaut Office, Abbey chaired every board, as I remember, and the bulk of the members were from the Astronaut Office. Then you had Human Resources folks in there, too.

WRIGHT: Okay. About ten years passed since you launched with Skylab and when you commanded STS-6.

WEITZ: Yes.

WRIGHT: You trained for Skylab and you trained for Shuttle. Can you tell us what the differences were from those, and how you trained for one era of NASA's space history to another?

WEITZ: The fundamental process isn't any different. I mean, our approach always is, first you read the printed version of something, whether it's called a handbook or procedures or a desktop simulation or what, and then you go to a mockup, and then you go to a trainer, and then you go to a simulator, and you work through that process as you go.

That's why when people, as I say, "Weren't you afraid on the pad?" Allegedly Jack Lousma fell asleep on the pad before he launched for Skylab, because you've been in that situation. Especially in Apollo, you're sitting there and the boost protective cover's over the windows, so you don't have any windows to look out of. Our simulators are very good, so you've already been there dozens, if not a hundred times already. That's the key to the whole thing: no surprises. We don't always get away with that, but the key is no surprises. So the process is the same. The details change.

Let me go back to the times when I could do my own maintenance on my car and you didn't need a computer to check your car's computer. I had a VW and I had a Chevy. Well, I learned on the VW, but the same type of process is applicable to the Chevy, even though everything about the Chevy in detail is different from the VW. So the process we used to train for Skylab was the same as what we used for Apollo. I say the same. Evolutionary same, as was used in Gemini, as was used in Mercury, and we just went through that whole thing on into Shuttle. So my answer to your question is, there really wasn't a difference. I mean, there was in the detail, but not in the process.

WRIGHT: Of course, the big difference was it was a totally different type of spacecraft.

WEITZ: Yes, sure.

WRIGHT: How did you feel about being the commander of an Orbiter that it was its inaugural flight, went with *Challenger*? No one had flown this one before.

WEITZ: We were glad. As a crew we were glad to have the opportunity. It's a little distinction. Each crew, each mission looks for some distinction you like to hang your hat on.

Flying the inaugural flight or the maiden flight with *Challenger*, we thought it was a good deal. It didn't make any difference really, any flight, what you're after.

But we also got to do another thing that I consider—STS-6 we launched the first TDRS [Tracking and Data Relay Satellite], which didn't go well. It wasn't our fault, but they had to work very, very hard to get it up into orbit.

The other significant thing was thanks to—if you remember the first four flights, there were two people on the crew, and on the fifth flight there were four people. Joe [Joseph P.] Allen and Bill [William B.] Lenoir were scheduled to do an EVA, because we had new suits, we had new life support, EVA life support system. Well, one of the suits malfunctioned, so they didn't do it. So it was a bonus that I got them to add, I think, a day to our mission and to add an EVA. I think I did. It didn't take much work, as I remember, because we wanted to get this DTO, basically detailed test objective, behind us, and get on with suit development. We had to find out how the things operated in the vacuum and weightlessness. So we got that. That was the other highlight. We did TDRS, I think the first day, I think launch day.

In your little rundown you had all this other miscellaneous itty bitty stuff that I really don't remember much about. One was called NOSL, N-O-S-L [Night/Day Optical Survey of Lightning]. I don't remember what that was. The other thing was—what was that biomedical thing down in the mid deck? You mentioned it there. Electrophoresis.

WRIGHT: Yes.

WEITZ: Electrophoresis. But Story [Musgrave] was an M.D., so I said, "Story, electrophoresis is your baby," because they used biological materials in it, so that was his. I was the captain of the ship. If they wouldn't let me do the EVA, then gosh dang it, I was just going to use my prerogative to only do the neat stuff, other neat stuff, which wasn't much.

See, it's just like flying. The junior aviators get the best job. They get to fly all the time, because they don't know any better and because they don't have that many other responsibilities. The chiefs, they've got to do paperwork and planning and all that stuff. That's the way it is in the Shuttle missions, too. The commanders, they get the big label that says "commander," but they don't get to do the fun stuff.

WRIGHT: Well, did you enjoy looking out the windows of the Shuttle?

WEITZ: Yes.

WRIGHT: You had a little bit more, different type of view this time.

WEITZ: Yes. Since we were kind of on constraint, and also we had some of the—a couple of the experiments called for us to observe the Earth, not with any detection system. One of them, I think, was low-light-level binoculars or something like that, so we got to the point, the top of the Orbiter, which is really the only useful window. You either had to point your nose at the Earth, or the back of the Orbiter to Earth to see anything worthwhile. So, yes, we got to look out there, but not as much as on Skylab.

