ORAL HISTORY 3 TRANSCRIPT

JACK A. KINZLER
INTERVIEWED BY ROY NEAL
HOUSTON, TEXAS – 27 APRIL 1999

NEAL: Rolling? Okay. We're rolling. And just for identification, first of all, I'll tell everybody that we are now on the campus at the Johnson Space Center in Houston, Texas. I am Roy Neal and with me is Jack Kinzler. And you're going to find out all about him. By the way, if we seem to be in space, it's the result of an arduous effort on the part of our crew, who have been working very hard to give you a proper background, the explanation of which will come later in the course of this interview. Right, Jack?

KINZLER: Right.

NEAL: Okay. Now let us then get ready to roll through all those years. How many years was it when you first came aboard NACA [National Advisory Committee for Aeronautics] (not NASA)?

KINZLER: 1941. March of '41. And the way I came aboard was as a model maker, as well as a friend of mine, Caldwell [C.] Johnson. We lived in various cities and heard that the government was hiring employees to actually build models for wind tunnel research. And here I had spent probably from age 12 until 25 or so building competitive models; and it was, you know, very interesting to me in the aeronautics field. So, I had an opportunity, and I filed an application, got a call to come down to [NACA Langley Memorial Aeronautical Laboratory] Hampton, Virginia, and take a interview. And I'll never forget the day. It was such a wonderful thing for me to get hired to build models—my hobby, my life's hobby—

and get paid for it! So, that's how things started, Roy. I just was one of those lucky guys who came into the business through aeronautics, through our hobby in aviation.

NEAL: You said you started in 1941?

KINZLER: '41.

NEAL: As World War II was really getting under way for these United States.

KINZLER: That's right.

NEAL: Does that mean you were working on some wartime projects during that war?

KINZLER: Yes, it does. I worked in the machine shop at the time on Langley Field Base. And they had various secret projects for the military, for the war, including advanced designed airplanes that were still in the development stage. And so they gave we employees secret ratings; and whenever the draft boards in our local neighborhoods tried to call us up, all we had to do was go over to the draft officer in NACA and tell him, "We've got a call. What do we do?" And he says, "Well, just take your time. Don't worry about it." He says, "You're not going anywhere." So, as a result of that, we were put in the Air Corps enlisted reserve. We did have to board a bus and go up to Richmond, Virginia, and take physicals and go through all these steps that you would as a draftee. But upon the completion of the physical test and everything else, the colonel (or whoever it was) there said, "Okay, fellows, you're heading back to work at Langley Field." So, that's how that came about.

NEAL: And then one day the National Advisory [Committee for] Aeronautics became the National Aeronautics and Space Administration.

KINZLER: Yes.

NEAL: It had a new role. And that, of course, meant that your life changed considerably, didn't it, Jack?

KINZLER: Very much so. And it's kind of an interesting thing to talk about because, as a young fellow working in the shops, I was across the street from the department where [Robert R.] Bob Gilruth had his facilities: the PARD (Pilotless Aircraft Research Division). And you know, I'm sure, of Bob's activities. But I'll leave that go for now. But as one of the employees over there, I had developed a kind of a lot contacts because I was in charge of a group of 10 men as a subgroup of the shops and we would go out to the test facilities, install the precision models, and do modifications as required around the space—around the Center.

So, I got to be well-known and whenever they—Bob decided he was going to start a Space Task Group, he went to my superiors and he said, "I'd like to have at least one of your people who could come with me and develop a similar facility like we have here at Langley." And then he called me and he said, "Jack, would you like to work over in the space program with me?" And I said, "By all means!" I had been reading books about spaceflight and listened to some of the lectures that were available at the time, and I was primed, ready to jump onboard whenever he asked me.

NEAL: Still a very young man, of course, too.

KINZLER: Yes, I was quite young then.

NEAL: So, the Space Task Group reached out and pulled you in. And at first, did you have an assignment or did you have to make your own?

KINZLER: Well, it's kind of interesting. He knew that—he asked me to come with him so that the shop's organization could be represented in some fashion. Remember this: there were 1,000 employees at Langley Research Center, scattered around in all their research shops. And it's not a manufacturing-type environment; it's a research and development environment. So, with that knowledge, he thought, "I'd better take somebody with me that's familiar with this kind of business." So, he asked me if I would go, and I joined him; and we followed on, and we came to Houston, [Texas]; and he never gave me another bit of instruction. He said, "I want you to create an entire technical services organization with up to 200 people. And you would design the buildings, lay out the basic outline of the facilities. You would go about the country, recruit people. And while you're doing that, you'll run around to the Cape [Canaveral, Florida] with the Big Joe capsule that you built at Langley." So, it was a thrilling thing for me to get an offer like that.

NEAL: I'm going to come back to that, too.

KINZLER: All right.

NEAL: Because right now I think we're jumping out of Langley into Houston a little rapidly—

KINZLER: Too soon.

NEAL: —because you were doing things back there at Langley before you came here.

KINZLER: That's right. In the earliest days, just prior to NACA becoming NASA, there was a gentleman who created what is now called the parasail. And in that project I had occasion to work with him and then I also went out to the Jet Propulsion Lab and worked there. When we considered the idea of making a passive satellite (you may or may not have heard of this), but we built a sphere 6-in. in diameter and filled it with a—some material which would expand if you exposed it to a vacuum of space; and we had a 12-ft diameter Mylar plastic-type device that would balloon out and become a spherical satellite, if you will. So, I worked on that project as well as— [William J.] O'Sullivan [Jr.] was the gentleman who had the parasail. I was involved with both of those.

NEAL: And that balloon sounds a lot like something called [Project] Echo.

KINZLER: Echo, right. After our 12-footer was successful, we went ahead and built a 100-ft sized sphere, which packed in about a 24-in. diameter sphere. Same principles. Launched on some of the existing booster rockets that were in use in those days. So, here again we were well ahead of the beginning of any assay in this instance. Just, you know, a year or two. But—

NEAL: Well, you're back in the '50s now. You've been there from '41 into the '50s.

KINZLER: Into the '50s.

NEAL: And so this gives us that transitional time in the '50s, as NACA transitioned into NASA.

KINZLER: Yes, it does.

NEAL: And gave you a beginning into what was to become the manned spaceflight program.

KINZLER: That's true.

NEAL: That must've changed a lot of the thinking of the kind of things on which you were working. No more balloons.

KINZLER: Yeah, you could certainly say that, because they haven't made any more that I know of in the present period of time. As far as a transition: we were involved with aviation in NACA, and aviation dictates airplanes with wings and so on. So, the aerodynamic aspects of aviation certainly led over into the development of the capsules that had to fly. We had to have a means of them sustaining themselves, you know, in later flight. And of course, I'm jumping a mile when I get to the Shuttle. But nevertheless, we did—our experience with aviation, I think, was a direct leader into the days of the rockets and so on. As a matter of fact, you may or may not have heard a lot about Bob Gilruth's concept.

We in the machine shop built scale models of wings. We were interested in trying to break the sound barrier because it was a limit in the wind tunnels. You couldn't do it. The air flowing through the tunnels would get turbulent, and you couldn't get any decent data from it. So, Bob and his group came up with the idea of building small wings, mounting them on the side of a rocket, firing them out at Wallops Island, over in Virginia, off in the Atlantic. And as they were ascending at high speed, they would go through the sound barrier. Meantime, they were able to take telegraphic pictures (telegraphic's the wrong word). But photos of the activities, and also—telemetry is the word I was looking for. Radio telemetry. So, with that concept, we were kind of moving over into space, trying to get more data on transonic flight. That was a real transition there.

NEAL: Now that was before actually the—

KINZLER: Before—that was still NACA. But close to it.

NEAL: And so, when the time came that the Space Task Group was formed, there was a lot of background there and a lot of people who at least had some basic knowledge with which to begin.

KINZLER: Very much so. And I guess the public in general doesn't realize that we weren't a rocket-oriented agency then. But Bob's group utilized the solid rockets to fly and do work in the transonic speed range. So, there's the connection there. In other words, that led them to thinking that "Since we have a capability to fire rockets, maybe we could put a man in space." That—it really originated right there with Bob's group, the Project Mercury concept for a man in space.

NEAL: I noticed you said "transonic," not "supersonic."

KINZLER: Transonic.

NEAL: You were getting up into the higher realm, weren't you?

KINZLER: That's right.

NEAL: Even then.

KINZLER: That's it.

NEAL: About what timetable was that? The late '50s or the early '50s, mid-'50s?

KINZLER: Probably about '55, '57, '58. Leading up—coming up close to the creation of NASA.

NEAL: In '58, wasn't it?

KINZLER: In '58, yes.

NEAL: And that's when the Space Task Group really was formed, too.

KINZLER: It was.

NEAL: Then the astronauts were chosen—

KINZLER: That's correct.

NEAL: —shortly thereafter. Well, now we're into that realm of astronauts; and suddenly the new task is there. Tell us about the beginnings. How do you begin to design to send—to build something that will send a man into space?

KINZLER: Well, you do—you base your design work on the necessities, let's put it that way. That's pretty simple. But that means you have to have a machine that can support life. And you have to be able to leave the atmosphere of the Earth and return to Earth through very difficult conditions: reentry, where you hit 3,000°F and so on. So, they looked into things like ballistic missiles that used reentry warheads. This is a part I'm familiar with. And they concluded, "If we build a heatshield of the right curvature, we might be able to get back to Earth without melting." Simple things, but we leaned on what somebody else had been doing. When we—when the Mercury capsule design evolved, they knew that they had a living person going to be in it, so they got thinking about the necessity to safely save an astronaut at the Cape if there's a mishap. So, the—I was quite involved with this particular thing. I'll describe it briefly.

I was approached by Max [Maxime A.] Faget, who was part of the design team for Mercury. And Max said, "Jack, can you make a scale model of the Mercury capsule concept that we have in mind? And what I'd like to do is confirm the most direct thrust angle we could put on an escape rocket and still not burn up the spacecraft when we light it off. So," he said, "what I'd like you to do: I can give you the dimensions of the concept capsule." He said, "If you'll draw up some small-scale models; and we'll take them over to Wallops Island and we'll fire them with a small rocket on them, and we'll have different degrees of angle on the outlet rockets—the exhaust plume." What they wanted to do was get the nearest to a vertical thrust out of a rocket motor. They wanted to divert the thrust so that it would miss burning up the capsule, which is directly below it. So, the net accommodation was a tall tower with a small rocket on it that they weren't sure when they were writing the specifications for the design for the contractors to bid what angle to specify.