And just to keep things going, we didn't have the bunks in the Orbiter then like they have now, so I took my sleeping bag up on the flight deck and stretched it out horizontally.

WRIGHT: Wanted to keep that going, that tradition now had been made.

WEITZ: Right. I wanted to sleep on my back. Plus it put you closer to the commander seat, if something goes wrong, which it did. We lost a computer one night in the middle of the night and I was glad I was sleeping on the flight deck then.

WRIGHT: Did your crew look to you, since you were the only veteran on that trip?

WEITZ: No. That was a very bad crew from that standpoint. No respect at all [Weitz smiles].

WRIGHT: A bunch of independent team members, huh? They all worked together, but they were all very—

WEITZ: No. No, we worked as a team.

WRIGHT: Yes. Of course, your landing was a bit different this time when you came back to Earth than your original trip up.

WEITZ: Oh, yes.

WRIGHT: Could you tell us about that memorable experience of landing at Edwards?

WEITZ: Yes. Our whole entry was in daylight, so we didn't get to see the magic stuff that people later saw of the wake. Have you seen those pictures of the wake taken from the top windows? Darth Vader, they call it, the thing goes in and out and fluctuates, and it must really be fantastic. So we came streaking across the coast of California.

Another first we had is we had the first very fundamental primitive HUD, Heads-Up Display, as a landing aid. Other than that, it was just eyeballs out the window and do the best you can, which everybody did a good job, but we had a HUD. Also—let's see, that was in April. It had been a very wet winter and spring out at Edwards. Edwards is surrounded by

dry lakes, so-called dry lakes. We went to dinner one night out there before the mission, and the wind was blowing, and from this dry lake waves were washing up on the road. As a matter of fact, when we came around there, the lake bed—see all the landings up until then, except for ALT, I think had been on the lake bed, but the lake bed was unusable because it was too wet.

So it was almost like a carrier approach, because there was water off the end of the runway, and then there was the runway. We didn't know, until we came around the HAC, the Heading Alignment Cone, and the ground said to go to the close aim point. We had two aim points on the ground, and we hadn't been advised of that, mainly because the wind was up fairly strong. So to better ensure our chances of landing on the runway rather than short of it, we went to the close aim point.

I was mildly rebuked afterwards, because while we're flying around the heading alignment cone is then I'd let my co-pilot, my right-seater, Bo [Karol J.] Bobko, fly the Orbiter for a while. Well, it turns out I didn't ask and I wasn't told that I wasn't supposed to have done that. But I felt, why not let him get the feel of it, because he's going to have his own mission sometime, which he did. Bo flew two or three more missions as commander. Nothing serious.

But the landing went well. The HUD worked, helped, I thought, was an aid in landing. Then the touchdown was, I was very much pleased with it, it was relatively smooth and everything went just like it should as far as rollout was concerned. The thing that impressed me, on entry as the Gs built up, I was relatively free with moving my head around, it didn't bother me at all. Five days, piece of cake compared to twenty-eight days. After the wheels stopped and we did the shutdown procedure and that, and then I went to get up out of the seat, then I was almost subjectively as heavy after five days as I was when we got out of the command module after twenty-eight days. Now, it went away a lot quicker, and it wasn't really—two Gs is what I felt like in Skylab. Took about three days to reaccommodate to one

G after Skylab, and this was a matter of twenty minutes, perhaps. But other than that, there was nothing, events were untoward, I guess. Then we came back to Houston and then went through the debriefing process.

WRIGHT: Landing the Shuttle, was it similar at all to when you used to land your planes when you were in the Navy?

WEITZ: No, no, no, not at all, because you're coming down, you can only modulate drag in Orbiter, you don't have any thrust. No, Orbiter at one time did have little jet engines on it, not enough to take off, but enough to help your lift-to-drag ratio. The approach is so much steeper, I mean, even the approach to the carrier is steeper than it is at an airport, it's commercial. It's nothing compared to the 17 degrees that you're coming down in the Orbiter. So there was really not much transfer outside of it being another flying machine. But as far as technique, there's no transfer from a carrier landing to a Shuttle landing, in my mind.

WRIGHT: Well, you've been there, so—

WEITZ: Well, other people may argue with me.