So, I drew up a 10-deg, a 15-deg, a 20-deg, a 25-deg angle off the vertical for the nozzles and we'd fire these with a 10 and then 15 and the 20, and we got a pattern of the flame intrusion on the spacecraft. We did that with high-performance cameras. Actually they had those cameras at Wallops, where they could—actually, while a test subject was flying, you know, going up at enormous speed, they could still track it and get data from it. So, in this case, I helped make the first test models, had them made in the little shop from my drawings, and then I went over to Wallops and supervised the testing aspect of it. That was a—just one little pinpoint of something that you had to do because of—men were going to fly.

NEAL: These were models that were tested not in wind tunnels, but in actual flight?

KINZLER: Actual flight. And they went through the transition period that I was talking about, which is similar to what had to happen later on in real flight.

NEAL: Well, as you got a little closer to manned flight, you began getting into what they call boilerplate models. And again, that word "model" comes in. Were you responsible for any of that work?

KINZLER: Yes. We built the models in the sheet metal shop in the boilerplate fashion. That's a true term, by the way. Boilerplate is steel metal plate; they just call it boilerplate. And the original early models for Mercury, the pre-Mercury models that were built in house, were actually made out of just plain steel plate. And they weren't designed for reentry, but they had the configuration shape of what would be later the exact flight models. And we built those models; and we had occasion to do drop testing.

I don't know if you've heard of this particular phase yet. We brought in helicopters from the Navy; and we would go out on Wallops—not Wallops but in the bay near Langley. We'd go out in the bay with the models on a boat. We'd pick up the boilerplate with a helicopter and lift it up to maybe 500 ft or so, and then set all the cameras and everything and release the capsule and let the parachute flare. (It was more than 500 ft. We were a bit higher.) But anyway, it would drop the boilerplate, and it would deploy parachutes; and they'd come down and they'd make an impact on the water (of course). And with that kind of data, they began to realize another thing. They realized that they couldn't keep an astronaut alive if they were to hit the water too hard.

So, I got involved in another thing. We—and the next thing—we were still at Langley now, but it was now NASA at this point. We had a water-testing tank, a facility where they ran down and just tested seaplane hulls and things of that kind. So, with that water facility available to us, we decided we'd better do something along the impact line. And finally within our NASA, it occurred that we should disconnect the heavy heatshield that was bolted directly to the upper part of this capsule and add a rubberized circular band around it, about (I think it was) 4 feet deep and the spacecraft was about 7 or 8 feet in diameter.

So, imagine a circular hoop of rubberized fabric with 2-in., 3-in. holes throughout so that it could let air in and let air out. And imagine that's all folded up and secured to the underside of the spacecraft prior to normal usage; and then upon nearing—when the parachutes are out and they're nearing descent to the ocean, they had a release device (actually it was an explosive bolt), and it would drop loose and it would fall down, extend itself so that it was suspended (the heatshield now)—is suspended about 4 ft or so below the Mercury capsule. And as it hits the water, it starts squeezing the air out because it's like an enclosure with air in it. The heatshield hits the water first, and then as it squeezes the air comes out. So, we got a real soft landing, which was the solution at that time for the Mercury capsules. We had installed that particular element into the manned Mercury capsules.

NEAL: And that actually flew.

KINZLER: Actually flew, yes.

NEAL: You know, that was one of the things we never really saw during the landing operations.

KINZLER: No.

NEAL: We never realized that heatshield slid down.

KINZLER: Was dangling down in the water—sloshing around. Now, I've got to give you a little side. (You're helping lead me on here in the way I want to go.)

NEAL: I think that's what they have in mind for me.

KINZLER: Yeah.

NEAL: That's my kind of role. Go ahead, Jack.

KINZLER: Okay. The engineers over at McDonnell Douglas [Corp.], who had designed the prototype Mercury capsule, they got involved with the new addition that NASA itself thought of; mainly the shield of rubberized fabric. And they came and, in their design, they picked some 6-in. long turnbuckles. If you know what a turnbuckle is, it has male and female threads and you can tighten things up. Well, they took some stock turnbuckles out of a catalogue they had and they put them on, and their purpose was to allow the heatshield to jostle around in the water and still be, you know, freely contained. However, they didn't work too well. They put some in the test model in the Langley tank and turned on the wave maker and let them jostle. And it didn't take any time at all for these big, cumbersome turnbuckles to get twisted around and break. Well, one day Mr. [James S.] McDonnell [Jr.] himself was there watching the testing. And I got to looking at it, and I decided, "This is ridiculous. We shouldn't have these big, bulky turnbuckles."

So, I went back to the shop and I made a turnbuckle that was ¾ in. long and about ½—¼—3/8 in. in diameter. It had steel cable going into it with a steel ball embedded inside of a hemispherical radius. So, when you put it together, closed it up, you had a cable coming out, an attachment on the other end, and just nothing but a little tiny ball that could swivel. McDonnell—Mr. McDonnell turned to me and he said (I gave him one I had in my pocket)—he said, "Jack, do you suppose you could let me take that back to our plant? And," he said, "we'll see about solving this problem." So, there's a tiny, little insight into what happens when you think simply. You know, simplified design is what I'm driving at here. So, they took my—they redesigned the method of suspending the heatshields using that little ball swivel, which I made.

NEAL: Interesting that you went to Mr. Mac himself.

KINZLER: Well, I felt like I could! He was on the job and I never felt like any particular higher official was of unique experience in that you couldn't talk to him. And he was a down to earth man, by the way. I knew this previously from the way he worked. He'd walk in the shops and talk with the men and work the machines and so on. So, he was a guy's machinist-type buddy. You know, the kind you could talk to. But that's what I did.

NEAL: Wasn't that kind of true throughout the program—there were never any barriers. The top people used to pitch in.

KINZLER: Oh yes. Absolutely!

NEAL: I remember George [W.] Jeffs talking about how George Jeffs from North American [Aviation, Inc.] and Bob Gilruth put nuts and bolts together when the job needed doing. Gilruth came down from on high to tighten those nuts and bolts.

KINZLER: Yeah. Well, I can give you an exact example of that. We'll have to jump way forward, but we can come back. On the Skylab Project, which I'm sure you'll get to later, Max Faget was on the floor watching us do our early demonstrations of the parasol. And we had some telescoping tubes, which slid back and forth, but they didn't have any latching effect on them, so that they had to depend on just a friction, like a fishing rod. And he got down on the floor, and he worked one as I watched, and he said, "You know," he says, "I don't see why you can't put a little slit in this aluminum tube, bend it down (it kind of has a spring temper to it)." And he said, "Then put an offset in the next adjacent piece." He said, "Whenever you pull them out, one at a time, they'll jump and latch; and they won't be able to go back."

So, he did that. He designed something that—I was [the] designer primarily of this Skylab parasol. But a person like Max, who was a Director at the Center—a Division Director lay down on the floor and kind of looked at it! So, that's typical. And both Bob

Gilruth and George Low, those were all design engineer-type people. They had to learn how to become administrators and managers, but they were already highly skilled designers on their own.

NEAL: Well, they tell the story that on one occasion, using ingenuity again, you had a boilerplate that was somehow dished up on a mattress.

KINZLER: Oh, you know about that?

NEAL: Oh yeah.

KINZLER: You've been reading books.

NEAL: I've been reading about you. So, why don't you tell us that one, if you would. Okay?

KINZLER: All right. Well, that's a particularly interesting thing to me to talk about. We built the first boilerplate that—at Langley Research Center. And it was time to take it down to the Cape. And I had a—by that time, I had about 10 employees. And they were all shop guys—a machinist, a metalsmith, and so on. But they all knew how to drive a truck. We got a surplus flatbed truck at Langley from the GSA, an old clunker of a truck; we put our boilerplate on it vertically and tied it down; and we decided it might get jostled pretty badly if we didn't do something about it. So, I said, "Well, I know we—what we could do is: let's go buy a mattress and some plywood, and let's put a sheet of plywood on the truck bed. Let's lay the mattress on the plywood, and then put another sheet of plywood on top of the mattress and bore holes through it and tie it all together so it becomes a soft mounting." So, the fellows drove all the way down to the Cape with this spacecraft fastened this—in this manner, in this old used truck.

Now the story gets more interesting as—we go on. At the time, you know, we were at the Cape in Hangar S (it's called). And during that time, we were ready—almost ready to take our Mercury prototype out to the Atlas. So, adjacent to the hangar is a great, big, huge, about 150-ft long dolly that has a mattress laying on it in a horizontal position with very intricate weldments and, oh, just all kinds of beautiful stuff to make sure nothing would happen to this Atlas. So, they were ready to drive out and take the Atlas out to the launch pad; and it was our turn to—we had to follow them. So, we took our Mercury capsule—sitting on its rubber mattress—we followed this (probably a $2 million or $3 million) dolly that was carrying the Atlas. We followed it out, just slowly out the track. And we have some pictures of that, and it was really exciting. But anyway, they raised up the Atlas with the crane; and then they lowered the hook down, and we hitched it on our Mercury capsule. And they picked it up there and put it up on top.

Well, we as a crew then, we were non-skilled crew people for launch preparation. But my people got up there, and we checked everything out and made sure it was fastened properly. And so, we kind of got a little bit of teasing about that, you know, the kind of thing that we came in with. But we were naïve, I must say. We, as a group of people, when—we didn't worry about everything being just exactly according to Hoyle, you know. Just "improvise," is the word we used many, many times. Another time—do you want to hear about one other?

NEAL: Of course.

KINZLER: Okay. Their heatshield was made out in California in a plant—this—we're talking now about a solid heatshield, not an ablative-type heatshield—

NEAL: Not ablative but a solid. Okay.

KINZLER: —but made out of ablative material, and it was delivered with the spacecraft. And it got down to the—down to the pad—not to the pad. It got down to the hangar area, and so it was taken out for a trial fit. They raised it up and started to lower the spacecraft onto the mating junction, which is a cylinder which is of a given diameter (like 20-ft in diameter plus or minus 1/16-in., something like that). Well, they started to lower it down, and they said, "Oh boy, we've made a big mistake here!" They took it back and, instead of going all the way back to the factory to re-machine it, they called on me.

They brought it into the hangar, and I looked over it, and I went and made up a device that I could go out to the pad and measure the exact distance or the diameter of the aperture that we had to fit in. And I found out we had to cut a ¼ in., an 1/8 in. on the side (a ¼ in. diametrically) off of this heatshield in order for it to nicely nest in the mating part. So, I used simplicity once again. I—they set the heatshield up, upside down, on a stand. And I got some duct tape; and I duct taped the block of wood with a bored hole in it on the dead center of the heatshield, which was to become a pivot point. And once we got that duct tape in place, then I got some wood and made a freestanding—do you know the word trammel? (A trammel used—okay.)

I was making a big trammel—big by size wise, of course. So, then I had them get me some wood and we made a rather stiff, like a flat board with a vertical board join to it so it wouldn't sag and twist. And then we bored a hole in the board, and we had it fixed so that was on a pivot in this center piece that was taped down. I went and got a router, hooked up a regular, conventional router. Sent over to (oh gee, one of the hardware stores nearby)—

NEAL: In Cocoa Beach.

KINZLER: —Cocoa Beach [Florida], yeah. I sent into Cocoa Beach, "Buy a router, get it out here in a hurry. I need it." So, I mounted a router on this board and I walked around the perimeter of the heatshield, routing material with a hand router, using this wooden trim thing to act as a guide. And then I'd measure with the device I made up on the top of the stack, so whenever it was enough clearance I said, "You can take it back. They don't fit." So, I did that job all by myself. I personally did it! And came up with how to do it.

Now, you have to think about this a minute. If that heatshield had to ship back to its origin, you're talking about a month's time or a week's time at least in transit. And they have to go back through and do what we did in one day. One day! We brought it down and fixed it in one day, and set it back up. And it went right on and stayed.

NEAL: There are probably dozens of stories like that that you could tell.

KINZLER: Oh yeah, I could just go on.

NEAL: Yeah. But basically the big story there is that you simply applied what you knew to make something work.

KINZLER: Yeah. Yes.

NEAL: And—

KINZLER: And used sort of commonsense ideas as far as procedure, but not common—not anything that the average person would do, you know. I mean, I don't think there are many guys would do it, what I did, in this case.

NEAL: Well, you did it and it worked.

KINZLER: Yes.

NEAL: Of course. So, now finally after all the boilerplates, Mercury was ready to fly.

KINZLER: Right.

NEAL: Did they require any more model-making at that stage of the game—

KINZLER: Yes.

NEAL: —or—

KINZLER: And I've left out the function of the shops at Langley. They made a lot of precision models of the Mercury capsule for testing for the aerodynamic shapes and things of that kind. So, there was an active program of making models (metal models) that could be tested in wind tunnels as Mercury was developing. We didn't just skip by that. We built models. And in my shop, the machine shop at the Johnson Space Center, also made models in the early days. And then we made models later of the Apollo and the Skylab and, you know, everything that came out as a full-size object started in modeling throughout the entire program.

NEAL: Now they were flying Mercury while you were beginning to look at Gemini and other points and to the Moon, too.

KINZLER: That's right. Mars even.

NEAL: And you were—

KINZLER: All the way back, we had Mars models we built in 1962. Not many people know that. But we had a group of engineers who were thinking ahead about Mars in the early ’60s. Now we’re talking about we can do it in 17 days, and you know—but that’s a fact. Because we had the Mars mission models that we built. Now we didn’t go very far with that, of course. We just did some—built some replica conceptual models.

NEAL: Interesting at the time. But, too, you had the immediate job of, “Let’s get on with flying to the Moon” by that time.

KINZLER: Yes.

NEAL: Once Mercury got well involved, the President [John F. Kennedy] had declared and you had a goal. And I imagine this accelerated things in your life, didn’t it, Jack?

KINZLER: Well, yes it did. It brought on the fact we had to move from Langley. And in addition to that, we were charged with all sorts of responsibilities that I didn’t have before. I had to come on to Houston and design a layout for a shop that would support the research and development we did and—

NEAL: And it was named Technical Services wasn't it?

KINZLER: [Technical] Services Division. Yes.

NEAL: You finally had a title.

KINZLER: Yep.

NEAL: You were Director of Technical Services.

KINZLER: Yes. I left my title with Bob Gilruth as his Technical Assistant and became Technical Service Division Chief.

NEAL: And what did that really mean?

KINZLER: Well, it's a common name given to the Langley, Lewis [Research Center, Cleveland, Ohio, now known as John H. Glenn Research Center at Lewis Field], and Ames [Research Center, Moffett Field, California], all the old NACA labs that are now NASA labs, where they had a service department. You have to bear in mind: these service departments only work in research and development. They're not into manufacturing like the contractors do. So, they do prototype work. Original, first-time projects. Well, that term Technical Service Division was commonly used. It was called [that], the one at Langley. So, I named my Division Technical Service Division.

And that's how that name came about. But what it consists of is bringing together a large number of highly skilled craftsmen, machinists, sheet metal workers, aerospace technicians who can work on—well, we had parachute packing facilities that we worked with. You have a model shop, where you build your preliminary models. When we first came into Houston, we built a full-scale model of the lunar lander out of plywood. And the astronauts would come in our shop, climb upstairs into the model, and look out and say, "Boy, these windows aren't big enough for what we've got in mind. We've got to be able to look straight down." And so we would change the shape of the windows. We'd just talk. You know, "Can you add another 6 in. or take something off?" So, we would build prototypes with the astronauts in our midst, based on—they and the designers would work together. And so the Tech Service Division really had a lot to do with helping develop the prototypes of all kinds.

But let's see, did I leave everything—anything out there? Machine, sheet metal, welding, electronics, model shop, plastics department, electroplating facilities, and then I created a group of technicians called the Field Test Branch within my Division. Now these were technicians whose assignment was to go out on test projects and support the test engineers. And I kept—I had the whole complement of non-engineering people in my control when I first came here, and then I gradually transferred them off (as you can imagine) as the thing grew. But anyway, these technicians in Field Test Branch were quite helpful.

I mentioned us testing boilerplates down at Langley with them jostling and things, and then going out on drop tests. Well, these same people, when we got to Houston, continued doing that sort of thing. They'd go out to White Sand, New Mexico, and do drop tests or do Little—well, we had Little Joe and Big Joe, two different names, for capsules. And they would support the preparation as well as stand by and help with the launch activities. So, it was a real broad Division that I put together.

NEAL: Essentially you were in charge of making all the hardware that had to be used to test the hardware that would be used.

KINZLER: Yes. Right.

NEAL: You were really building up to that.

KINZLER: That's right.

NEAL: Did you actually involve yourselves at the time also with the working hardware that would fly with the astronauts?

KINZLER: We built flight hardware from day one. They call it "flight hardware" when it's going into flight. And I've been talking about boilerplates and models and capsules and such, but flight hardware was a common activity of our department—both in Langley, when we—well, they didn't bring—they built—they didn't build any flight hardware there. They just built the early prototype Mercury stuff. But once we got to Houston, we made things that were mostly the experiments that had to do with each flight. We would build the total experiment in house. And the experiment could be, you know, a lot of machine work and electronic wiring and hookups. And the development of exercise equipment for the astronauts. You know, the thing now that everybody uses to walk on in place? We built prototypes of those in our shops. And they actually flew those things!

NEAL: Let me get this straight, too, Jack. Because basically, you were getting the spacecraft from the contractor. Others were concerned with making that spacecraft flightworthy.

KINZLER: That's right.

NEAL: You were basically handling or developing flight articles to be developed and used.

KINZLER: Flight articles to be flown. That's right. Flight articles. But then there were times when the Apollo fire came and they had a bolted hatch together, and it was determined, "This is impossible. We shouldn't have anything like this. You can't get out quick enough." We built a alternate quick-opening hatch in our shops as a fix for the Apollo fire change design. We built it from their drawings, the actual full-size door that had hinges and it would open quickly; and you didn't have the complications of the other one. So, we had times when we built things that were actually put right onboard.

NEAL: And that was the design that was adopted then as the fix was made?

KINZLER: Yes. That's right.

NEAL: Redesigned the Apollo.

KINZLER: Redesigned the Apollo, where they decided the door hatch was a limiter and would be very apt to, you know, cause a future problems, if they had another fire or whatever. So, they quickly got together and came up with a completely modified design that opened in seconds.

NEAL: I remember, too, during that time you were doing a lot dealing with EVA [extravehicular activity]. Spacewalking. Propulsion systems. That sort of thing. Can you describe those for us?

KINZLER: Yes. When they were nearing the time to go into trying for spacewalks, we had an engineer who came into our shops and said, "I think I've got an idea. The Russians opened their hatch and they dangled their astronaut out," Yuri [A.] Gagarin, I think it was. I'm not sure.

NEAL: The first guy who did the walk—oh, the first one—the first one was [Alexei A.] Leonov, who did the first spacewalk.

KINZLER: Leonov, okay.

NEAL: Leonov.

KINZLER: Well, Leonov came out of his hatch and dangled on his umbilical cord. So, a fellow named Harold [I.] Johnson that worked—you might have heard his name. Harold Johnson thought, "Gosh, we can do better than that." And we were only weeks behind the—Leonov being the first EVA. So, within weeks, he came over. We quickly built a handheld maneuvering unit—totally built in our shop. It had nitrogen bottles with compressed air—compressed nitrogen in it in a tube. And then it had some little wings, tubular wings that would hinge out, and they had nozzles on their ends. And it had a hand control that moved—that moved up and down. And we fixed that up for Ed [Edward H.] White [II].

And Ed White got outside of his hatch. He went outside and opened up the wings on this maneuvering unit, and he motored around—forward, backward, up, down, and everything—and we were so proud that we Americans had done something meaningful! We gave an astronaut something that he could maneuver with rather than just dangle. So, that's that story. But that was done in Tech Services.

NEAL: The HHMU. Handheld maneuvering unit.