WRIGHT: Then the opposite of that, when you launched, of course, you launched on the Saturn and then you were launching from the Shuttle. You mentioned that simulations helped you prepare for that—

WEITZ: Not yet.

WRIGHT: —but what were the differences of launching from that vehicle to the one that you launched to with the Shuttle?

WEITZ: Well, the value of our simulators ends when those engines light and you lift off, see, because, I mean, they try to fake you out a little bit by tipping the Shuttle Orbiter simulator and that, but it doesn't compare with three Shuttle main engines and two solids going. As I tell people, I said, "You know you're on your way and you're going somewhere and you hope they keep pointed in the right direction, because it's an awesome feeling." But you don't get as many Gs. I think we got up to about four and a half Gs on ascent, on the Saturn I, where the Orbiter throttles back to maintain no more than three Gs.

Now, the things that are different is the thrust in the Saturn was actual—in other words, it was straight ahead, so you're being pressed directly into your couch, where in the Orbiter, you know, the Orbiter's sitting on top of the ET [external tank], the solid rocket's around the side, so that effectively what you're doing is now these engines, the Shuttle main engines are thrusting this way, which wants to push to the stack over this way. So really, when the Orbiter is going up on ascent it's flying this way. So besides the eyeballs-in stuff, you get some eyeballs up. It was more marked than I had been led to expect, even though you talked to other crews, so you really are pressed up against your shoulder straps on ascent. It wasn't particularly uncomfortable or disconcerting, it just was, you'd have rather not had that, because it's unnatural in an airplane or any flying machine to have you going up that way.

There were more Gs. They had a thing in the center, one, I think was a second stage, called PU shift, Propellant Utilization. The onboard computer takes a look at how much of each of the propellants is remaining and then does a mixture shift. Well, they said there'd be a slight decay in thrust. Hell, I thought the engines—heck, excuse me—I thought the engines

had quit on that. I mean, the drop in thrust was significant to this new guy as we were going uphill there.

But everything else, staging went well, and the same thing, the usual with the Shuttle, when the solids separate, you get this big blast from the separation motors on the solids and it puts gunk all over the windshield. We haven't still solved that part.

I can't think of anything else right now.

WRIGHT: What do you feel the lessons that were learned from your STS-6 that were able to be passed on that made an impact on the missions that followed?

WEITZ: I can't offhand think of a thing. Well, the suit evaluation, the EVA procedure and suit evaluation. Also it basically was confirmation that the procedures for deployment of large upper stages value, but that was just confirmation and maybe tweaking of some of the stuff. I don't remember what came out of the suit evaluation, because it was glove mobility, flexibility. It was the usefulness or inconvenience or what have you, pluses and minuses of the tethers that they used. But that's kind of routine stuff. That's what you go into the mission looking for. You say what revelation did we bring back that will make things better and easier for other following crews, I can't think of anything.

WRIGHT: It must have seemed like a short trip, though, after your first one, five days, and then you were back home.

WEITZ: It was long enough.

WRIGHT: Yes.

WEITZ: I mean, we did everything we wanted to do.

WRIGHT: Sure.

WEITZ: See, the thing to do on the Shuttle would be just launch once a week. I mean, those landings are great. They're a lot of fun. So you'd like to just fly a bunch of one-day missions.

WRIGHT: Once you were home and that mission was over, then where did your path lead you with NASA?

WEITZ: Well, I had another decision to make, and while I was cogitating on those events, we had another couple of selection boards. I guess I went back to being John's deputy, and then, of course, John flew again, on STS-9. So that gave me something to do in the meantime.

But that period is kind of overwhelmed by *Challenger* 51-L business. The best thing that ever happened to me from a personal standpoint is—well, George Abbey went to the Cape for every launch and he wanted John there and he wanted me there, also. So we went down and then I got a cold while I was there. I mean, if I couldn't have contact with the families or the crew, then there was no sense of being there. So I'm back to Houston, and I have to believe that having to deal with the families at the Cape was a very, very traumatic episode for John and George, and I was glad that I wasn't there for it. I was in mission control.

Since I was a senior member, I think, of FCOD, as soon as I realized what had happened, I didn't know what the procedure was in Building 30. I was afraid I'd get locked in the viewing room, so as soon as I realized what was going on, I basically fled the viewing room and got out of the building, so that I could be free to do other things as required.

WRIGHT: And what was your role during that time?