KINZLER: Yes.

NEAL: There must've been lots of others, dealing with EVAs, like, oh, handholds later on so the astronauts could figure out how to maintain a work status in space.

KINZLER: Yes. Yeah, there were. Even after I retired in '77, I had contact still with some of the contract engineers with Rockwell [International Corp.]. And they'd call me once in a while and ask—I had a machine shop in my—in my garage, a real minimum one but a shop! Once a machinist, always one. And I got a subcontract arrangement so that I could do work and be paid by the contractor on occasion. And one occasion was the—on the Shuttle.

They realized that the way the Shuttle was coupled together they had the doors, the hatches that opened, they were entirely latched together with one continuous group of rods, interconnecting, so that they would all do the same thing together. You know, the latches that lift them? Well, they got thinking about this. "What if those things hang up? What if they open the hatch and it won't close? That would be the end of the Shuttle right there." So, are we doing okay?

NEAL: Oh, I'm—don't you worry about the time. That's my job.

KINZLER: Okay.

NEAL: I'll worry about it. You worry about just telling me a story.

KINZLER: Ok. Well, we drifted about a bit. But this is a good—

NEAL: Yeah, it's a good one. A darn good one.

KINZLER: —I'm retired, and they come by and call and say, "Do you suppose you could think of some way we could change this, disconnect this continuous linkage in some fashion, so that it wouldn't be as likely to lock up the whole system? You know, we'd operate more freely. And then we need some tools in which to do that." So, I built a lot of tools that were—I designed the tools, actually, with a sketch from an engineer saying, "I need something that can reach around this far and get a hold of a linkage and be able to maneuver it, you know, by frictional grip." So, I actually designed (just paper design) some latching separating devices, which they took over to the Johnson Center and ran tests on them. And they adopted that scheme of things. So, then they wound up making all the hatch doors so that they could be safely operated without jamming, without the entire system jamming. So, that's a case where I wasn't even working at Johnson Center. I was retired!

NEAL: That was later on.

KINZLER: Yes.

NEAL: Well, during that time, though, I—you people did the plaque on the *Eagle*, didn't you?

KINZLER: Yes.

NEAL: You made—how did that happen?

KINZLER: Well, I'm very proud of that; I'm glad you brought that up. There was a symbolic meeting, a symbolic committee meeting at the Johnson Space Center with representatives from NASA Headquarters—high-level ones—Bob Gilruth, Neil [A.] Armstrong, and a couple of other Division people at the Center. And as that meeting was about to transpire, Bob Gilruth phoned me over at the Tech Service Division. He said, "Jack, we're getting ready to determine how we should best celebrate the Moon landing, the first landing. And I'd like you to come over with some suggestions of what we might do." Now this was [an] original phone call. So, I go back and I talk with my deputy. I had a real capable fellow that was with me all the time, David [L.] McCraw. Dave and I got to thinking, "Well, they need a plaque. Why don't we use some stainless steel? It'll be long living, long lived. And certainly it has to have a message on it; it has to have crew names on it; and it might have to have the landing site and that sort of thing."

So, I had some prototypes made up in the rough. And I carried that plaque concept from myself over to the meeting. I have to back up a little bit. The same time Bob Gilruth said—no, that was—that's right. I just took the plaque and showed the plaque idea. And sure enough, they were thrilled with that idea of having a plaque. We told them where it would fit. We would mount it on the ladder, center ladder, on the descent ladder. And so we took our prototype. We went out to a mockup. We fitted it on the ladder and double-checked that it would go. And we had that all ironed out, you know, total concept from scratch idea to, "Here it is!"

So, the first conceptual plaque metal that I took into the meeting had the American flag engraved in the middle, and it was painted with the red and blue—red, white, and blue paints that were baked into it, into the etched definition. And then it had a place for the message, and it had a place for the name of the landing spot, and then the crew signatures. So, Bob Gilruth, in looking at that metal plate—and I have to tell you why it had a flag on it. They had painted a flag on the lunar landers, on the base. When you look at old pictures, you'll see a American flag painted right onto the part that stays on the Moon, on the descent stage. So, I personally thought, "That's not a very effective way to celebrate an American flag." So, I thought of having a freestanding flag. So, and—we've slipped off the plaque here for just a moment—

NEAL: Yes.

KINZLER: —but I'll get it all together. So, I went over there and I brought up two points. I said, "What you need is a freestanding American flag, and we can design something that'll telescope and fit in a nice, simple package. And we can do that readily. And then," I said, "but in regard to the plaque." Bob Gilruth looks at the plaque and he says, "Well, there's a flag on the center of the plaque." He said, "Jack, what do you think about this idea?" He said, "Suppose we took the flag that's off your plaque and put two hemispheres on the top: one the eastern hemisphere and one the western hemisphere." He said, "If we do that, any creatures that come from outer space in future years and look at the lunar module that's setting there on the surface will recognize the source from where this device came." So, as soon as he mentioned that, I said, "Boy, that's a great idea!" And he said, "Okay." And we got a—the committee that was there in the room, they said, "Okay, we're going to buy the idea that we'll have the lunar plaque contain the hemispheres." And then they of course went with that.

Then I had roughed in—I had roughed in a message like, "Here men from Earth made a landing." But I had addressed it to NASA's credit. In other words—and was going to have it signed out by NASA, Johnson Space Center, USA. Or something. So, once the plaque concept was approved, now all it had on it was the two hemispheres, and then it had the crew signatures, and it had the name of the landing site, and the date. That's it. So, they—Washington Headquarters-types took it over and said, "We'd better go by the President and see if he approves this sort of thing." And they went over to see President [Richard M.] Nixon. He says, "I like the concept, but don't you think it ought to have the President's name on the bottom?"

Now the story goes a little further. So, obviously NASA called down to the space—to us and said, "You—we just have this picture you're going to use to create your final metal plaque. Can you add the President's signature to it easily?" And we said, "Yes, but we need a data fax copy—a faxed copy of his signature." So, they sent a copy of his signatures down to us. And this is where the story gets really unique. I have a secretary whose name is Germany—Mrs. Germany. And Mrs. Germany's mother-in-law received a letter because she had become 100 years old, and the letter was signed by Richard Nixon.

Mrs. Germany, my secretary, saw the data fax signature that was sent to our office and she got to thinking, "That doesn't look like the signature that we're supposed to use for President Nixon." So, she—I said, "Would you mind going home and getting that letter your mother received and then I'll take it from there." So, she took off work and went back home, got her mother-in-law's letter, brought it in, and I had to call up NASA Headquarters and say, "Folks, we've got two different style signatures here. Which one are we supposed to use?" The one was brand-new from a letter received a few days ago. The other was probably out of the file. And anyway, it had—I think it had "Richard N. Nixon" or "Richard Nixon" without the N. It was one way or the other. But that little aside there, we almost put the wrong signature on the plaque! But—

NEAL: Which signature was the one?

KINZLER: Richard—N—M—

NEAL: M. Milhouse.

KINZLER: —Richard Milhouse—Richard M. Nixon. But the first time he had it just "Richard Nixon."

NEAL: What was your—in this case the mother's signature correct—the correct one?

KINZLER: Oh, yes! That was—the one the mother—

NEAL: The one they sent you was the wrong one.

KINZLER: They sent me the wrong signature. Yeah, I didn't make that too clear. It was "Richard M. Nixon." Okay, and so we talked about that but we didn't finish with the flag.

NEAL: That's right.

KINZLER: In regard to the flag, I stood there in that—sat there in that meeting and suggested that, "You know, if we had a freestanding flag, it'd be much more appropriate than just depending on the Moon flag painted—I mean, the American flag painted on the lunar lander." So, I got an action item to go and come back with a projection, you know, a scheme. So, I went back to the office and I remembered how nicely telescoping tubes work and so on. So, I got some telescoping tubes out of the shops and we made up a prototype, and then I got a directive to show it to Neil Armstrong and see if he would approve of what we had. So, he came over to the Tech Service Division. We put our flag together in—on its little prototype. And he said, "That's perfect. Let's go with that."

So, then the details came out. We had to be able to have somewhere to put it that would be easy to have access to. So, we went out to—once again to this mockup that we had there and Dave and I looked it over, and we thought, "Well, if they come down the descent ladder and walk around about three steps to the side, if we hang it underneath this—the arm—the armrest of the ladder, that'd be a nice, handy place." So, we did. We designed a way to fasten it on the underside of the descent ladder armrest, and we added things called "pip pins." They're real quick releasing. You just squeeze them, and when you pull them out, a ball intercept releases itself and then you can just take the thing right off. So, then I had the design. We had to put a hinge in the top of it and tubing. Got to thinking about, "It's going to just hang limply, and it's got to fit in a 3-ft long package. We can't have a 10-ft pole sticking out there." So, we made a telescoping piece for it. And this is where the story gets even funnier (or more interesting).

We put linkages—we used the concept of a telescoping tube that's inside of a drape in a window, you know; just a sliding effect. Then we added these tubes of a length that would fit in a maximum 3-ft limb, so that that was okay. And the idea was to hinge it up on a 90-deg hinge and have a stop, so it would catch and would just stand horizontal, the one tubular limb. But in the meantime, since we had to hold it, we sewed a hem—a seam—a hem in the top of the flag. And by the way, this was a GSA [General Services Administration] warehouse-issued flag that cost about $5 as I recall. They're nylon and I got to thinking that nylon would stand 200°[F] plus or minus. And they ran tests to prove it did. So, with that in mind, we were able to slide the tubular piece hidden within the flag and stretch it out.

And if you pulled it all the way out, you'll see in—if you look at the 11 and then 13, 14, 15, 16, 17, different Moon landing pictures, they all have flags out. They moved them in different ways, you know, different amounts. But we fit the vertical pole. It had to be a 10-ft tall pole to do its job. So, it had sections that fit inside of one another. And the lowest section had to be something one could drive into the soil without damaging the joint you're hammering on. So, we put a hardened insert out of a hardened steel—it's this tubular aluminum. Very thin, lightweight aluminum. So, we built it with a hardened piece for hammering. Then we told the astronauts, "You take the hammer out of your geological tool kit and pound this thing down." And we put two different red lines on it: one at (I think) 12 in. and one at 18 [in.] as I recall, that were to tell them, "If you hit it this far, it'll be okay. But don't exceed this distance, because it'll be sitting too low."