WEITZ: I don't know. I don't remember. It was holding hands, basically, trying to comfort the families. That was primary. That became primary. I went to a lot of memorial services and visited a lot of home towns, spent a lot of time with some of the wives, especially Jane Smith, in my case, because Mike and I were good buddies.

WRIGHT: Must have been an agonizing time for the whole astronaut corps.

WEITZ: Well, it was, and then the agency, as I mentioned before or alluded to, never really took charge of the investigation, mainly because the agency was in a bit of a turmoil. Gerry [Gerald D.] Griffin had just recent, not that long ago, left as director of the center. I think [Richard H.] Truly was administrator the day of the accident. I don't remember, but I think he was. Jesse [W.] Moore was supposed to come down and be a new center director at JSC, so Code M was kind of in a turmoil. I think that was part of the reason that perhaps the headquarters didn't act as swiftly as they could, and again, the leadership at JSC was in the process of a transition.

So, yes, the primary thing at the time was dealing with the loss and the grief, perhaps at the expense of getting on with resuscitating the program, but I still think at the time it was the right thing to do.

WRIGHT: Was there a turning point that you know of that put NASA back on that path where flights were going to be scheduled again, people felt that it was time to move forward?

WEITZ: No, not what I would call a turning point. They had the committee. Whose committee was that? What was the name of that?

WRIGHT: Rogers Commission?

WEITZ: Right. The Rogers Commission, yes. They did a good job and they had the right people on there, it just took a long time, because it was in a bureaucratic environment of Washington. By then the commission—if I were Rogers, I'd have done the same thing. You have to satisfy perception in many cases, as well as serving the issue, so we had to do that.

WRIGHT: Were you at the launch at the Cape when we returned back to space travel?

WEITZ: I don't remember. I was deputy director then, so I probably wasn't—no, I think I wasn't. Whatever. We had then gone back to regular numbered flights, so that was 26, 27, twenty-whatever. You know why we came up with that system? You've been told that, right?

WRIGHT: Share with us how that happened.

WEITZ: Mr. [James M.] Beggs, who was the Administrator of NASA, apparently suffered from—I use the term "suffer," but experienced triskaidekaphobia. He didn't like the number thirteen. So he didn't ever want any mission numbered thirteen, so we went through this system of 51-L. Now, how was that? I think the first digit was the fiscal year that the flight was originally scheduled. One was an East Coast launch. Two, second digit being a two, was a Vandenberg launch, which, of course, has never come to pass. I forget now how the

letters came about. But anyway, we've now gone to a numbering system, but, of course, we don't fly them sequentially anyway.

See, that was a big decision we had to make at one time. "Big" I say. And it turns out that the paperwork was the deciding factor. Once the crew started training for STS-XX, it just was too big a job to make sure you kept the documentation, all the documentation, all the training documents, checklists, the whole thing, to keep it straight. Funny how a little thing like that, but that was, as I remember, the deciding factor for saying that 101 flies three years before 97, or however it works out. But it's confusing to the public sometimes.

WRIGHT: That's okay.

WEITZ: So in that period then, I got a call from Admiral Truly saying that they wanted me to be the deputy center director. Well, I didn't know if I was keen on that or not. Then Aaron Cohen called me. I'd already planned to go on a hunting trip to Wyoming, so I asked Dick [Truly] if he wouldn't give me a week to let him know.

So anyway, for better or worse, I agreed to take the job and [never] regretted it. Aaron Cohen was a great guy to work for.

WRIGHT: Were you given specific duties or were you again—

WEITZ: Yes, I did everything Aaron—like most deputies, I did everything Aaron didn't want to do.

WRIGHT: Could have been a different agenda every day, huh?

WEITZ: No, not really, because it was by function. I say that semi-jokingly, but equal opportunity, for example, has always been the job of the—always had been of the deputy center director, dealing with the so-called institution, the non-programmatic functions, like the construction of facilities budget, the institutional budget, in other words, what it takes to keep engineering running, for example, not from a test standpoint, but from facilities and people. So those are the kind of grunt things I did.

WRIGHT: Then your position evolved, is that correct, moved into more a—at some point you were the acting center director?

WEITZ: Oh, yes. Well, when Goldin was assigned then, then he pulled in what he saw as the top talent from out of the agency, which typically was center directors. So a lot of centers were trying to be run by the deputies, because their bosses or directors were at Headquarters essentially full time, helping Goldin out, which, again, was the right thing to do. I mean, I didn't mean personally, but just coming from the job we had and the job he was given, he needed the help.

I agree with his—I forget the people he had up there, but I know two of them was Aaron and good old what's-his-name, the guy who was the director at Stennis over in Mississippi [I. Jerry Hlass]. I can't think of his name now. My goodness, I can place his face. I can't think of his name. So Aaron did, mainly because Aaron and the Stennis director were really solid citizens and a long time with the agency, a lot of experience. Goldin kept them both up there for quite a period of time.

Of course, Aaron basically gave me free rein. That doesn't mean that I didn't call him for counsel sometimes, because when significant things came up, you wanted to touch base with your boss. Then he retired, so there was a short period of time then when I was the real

acting center director because Aaron was gone, and not until Carol [Carolyn] Huntoon moved in.

WRIGHT: Did your title change after that time, because you were still—

WEITZ: Well, then George Abbey came down as the deputy. I'd been telling Aaron and the Marine general who was Code M back then.

BUTLER: Abramson?

WEITZ: No. No, he was Air Force. That was a long time ago. Anyway, I'd been telling JSC and Code M that I was leaving in spring to summer of '94 for quite a while, because I didn't want to spring any surprises on anybody. So Goldin called me up and he says, "You're the deputy director. How about if I send George Abbey back down there as the deputy?" You know, he was nice enough to call me. I said, "I've got no complaints with that."

In the meantime, besides, I didn't have to take a cut in pay. [Laughter] The associate director, Dan [Daniel A.] Nebrig, had retired previously, so I moved from one office to the other there, took on the title of associate director, which really was kind of what in the Navy we used to call a twilight cruise. And they would often do that, they'd say, "Okay, you're going to retire. Where you going to retire to?"

You say, "I want to retire in Jacksonville, Florida."

They say, "Well, we'll see if we can't find a job for you there for your last year, if you promise to be productive for that year." Saves you moving expenses.

WRIGHT: Sure.

WEITZ: So anyway, it basically was a twilight cruise for me. The associate director and the deputy director kind of shared responsibility, so I'd always left the travel budget and other things like that, really nasty things, up to Dan Nebrig. So then I got to deal with those when he left, when I moved in there.

WRIGHT: During that time period where you were in the center director office area, NASA moved into a partnership with Russia for part of the Shuttle/Mir Program. Were you involved in those negotiations and those efforts at all?

WEITZ: No. No, not really. At that time the Space Station effort was really almost separate from JSC. I mean, we provided facilities for them. We housed some of the Space Station stuff, both Space Station Freedom and later ISS [International Space Station], but they'd come in with the advanced—what's the new building over there, 5A? Or what's the one just south of Building 4, that seven or eight-story building? It's relatively new. It's next to the cafeteria. Took out the Building 4 parking lot.

WRIGHT: I think they call it 4 South, the sixth-floor building.

WEITZ: 4 South, right. Right. Thanks. 4 South, that's what it is. I was the deputy center director responsibility for facilities, and these Space Station guys come in and they demand three floors or whatever it was, and I say, "Well, you can't have it. You can half a floor. How about that?" I mean, we were a host, is what amounted to at that time, so my involvement was practically nonexistent in either Space Station Freedom or International Space Station.

WRIGHT: You mentioned you were trying to give them enough time to let them know that you were getting ready to retire. Was there something that pushed you toward that decision, or was it just time for you to make change?

WEITZ: I was ready to leave after forty years of government service, and there comes a time when jobs that at one time were interesting and fun weren't so much anymore. Plus, frankly, I agree with Mike Collins, we shouldn't mess with Space Stations. We should either go directly to Mars or go to Mars via the Moon, and you could do that with the Russians, too. We could do that with our international partners. But so be it, that I wasn't asked for a vote or given a vote, and it just was time. I was ready to retire and do nothing.

People say, consulting, "Who are you consulting with?" I said the only thing I consult with, I have these flies in my fly box that when I want to go after Mr. Trout. I consult my bird book every now and then if I see a strange-feathered creature. But I don't go after anything and no one's come after me, except you guys.

WRIGHT: And we're glad we did. Looking back, is there a time or a significant achievement that you feel like is your favorite memory of being part of the space program?

WEITZ: Flying. I mean, that's what you go there for. That's part of the reason that I had always, I think, wanted to be a naval aviator, was I thought that you had to be a little cut above the people who land on 10,000-foot runways to land on an aircraft carrier.

WRIGHT: Any thoughts about where you think our space program will go in the future?