So, sure enough, we had determined how hard to drive it into the Moon soil and all that. And (let's see, where else would I go with that?). That was quite a particular event. I'm so proud of that, because that flag is on each of the six Moon landing sites; and there's only one (Apollo 12, the second flight, when [Charles C.] Pete Conrad [Jr.] made his flight) for some reason—after they got back, I heard this—he said that when they raised it up, the latch didn't catch. So, you'll see him standing there, holding a sagging flag in his picture. And I kid [him] a little about it: He was too short to reach high enough to pull it. But that's just an—that's an aside. (Don't publish that!) But that was quite a thing, to come out with. I gave two suggestions, and that was the only two that were taken. You know: the flag and the plaque.

NEAL: Those vivid mementos that people carry to this day of Neil Armstrong saluting the flag.

KINZLER: Yes. Right.

NEAL: Which he did.

KINZLER: Right.

NEAL: I think he carried it through to the logical conclusion, don't you?

KINZLER: He did. Yeah.

NEAL: Those were incredible times. Now once they had made the lunar landing (let me see where we are for time; yeah, we're getting pretty close to a reload time here, but we still have a little left on this tape I believe).

KINZLER: Okay.

NEAL: Once they had made the lunar landing, there were more things that were needed for the Apollo Program.

KINZLER: Yes.

NEAL: Were you involved with those?

KINZLER: Yes, we had occasion, in house, to build all the geological tools. Everything that was used to—including the shovels, the hammers, the devices that all went together to become a lunar tool kit. And initially, they hand-carried it as they went along on Apollo 11. But eventually—and another thing happened. The rover was so late in development, it was not going to be available for two or three Moon landings. So, they had to get something to use to do their tour, you know; to go about and gather rocks. So, we built every one of the lunar tool carrier objects in our shops at JSC. And then a little later on, we made up a hand-wheeled dolly that Al [Alan B.] Shepard [Jr.] thought he'd like to have; and that was something he could put the hand-carry dolly on in a converted way and walk along like you do [with] a golf cart tote. And we made that.

NEAL: Did you help him make his golf club out of existing hardware?

KINZLER: Yes. I have to explain that, too.

NEAL: I think so.

KINZLER: Always using simple ideas, he came in one day and he approached us about making a—not the whole club but just the club head for something he could use. And he said, "You know, you have—we have all these handles that have shovels on the ends and they have quick disconnects on them and so on. Suppose you could make a club head that would snap right on the same fitting that is the end of one of the shovel handle things," which made him a complete golf club. So, we built that little device for him, and he took it in his PPK kit (which is pilot's preference kit; they're allowed to have so many pounds of their own things). And I don't know whether he told management about it or not. I never did hear whether he did.

NEAL: He told me, very specifically, that he had a special arrangement with Jim [NASA Administrator James E.] Webb.

KINZLER: Oh, okay.

NEAL: And the arrangement was very simple: If the flight was going well and there were no problems, he was able to make the golf club use.

KINZLER: Okay.

NEAL: Otherwise, no.

KINZLER: Don't do it.

NEAL: That's right. And so obviously the flight went very well and he was able to use it.

KINZLER: It went well. He did it.

NEAL: He did have management permission.

KINZLER: Yeah, but that's how we pulled it off. In other words, he didn't have to have anything except that little club headpiece, you know. And it was made to a perfect fit, so it was like a set of snap-on tools that have ratchets and you can plug them in, you know. It was very simple. But that did happen. We built that.

NEAL: How about the lunar rover? Did you have anything to do with that?

KINZLER: Not the rover, except we built models of the rover for (I guess) demonstration and determination of design and that sort of thing. But it came in pretty much as an outside developed device as far as I know. But we did not do too much with the rover.

NEAL: You know, we've talked pretty much about a lot of the things that you came up with that I've generated for you. Is there something in particular with that Apollo series of ingenuity-made devices of which you're particularly proud?

KINZLER: Yeah.

NEAL: Go ahead. Tell me about it.

KINZLER: Well, one is (I don't know which one's the best; there's two)—

NEAL: Well, we've got time here. Tell us about both of them.

KINZLER: Do we have time for both of them?

NEAL: We'll make time.

KINZLER: Oh okay. We'll start with the first one. Another thing happened when the Apollo fire occurred down at the Cape. There was a "Stop and let's get a—let's look around and see what we've got here that is an unsafe working condition wherever," you know. And the first thing they realized was that the Saturn-LM adapter, which is a big cone about three stories tall, it's big enough to encompass the whole lunar module, which is inside of it (you know, it's closed up inside of it). It had three different levels of catwalks around it, and it had a door at the entry to the bottom one, and I think a door at the top (if I'm not mistaken) for a crew to go inside and work. You have to bear in mind, they could spill anything. They could have acid. They could have a fire. They could have all kind—because the place—they have to be in there, even when they're loaded, ready to—prior to launch. Just one of the last things they do is get out and close those hatches. Well, they had these minimal hatches that one could get out of.

So, Gilruth (I think) approached me on that one. He said, "We need to think about a more safe way of rescuing people from inside the cylinder," which is the lunar—the SLA (Saturn LM adapter) (I cross my words up once in a while), "the Saturn LM adapter. And can you come up with any ideas?" And he—I think he said to me, "One of the simplest ideas that might occur"—Oh, the structure that we'd have to get through is honeycomb aluminum. It's an—it's about 2-in. thick, but it's very thin, like egg crate material. It has a skin of aluminum about 1/16-in. thick (even less than that)—1/32-in. thick, aluminum skin outside and aluminum skin inside. But between those two is a sandwich of honeycomb, very lightweight. And to get through that, you know, you'd have to cut with some fashion—in some fashion.

So, the first thing they do is: they got a—one of these bush bolos that they—you take a hammer and you can take a bolo and put it up against the structure and hit it (this is crude now)—you can chop your way in. This is an emergency; assuming there's a fire in there, and they've got to get in. Or there's something. So, they first made up something where you could take a hand hammer and chop an opening into the structure. Well, that didn't go very far. But that's the one that was in existence when I came along. And I got—

And then Gilruth said, "Well, if you make anything that does powered cutting," he says, "it can't make any sparks, because there might be a fire based on sparks." So, I finally thought about, "Well, why don't we use some air motors that are air-driven (there are such things; there're motors that drive by air), and why don't we take a real slow-rotating cutter made out of Tungsten carbide, like a cutting tool; and if we mounted a air motor on a top horizontal run, it would be getting pointed where it could motor across while driven, you know. It could cut a slot. If we had one that would go down, it would cut a slot. If we had one that went across, it would cut a slot. With four air motor-driven components mounted on a device, we could turn on a switch and let all the motors start running, and they would walk through and they would cut these four openings simultaneously. And you could push out a nice panel big enough for a person to escape out of."

So, we built that prototype in—we designed that and built it in our shop. That wasn't an engineer design; that was designed by the shop. And it worked beautifully! George Low was there and others, and they said, "Boy, that's—" Oh, timewise, I think it took 30 seconds to completely cut and come out. We hung it on a gantry, which is a pivot like you use for a boat or something. We had it designed so once it cut lose, you'd just give it a push and the gantry swung out of the way, and the astronaut could dive out (not an astronaut) but a technician. So, that ought to have been good enough. But then I got thinking, "Why don't we get something that really works really quick. Not 30 seconds, but how about 1/1000 of a second?" So that was a kind of a change when I went to that. We came up with a SLA cutter (SLA, Saturn LM adapter cutter); we called it the "SLA cutter," which sounds like coleslaw. And that device was miraculous. (I have a patent on it by the way.)

It consists of a cylinder that can be activated with 2,000 psi air pressure. It has a male cutter on the outside of the capsule. It has a receiving, matching (you know how cookie cutters work, one cuts within the other?) (I have to use my fingers for this). It has a female-shaped receiving piece. And you have to imagine (right in here) is the structural material. So, you bore a hole—you bore a ¾-in. hole through the structure and you put a shaft in that hole that has a piston on the end of it, and it's in a cylinder. So, like a 1-stroke cylinder. You mount the receiving piece on the inside and the other energizing piece on the outside, and tighten up one nut—you just tighten up the nut with a wrench—and you've got a standing, waiting emergency exit device. We built nine of them, so we'd have one, two, three on 120 degrees apart. All three floor levels. No matter where the guy was when the fire starts, he could get out of one in seconds.

So, then we wanted to power that thing. And I first thought about using pyrotechnics, so that an explosion to fire a single stroke of a piston in a cylinder. Because all you had to have was an energy force to move one time and push the thing, and it would cut. But I consulted with [Joseph G.] Guy Thibodaux, who you'll probably do something with eventually. He was a pyrotechnics fellow. And he said, "Jack, if you go down to the Cape with your device with pyrotechnics involved," he said, "you'll never get through the review board for the next 3 months!" I said, "Well then, how about compressed gas?" He said, "Go that way."

So, we went out and we bought these scuba bottles, 2,000 psi. We hooked them up with a quick-acting valves. When you send an electric circuit, you know, a pulse of electricity, the valves open, the scuba bottle valves open all at the same time, and they go all at once or individually, selectively. So, they fire in 1/1000th of a second! You're looking at a non-, you know—a non-active thing, a—1/1000th of a second later, you've got an opening and it's swung out of the way from its initial cutting force. And so that's the SLA cutter. That's all mine. That was my concept. And those were used through all the launches as a safety device. Never had to fire it in to save anybody, but they saved taking those Saturn LM adapters back to the factory and building 9—8 new—no, 3 from 9—6—they'd have had to make 6 new special act that way. Also, we even came up with a patch device so if they accidentally fired it all they had to do was set the blank back in. Because it cut it so cleanly, you could set it back in place and epoxy it in, and glue it in with a—with an adhesive. Well, that's the one story I wanted to tell you. (Now let's see, what was the other?)

NEAL: You had one other that you were particularly proud of.

KINZLER: Yeah. Now I'm going to draw a blank. Surely not? SLA cutter. What was the other?

NEAL: We can come back.

KINZLER: Okay.

NEAL: Because I—you know, right now, I'm just thinking that after the Apollo fire, they called on you to clean up the program, didn't they?

KINZLER: Yes. After the fire, Gilruth sent me out to the contractor's plant and asked me to look through the—their whole operation out there, and write a report that of what you see as far as malpractice work. You know, doing things—

NEAL: Yeah.

KINZLER: —improperly. So, I flew out to the contractor's plant, met the night shift representative of NASA, who showed me around. And I thought, "If I go in at night shift, it would be quiet and I'll have a good opportunity to really see what's going on." So, I walked that thing through, and I wrote up about 25 or 30 observations. To give you just a few samples: They have heat-treating ovens that they have timers on that will run for a certain amount of time to cure a plastic part. Well, when the oven got overheated, they opened the door and let it bleed off. And I walk in and here's a—it's supposed to be a precisely controlled thing. Because they had overheated the oven, some guy goes and opens the door and lets it sit open for a while. And that's against total procedure. You don't do things like that!

Then I looked at some of the machine tools, and I found that some of them were improperly using them. They—there's a tracing head that follows a template on a lathe. And if you hook it up properly, you can run along and the template will guide your tool; and you can cut just what you're supposed to get. You know, the shape of the template's supposed to generate the shape. Well, I found that that was not hooked up properly. I wrote about that.

But then the cleanliness. I went and I noticed they had painted lines throughout the shops, trying to control the walkways. But there was stuff sitting over the lines everywhere, you know, the roll-around dollies. If there'd been a fire, somebody would fall on over them trying to get out of that place! So, I critiqued the visible plant in many different ways. I had—came up with, like, 25 or 30 points. And Bob Gilruth was so pleased with it he called up the president (I think it was Rocketdyne [Division of North American Aviation Corp.]—or no.) Who—?

NEAL: Rocketdyne made the engines. I think you're talking [North American Space Division head] Harrison [A.] Storm[s, Jr.]—he was out of North American. North American Aerospace Division.

KINZLER: Yeah. It was North American. He called Harrison Storms and said, "I've had Mr. Kinzler out here looking around your plant. And he's written up a rather lengthy report. I'd like to send it to you and see if you'll agree that maybe some action is needed." So, he sent the whole thing out! I got the word back that Harrison Storm called all his shops people in—he had everybody involved—and he laid down the law and said, "I want every one of these points straightened out," you know, "in nothing flat." So, that did happen. How'd you hear about that?

NEAL: Oh, [North American President J.] Lee [Leland] Atwood was a very good friend of mine.

KINZLER: Oh.

NEAL: And this—the story of Harrison Storms, incidentally—

KINZLER: I'm glad you brought it up because—

NEAL: —who lost his job in the process, as you know, a little later.

KINZLER: Yeah, yes, I do.

NEAL: But, no. That was—what you did, of course, was very popular with NASA.

KINZLER: Yes.

NEAL: Very unpopular with North American.

KINZLER: North American!

NEAL: But it was something that had to be, wasn't it?

KINZLER: Yes.

NEAL: You really—somebody had to go out there and say, "Hey, you're not doing this right."

KINZLER: Yeah.

NEAL: But was that really what caused the fire, do you think? Because they weren't doing things right? Or was it just one thing led to another, and—

KINZLER: Well, as you recall, I went out also and I climbed up in their capsule they were—the next one they were building. In that one, you could see wiring laying on the floor right where you'd walk and stumble over it. You know, basic, finished wiring. And our shops at their—somebody else's direction (there was a project engineer into this), but we made all sorts of sheet metal covers that could be put over clusters of wiring. And the outcome of that was a design change on how wiring would be carried—conducted through the spacecraft. So, we had something to do with that. The Tech Service Division made prototype boxes [of] different sizes and zip lids on them and everything else. They had fun doing that! I'd carry all these boxes out and say, "This is what you guys need here." You know. In other words, we put it to them in that case. And they did. They changed the—they made covers for everything.

NEAL: And the facts of life are such that following the Apollo 1 fire, there were no more breakdowns of that kind, even though there was Apollo 13.

KINZLER: That's right.

NEAL: You and your gang must've had a fantastic time with Apollo 13, or did you?

KINZLER: No. It was kind of quiet for us. It—the crew themselves, you know, did a lot to figure out what they had to do to save themselves. The flight crew. Now the support people on—in the JSC mostly were out of the flight operations end of it, where they have procedures to write and all that. And it turned out that we didn't have much to do with Apollo 13 fixes. They pulled up some cardboard boxes, you know, to make simulated adapters for transferring oxygen from the lunar module over to the command module. All those innovations happened outside of the purview of our Division. It just happened that they were able to do it without us. They didn't need too much made for the fix for Apollo 13. Just—

NEAL: Through the latter end of Apollo—the Apollo Program, then, had you done your job well enough that you could start to look to future things like Skylab or Apollo-Soyuz? Was it the time for that?

KINZLER: Yes, it was. It was time for Skylab and the most exciting time of my life, really.

NEAL: Well, around NASA they call you "the man who saved Skylab," and it's [i.e., Skylab's] right over your shoulder right now in its fixed configuration.

KINZLER: Oh, for goodness sakes.

NEAL: So, let's talk Skylab.

KINZLER: All right.

NEAL: Let's move into that arena.

KINZLER: Okay. Skylab, we called it "The Parasol." That was our favorite nickname for it. It had its origin when they launched the section of the Skylab unmanned and they lost some of the thermal covering on the outside of the spacecraft, which everybody knows that. But because of that, there was quite a bit of scurrying to determine, "What can we do to keep the Skylab unmanned capsule—spacecraft from burning up and being un-useful?" You know, unusable.

So, quite a few people at the Johnson Space Center got to thinking about the use of masts and booms, and like you do to rig sails on a sailing craft. Different ones of the fellows, I think, were interested in sailing, for example. So, I saw and heard the early activity around the Johnson Center about doing EVA and going out and rigging various covers by means of a rigging mast, booms, and then pulling fabric out and deploying it. And when I realized that nobody thought about going inside and doing it in the simple way, I thought, "Well, I'm going to look around some." So, I went over to the trainer over in building 8; and I found there was a sally port; that's a camera port, 8-in. square, right on the side of the spacecraft, where the heatshield had ripped off. And one thing leading to two, you know, "Why don't we use this sally port opening to deploy something from the inside?"

So, then I went back and I thought, "Well, I've got to have some way to demonstrate my concept in order to have it take precedence over these EVA-erected things." So, I had one of my technicians (actually a fellow that worked in my planning office) go down to

Houston and buy four fishing poles that are fiberglass extendible fishing poles, "Run down and buy those poles, and I'll get a purchase order for them, and bring them back to me." And then I drew up a hub with springs attached to the bottom of each of the four fishing poles, and then I had the shop—sheet metal shop roll up a sheet metal tube about 8-in. in diameter, maybe a—2-ft long. Then I called up to my parachute shop and said, "Get me a 24-ft square of parachute silk." (This is how we operated! "Bring me some parachute silk.") And they came down.

One of the technicians worked with me; and the machine shop fastened the four telescoping tubes of the fishing rods to the base of this—hub base; and I fastened that hub base to the floor of the big hangar, where we had a big—a shop area (a high bay, we call it). And I tied thread on the ends of each of the four tips of the four extendible fiberglass fishing rods. I lowered the big crane down from overhead to the floor level and strung my four lines over the crane hook. Then I got a group together. I called (I think) Gilruth, everybody came over for that thing to see a demonstration. I said, "I think I've got something you'll like."

So, they were standing around, just wondering "What's Kinzler up to now?" So, they took that—I had them—I raised the crane hook up as I was letting some of the excess cord go with it. And once I had the hook up high enough (say, 30-ft high), I knew I had clearance below the hook to do my deployment demonstration. So, I start pulling—they have a—they made a movie of this to document [it]. I started pulling all four of the cords simultaneously and—here's this canister setting on the floor. It looked like a magician's act because out comes fishing rods, moving out, getting longer and longer. They're dragging with them fabric because the fabric was fastened on the corners to the four rods. They drag out. They get all the way out to where they're fully out, and all I did was let go; and it went "sshumm." So, the springs were on each corner. So, they came down to the floor and they laid it out right on the floor, just perfectly. And everybody was impressed, I'll tell you. They were impressed! So, that concept—my concept—was the one chosen for the real thing.

And from that time on, we were—we stayed awake and worked for 6 solid days, around-the-clock. I had about 100 employees involved at that time in the shops. We built all the tubing devices out of aluminum. We machined up a new, fancy hub that was more efficient than the one I had first drawn. And we welded up an aluminum box. Oh, I left something out. The camera port was designed to receive an 8-in. square, lengthy box for the camera. So, we used the identical dimensions of the box and figured, "We've got to fit everything into this, because that's all the space we've got! We've got to get out of that 8-in. hole." So, we designed the parasail assembly to fit in an 8-in. square by 3-ft long box. And we went ahead, built the metal box; and at this time there were so many people involved and it was so urgent that we wanted to make sure that we could go as fast as possible.

So, we subbed out some of the things to aerospace contractors to make up in parallel to what we were doing. They made some boxes that were backups in case we ruined a box; and then there were metal tubes, tubular threaded pieces, that were each 3-ft long. And those were hand—they were contained in a bag—a fabric bag, a separate bag. And those were designed so you could screw one rod, 3-ft long, on the back end of this box. You could push it forward 3 ft; then you'd screw another 3 ft on, push it out 6 ft; put one on, 9 ft. And you can get all the way out to the 28 ft if you have enough pieces!

So, they made up these lightweight, short, threaded, tubular pieces, and put them in a nice, neat bag. And then the rest of everything else had to be compressed into the box. And the next thing had to happen was you have to demonstrate that your flight-type parasol will work. So, we built the flight models; we went over to the large space chamber that's at the [Johnson] Space Center; and we raised the unit up on a—and once again, we had the box mounted up 20 ft or so in the air. One of the astronauts that was monitoring the program with us climbed aboard, and one of my technicians went up; and they took these same tubes, and they started pushing and deploying the parasol out of its canister, downward.