WEITZ: Oh, I think it's solid now. As a matter of fact, I just read a thing in the paper yesterday, [William J.] Clinton's budget includes an increase for NASA over this year's. It

doesn't keep up compared to what we had in Apollo, adjusted for inflation costs. We're going probably a quarter to a third of real dollars of what it was then.

WRIGHT: Well, I was going to ask Carol and Sandra if they had a question for you. Do you have anything you want to add?

BUTLER: When you were preparing for both of your missions, both for Skylab and for the Shuttle, and you said on Skylab you had been involved with the earth resources primarily, had you had a lot of interest beforehand in anything specifically related to earth studies?

WEITZ: No.

BUTLER: Did you develop that as you went along? How did you prepare for that?

WEITZ: You didn't have to be a scientist to do that. You didn't have to be a scientist to run any of it, because they knew we were flying few real scientists. [Owen] Garriott and [Edward G.] Gibson were probably as close as they come. Ed Gibson wrote that book about solar physics called *The Quiet Sun*. It's too bad the timing turned out. We were at the low point nearly in solar activity in the eleven- or seventeen-year cycle, whatever they think it is now. But, no, it more is an operational, a crew interface, how do you come up with equipment that is simple enough to operate that you can get these dummies to operate it and get good data back. Doesn't always work.

We made one pass one time. Frank tells the story on ourselves, it's on me and Pete, and Pete can't object now, unfortunately. They had an optical quality window in one side of the MDA, because had these six multispectral cameras. They were modified Hasselblads, and each one had film in it, each camera had film in it that had a different sensitivity,

different wavelength sensitivity. So it was a gang of six. But to protect this optical quality window from orbital debris, it had a metal cover over it that could then be, with a hand control, you swung it out of the way.

So we made this EREP pass and then we were cleaning up afterwards, and you'd lift up this bank of cameras. I lifted up the cameras and the window cover is closed. We just finished the data we were taking. I said, "Pete, when did you close the window cover?"

He says, "I didn't close the window cover."

Well, neither of us had closed it, because neither of us had opened it. It was my responsibility to open it. So, see, even that, you don't make it foolproof, because when the gang of cameras in its holder were in place, you couldn't see the window it blocked it out. The cameras are going "kunch, kunch, kunch, kunch, kunch," taking all kinds of exposures, and we didn't know that they were only getting black.

WRIGHT: Saved a lot of processing time that way. [Laughter]

WEITZ: Another archive photo, we made it very simple, and Pete made it up and we Scotch-taped it to the—we had a separate control panel for most of the EREPs. He Scotch-taped it on there and that will soften it a little bit, and it said, "CDR and PLT's EREP DS cue card." So that was our summary cue card until we double-checked the very important things like the multispectral camera door open, window cover, whatever.

WRIGHT: It must have added a little bit to the flight to be with Pete Conrad for twenty-eight days, from what we understand—

WEITZ: Oh, yes.

WRIGHT: —about his character and personality.

WEITZ: Oh, yes, he's a very serious guy when serious was required, and he was fun to be with when it was time to have fun.

WRIGHT: I heard one time that he fixed the battery on Skylab with a hammer.

WEITZ: Oh, yes. That was during the film retrieval EVA. It was a battery regulator or charger regulator. Pete also prided himself as being—he had a sailboat the time, and he prided himself as being a sailor. He'd been into sailing for quite a while. I mean, he had like, I don't know, a twenty-four-foot sailboat at the time. They did a couple of things. They wanted to assess what happens to the material, the mylar material that the parasol was made of after exposure to it. So Pete was happily, busily, sewing this sample. He was sewing the sample together and sewing pieces of Velcro on it, because they wrap around one of the tubular support structures of the ATM. So he's busy there with his needle and thread, and then they said, "We want you to do this," I think CVR charger battery regulator module was sticking some way.

So he had a hammer. I guess we just had a hammer in our tool kit. So we had to rig up a restraint so Pete could take it outside, and then he gave it a mighty whack on his way out to the end of the ATM. Sure enough, it was the old "If it doesn't work, kick it once and see if it works." So we got it back into shape.

WRIGHT: Did what it took.

WEITZ: Yes.

WRIGHT: Is there anything else you'd like to add before we close this session today?

WEITZ: No, I can't think of a thing right now.

WRIGHT: Well, we certainly thank you for your time and for all the good information.

WEITZ: Well, you're welcome. I hope it's of interest to somebody sometime.

WRIGHT: It definitely will be. Thank you.

[End of Interview]