Now we have to work with the help of gravity, not have gravity disrupt everything. You couldn't work horizontally or everything would fall over in an awkward way. So, if you go vertical and let things out, you know, they'll tend to fall in a natural way. So, that was the nearest simulation we could get to a vacuum space-type deployment. So, they deployed the parasol, and it came out nicely, laid out on a—they had a grappling net there to keep it from getting damaged. And we thought, "We're home free. We've got this thing all working, and all we'll do is pack it up and take it to the Cape." Well, that wasn't the case.

We had a thin Mylar, aluminized sheet of material forming the parasol fabric (about 2/1000 or 3/1000 of an in. thick; the thickness of a piece of newspaper, is what it was). And they decided they'd like to have even more thermal protection on the parasol than that would offer. So, I said, "You think you can repack with another layer of material and still get it into the same small box?" Well, we did by forcing and squeezing and going far out of norm, we actually forced an increased one, and decided that wasn't the thing to do. So, after we forcefully got it out, they backed off. They said, "You know, we don't really need that second layer of Mylar on top of what you've got."

So, we had—then we had to go pack it again for flight. And we got it ready to go to the Cape, and within the hours before heading for the Cape, once again (I think it was Max Faget watching what we were doing); and he said, "You know, if you had a short extension about 3-in. long, it—that will first screw on the box, it would help the astronaut in continuing to deploy all the tubes." So, we designed a quick piece of stuff in the machine shop; and it had to be oriented. It had to be indexed, we called it. It had to screw up and stop where the threads that were on the previous piece had the same stopping point. That's what we call indexing.

VOICE OFF CAMERA: We're going to stop.

NEAL: We're going to change led to another, and—

KINZLER: Okay.

NEAL: —tapes. That gives you a nice chance for a short break.

KINZLER: Yeah. And I'll think of that other thing I want to talk about.

NEAL: Yeah. Let's—

NEAL: As we left—as we turned off a few moments ago to reload, Jack, you were about to tell us about this special device that was used, or that would be used, to deploy the parasol on Skylab.

KINZLER: Right. It consisted of agroup of threaded, extended pieces of metal tubing that could cause the package to move outward, somewhat like an umbrella when you deploy it. And it went in its own package. It wasn't part of the box that we talked about. But the rest of it was designed in such a fashion that it had to accommodate another part of the problem. The damage on the spacecraft was not concentric with the opening in the port box—the 8-in. porthole.

So, we had to think about that a little bit, and say, "How do we deploy something out of the porthole, like an umbrella device, and have it deploy so that it's over here rather than over here?" In other words, not centered. And we didn't dwell with that too long. We said, "I know what to do. Let's add another 6 or 8-ft of cord to the end of the two poles that we wanted to move away from. If we deploy it out with these strings—cords attached first and then the tip of the fabric corner would be attached to the 8-ft length of cord. If you do that and you push it all the way out, when you get it fully extended and you release it to spring out, it will spring out and it will actually kick itself over to the exact spot where you need it." So, we added cords on the ends, which made an offset, which pulled the piece of fabric over right where it belonged.

And then the good news is: The cabin was 120°F at the time, sending signals back to Earth. And they had all kinds of foodstuffs and camera, film, medicines; they had things that would be destroyed in a very short time with that high temperature. So, once we deployed the Skylab parasol, the temperature went down within a few hours to 70°F. And we had fixed the Skylab. We had saved it.

And as an aside: After that, it hit worldwide news. And I started receiving letters for the next year, asking for autographs and, "Would you please sign these? Because you're the guy that did this, you know, momentous thing of saving Skylab." And, of course, the best part of it is: I got this—the Distinguished Service Medal from NASA for doing the Skylab design. And that's the highest medal award they have in NASA, Distinguished Service Medal. So, I'm very proud of that.

NEAL: When Pete Conrad went up there with that device, you were able to watch a lot of that from television.

KINZLER: Yeah.

NEAL: Where were you when he actually made the deployment?

KINZLER: I was in—

NEAL: What were your emotions?

KINZLER: —okay. A very good question. And I'll leave these out until you've asked them. I was asked to go over and stand by at Mission Control during the deployment phase. And sure enough, I was there; and they started the deployment in daylight, and as the spacecraft was moving towards darkness they had not completed the deployment. So, the question came up, "What will happen to your fabric if it's in the night phase and it gets stiff and cold?" You know, there's –200°F versus +200°F in a day and night cycle. So, they asked my opinion and I said, "Why don't we stop right where we are?" They had it partway out. And they'd just stop and wait.

So, sure enough, they waited until they moved around to the daylight cycle (I think it was about another half-hour or so, as I recall), and they continued deployment. And when they did deploy, it came out very nicely with one exception: it had a little kind of a twist—a little kink in one corner that didn't affect the coverage. It was big enough to cover. But I was there, in the Mission Control, at the deployment phase, with Pete up there busily doing it.

NEAL: You were there perspiring freely, I would imagine.

KINZLER: Yes! Yes.

NEAL: Well, you know, that was one of the real highlights of your career.

KINZLER: Yes, it was.

NEAL: What happened after that?

KINZLER: Oh, I remember finishing Skylab. I didn't get involved with the Shuttle to any extent because I was near retirement in '77 and Shuttle was just in its infancy. And we had—we were building models and demonstration wind tunnel things and so on. But we didn't have too much to do with the Shuttle. But we had the Apollo-Soyuz followed the Skylab, and that was an interesting project.

We—the Russians and the Americans decided they could do a docking maneuver, where they could join together. And during that time, the Americans went over to Russia and examined the docking mechanism that the Russians had been using for some time; and they didn't like the reliability appearance of it, and they were a little bit skeptical about whether it would be satisfactory to use it in our version. So, we finally discussed that back and forth (I think) with them and the edict was put down that, "You can use your docking mechanism on your end, but we're going to design our own American docking mechanism for our side." We're talking now about a structure, a little chamber with two different docking mechanisms on it. And we made our American one up and it was proved out. It used all real accurate mechanical functions, and it was certainly preferable to the one that the Russians had. And then another thing happened in regard to that. When they finally did go with that mission, the first thing that happens (this is an international affair we're coming up with here), so back to me again. Calls from the office saying, "We need a plaque that can be shared between the U.S. and the Russians." And, "Can you guys come up with something like that?" So, we had some help from the graphics department in this particular instant. But we made the neatest combination plaque.

It fit together in two parts. And when it was together, it was a complete plaque, but as you took it apart each—each organization could keep half of it. We made up those in the shops; and whenever Deke [Donald K.] Slayton flew over there and joined up with them in—in this docking module they had, he and the crew exchanged greetings with each other and then Deke handed them this special half of a plaque that we had built in our Tech Service shop. So, we're always into everything whenever you look around. That—that's something that happened that maybe everybody doesn't know. But that was a nice—we were thrilled about that cooperation with our Russian counterparts. I never did feel badly about, you know, the fact that we've dealt—signed up with the Russians to work with us in space. And they're certainly doing well now with *Mir* helping us to—somewhere to park our vehicles that we build and that sort of thing.

NEAL: You're still following the program, I take it?

KINZLER: Yeah. Still am.

NEAL: Retired but following a path.

KINZLER: Oh, yes.

NEAL: As are all of us I think.

KINZLER: Oh,yes!

NEAL: Well, you know, in checking out your bio I found a lot of references to your work in finding and training people to go to work in the space program. Can you tell us about the recruiting and the training phases in your career?

KINZLER: Yes, I can. First off, I became a product of the Langley Research Center's training program that brought in technicians, like myself, interested in aerospace kind of people. And they enrolled us in a 4 or 5 year long class in which we learned all the different things you should learn in a given craft, like in the machine business or the sheet metal fabrication or aircraft sheet metal workers, and so on. So, I came through that program myself on a 5-year level and during that time or shortly after, when I graduated and received my ring—which—this one; this is the ring, I still carry it—we—I was asked to be a teacher in the Apprentice School at Langley, so I volunteered for that. And I taught blueprint reading and strength of materials and a variety of subjects. But having that kind of a background behind me, when I joined with Bob Gilruth I was determined to start an educating—educational group here at wherever we settled our Center.

So, I got with the personnel department; and, having enough experience with the existing Langley Research Program for Technicians, I put together a very similar program and then saw to it that I had to do recruiting of course. And we went to various high schools and—both Dave McCraw, who I've mentioned once or twice (my deputy), and I were very knowledgeable about how to choose a young person who has the natural attributes to be a technical person; technician. And, what do you suppose we used for criteria? Remember I mentioned we built models? Well, one criteria was: "Have you ever built model planes?" You know, "Do you have any interest in aviation? Have you built models?" The other was, "Have you ever tinkered with automobiles? Do you ever have any junk cars that you learned how to put together?" and so on.

So, Dave and I did all the recruiting for the initial classes. And we would bring in these young kids; and the first thing we'd get into, "Well, tell us about what you're doing nowadays." You know, "Do you have any hobbies?" (Looking for hobbies.) Well, some of them did; some didn't. But pretty soon, we found there were people who liked to build models. We found people that were real good at restoring cars and that sort of thing. They had mechanical aptitude, and they had interest. The key thing is: you've got to have some aptitude, or otherwise you're a dud, but you also have to be interested in becoming something in the way of a technician. So, that's pretty much the story about the training, where I went around and recruited.

One time we even had a series, later after the basic apprentice school was running, we were approached by a Black school out here in Houston that—a community college. And they approached the Chief of Personnel at NASA and they said, "Do you suppose there could be any place you might find to put some of these students of, you know, low expertise but still have potential?" "Well," we said, "we'll try. So, send some of them out." And they arranged to bus them out to our place, and we placed some in the electronics department and some in the welding shop and so on. And out of about a dozen, three or four actually had what it takes. The rest were absolute duds! They couldn't do anything. They'd sit around and sleep and miss the bus! They wouldn't even come regularly. But we wound up teaching a boy to become a welder; and we had another woman, who's still out here, who went through the electronics department. (And she is a very, very effective person; and she got in later on into another department. In other words, she's—we built her career for her.) So, we reached out to people with, you know, the idea that we are products of the high school-level folks. Caldwell's [Johnson] the same way. I refer to him but, he and I both, we owe a lot to the fact that we had enough drive to get ourselves into the space program.

NEAL: What advice would you give to anyone who might want to take part in NASA?

KINZLER: I would say: First, read as much as you can about what NASA is and what they do. The libraries have endless information. NASA has lots of free information. I know the teachers take NASA information home to their classes. So, the first thing would be to become informed in what NASA's done or [is] doing presently. Then the other thing is to consider going to night school, if you're already working somewhere at a grocery or something. Go to night school on your own, and a junior college is very helpful. They have courses where you can learn. The target should be to become a qualified technician. Not necessarily move all the way into engineering. That's desirable, and a lot of technicians later—some of mine, by the way, have gone on with additional college time and gotten their engineering degrees. But what we need in the country, we need badly highly skilled technicians. And you see that in the automobile business or just about everywhere. Air conditioning. So, my suggestion to young people is: become familiar with what NASA's doing, and then ask them. They'll tell you what courses to follow. And if you just do a little bit, show a little bit of energy of your own, commit yourself, you'll be fine. That's about the best way I can put it.

NEAL: I promised you the opportunity to come back to that thing that you couldn't quite remember when we were talking about—

KINZLER: Okay. I'm just—

NEAL: —achievements that you were particularly proud of.

KINZLER: Yeah. Now, I talked about the SLA cutter.

NEAL: Yes, you did.

KINZLER: And the Shuttle. What else did we do with Shuttle? It's strange how it would escape me, because it's a major one.

NEAL: Now this was Apollo.

KINZLER: Yeah.

NEAL: And this—

KINZLER: It's terrible. It has to drift for a while. Maybe it'll come back in.

NEAL: The senior moments.

KINZLER: Yeah. That's what it is. I'm glad you appreciate that.

NEAL: I do, indeed. Well, I'll allow you to slide into it in this case—

KINZLER: Okay.

NEAL: —by saying: where (as you look back over your career)—where do you see the real highlights within that career as the nation slowly but surely moved into space? You saw it all, Jack.

KINZLER: Yes.

NEAL: And what stands out in your memory, if any single or combination of things?

KINZLER: Well, the first: Alan Shepard's flight was pretty darn important. We took our first man and shot him up on a rocket! And I stood outside the launch pad. In those days, we were allowed to actually go out of the blockhouse and stand within 200 yards of the Redstone on which Al Shepard was sitting and watch him take off. So, that's pretty primitive, but that's—I have memories of that. I'll never forget that. But that's just the first thing.

As time went on, when we came into Apollo, I guess my fondest memory is that I had the opportunity with the symbolic committee to make recommendations for both a plaque and a flag. And then I got action items to personally, you know—to do those. I'll never forget those meetings, because I was sitting in an office with the top dignitaries of NASA who said, "Can you tell us what we ought to do?" And I did! It was kind of brash in a way! But they bought it, you know, 100%. They didn't add anything else. Nothing else. So, that was a highlight. After that, throughout Apollo, I did talk about how we did the SLA cutter. Oh, I mentioned about repairing the hatch door on the Mercury (that's one). There's a big one, but it's sleeping behind me somewhere.

NEAL: It's still—you'll remember it tomorrow—I'm sure, Jack.

KINZLER: Yeah. Good heavens! How could I forget it?

NEAL: Well, a couple of final questions then, if I may.

KINZLER: Okay.

NEAL: If it does come to your mind, you just feel free to pop it right up anytime.

KINZLER: Okay. Okay.

NEAL: First of all, you stayed, obviously, tremendously interested in the space program.

KINZLER: Yes. I still follow it.

NEAL: What do you think of the way the Station and the world are going in space? Do you think they're moving in a good direction?

KINZLER: I think so. But I'm disappointed we haven't planned to go back to the Moon. There's no reason why we didn't add a return to the Moon program and then use some development of living on the Moon. In other words, using, you know—building buildings that would support people and maybe excavating, trying to find water sources, and different things. So, I think we kind of gave up too quickly on the Moon, personally. The other thing I feel is that: I have no doubt—I am positive—we're going to go to Mars. And I'm so thrilled that today I read about a way to do it in—by—in 17 years' time. I may live that long! I don't know. But—

NEAL: You'll never know.

KINZLER: So, in other words, we haven't quit looking out into space and trying to understand space. And the more we do that, the more our religion and everything else fits in. I mean, we have to believe in the Creator and the heavens being omnipotent. And there's just something bigger than mankind alone, so I'm very supportive of way-out thinking when it comes to "Will we find civilization elsewhere?" and things of that kind. I can't guarantee any of it. But I can sure believe in it.

NEAL: You know, Jack Kinzler, you've been kind enough to let me guide you with my questions for the last couple of hours. I'd like to give you the opportunity now to say anything that you'd like. Anything that I didn't think to ask—anything that you feel about all of the things we've been talking about here.

KINZLER: Okay. Well, I do have one. And it's kind of what I consider an unbelievable work situation. We joined the Space Task Group, and we had a capsule that we were building at Langley. We had to fly down to the Cape, frequently, and back and involve ourselves with the Hangar S operation. (I'm talking about myself and probably a few of my employees.) We had to put together a shops organization. We had to design buildings that would be suitable. We had to come up with budgets, asking for millions of dollars to buy machine tools and so on. We had to commute between Langley and Houston and the Cape for months and months with that. We had a shuttle that was under contract to NASA. You just called up and said, "I got to get back to Langley tonight." And you'd hop on and, "We've all got to go to the Cape."

So, we were running a round- robin here, a three-way deal. I was. And I was setting up shops at Cape Canaveral. I was setting up shops in Houston. I was out recruiting people. I was talking to architects about the kind of buildings we'd need. And this is an "I" thing; but if you get the picture, I had so darn many involvements it's almost impossible to believe that one guy would have been allowed to do it! That's the thrilling thing to me, that I just pulled off something not too many people do.

NEAL: How big did it become, that organization that you headed?

KINZLER: I had 185 employees at the last. I had planned for 300 in my staffing designs and that sort of thing. But we ran into a clash between the change of NASA's views on using support contractors as opposed to civil servants. And once the civil servant squeeze sort of came on, then we had a reverse situation. I was actually given a reduction in force. And this is the sad part of our story. I had to let go many of these young technicians that we'd brought up over 5 years' training, let them go because they were the lowest ranked in the civil service ranking system. And if you didn't let them go, you had to push out your top 20-year people. So, we had a case during my time at JSC that was very distasteful for me. In other words, I saw the decline in the in-house capability and in the optional changeover to support service contracting. It grew like Mopsie. And it works. But you know what's missing in it, Roy?

We had people who spent 20 years working in shops in the NACA days, lifetime jobs (they never thought about going anywhere; they'd just come in, go through apprentice school, and spend their life at a research center). We then moved out into this newer area we're in, the NASA area; and one by one, the pressures that were to bear brought in contracts and contracts for providing those technicians, engineers, you name them. That became the pattern. And I think it was keyed after the atomic energy setup they had, the AEC [Atomic Energy Commission], the atomic energy operation. As I understand it, all they had was some Air Force colonels and so on sitting at offices overseeing contracts; and they did nothing. They didn't design, they didn't build. And they handed off the entire responsibility for things that they were doing in the atomic bomb development and so on over to industry.

And gradually, NASA has moved in the direction of handing off more and more to the—responsibility of the contract, which works. But you lose one major thing: you lose continuity. Everybody I brought in with me had over 20 years' experience. I'm talking about my initial team. And they stayed on until they reached their 60s or whatever. They made a career lifetime of working in research and development. You find very few places in the U.S. where you can get into a research and development environment as a technician or craftsman, because almost everything you encounter in the big companies is planned operations. In other words, you have a major design department. You send drawings out with little piece parts on them. A guy operates one tool, a lathe or a mill. They spend their life working on very narrow limits as to how much involved they are with the company, or the purpose of the company. The auto makers. The auto builders. We have a problem with that.

We need to have people allowed to get more involved with the entire process. In other words have these give suggestions, make suggestions, and have them reviewed by top management. And in many cases, they will find that some of the most brilliant people they have are just buried down in the maze of the working operation. So, NASA has crept in that direction. And our shop now has, like—the Tech Service building, 9 and 10, is staffed with about (let's see, how many would there be?) maybe 75 or 80 people that are civil service at the most. And not even that. Probably 50; and then they have another 100 or so that are contract people. Every 5 years, they recompete contracts. The contractors who are bidding in want to win the contracts, so they offer competing pay scales that are lesser than the ongoing ones. And this is a bit of a sad story. But this is factual.

So, in that regard, you don't have any system that keeps the good people working on a long-term basis. They tend to drift and, you know, be lost. So, I'm concerned about that. And I don't have a fix for it, other than I did see that in recent times the Tech Service Division, which is renamed now (has a bigger and fancier name), has actually built some prototypes of this escape device, the X-33 or whatever they call it.

NEAL: The X-38.

KINZLER: X-38? I'm impressed that something has happened! Believe me, years have gone by, 20 years have gone by, Tech Service's shops haven't built anything significant like an original device like the X-38—until now. They are doing it—I guess they've got enough trained people that they can do something like that once again. But they're all, most of them are contract people. So, it's a—it's kind of a contrast. I'm talking about it, against it, and yet I'm saying, "Hey, they're finally making it work!" But it took them a long time!

NEAL: You've given us a lot of lessons from the past.

KINZLER: Oh dear.

NEAL: And I guess that's really what you're preaching right now.

KINZLER: I am. I'm stating that the original days of the Space Task Group were unbelievable in that we gave the opportunity to everyone in the Task Group to just go ahead and take charge and do what you need to do. And we'll back you! We'll just let you go. And I went out and found buildings to rent. I ordered machine tools in the millions of dollars. I never talked about Gilruth about what I was doing. I just had the go-ahead.

Now he certainly monitored and knew I was doing the proper things. But I was not alone. People like (well, I don't know who to describe next), but I think, well, about Caldwell, you know. He was a fellow with a lot of capability, and he did a tremendous amount to help develop the design of the Mercury capsule. And yet he's just one of us guys, you know, that did it. And I can't think of that other—

NEAL: And you still can't think of that one major thing.

KINZLER: No. The Apollo. The Apollo thing.

NEAL: Well, actually, I think we've pretty well covered all the bases. If you're happy with where we've gone, where—what you've covered, I am, too.

KINZLER: You've got a lot. Okay.

[End of Interview]