ORAL HISTORY TRANSCRIPT

ALAN M. ROCHFORD
INTERVIEWED BY SUMMER CHICK BERGEN
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BERGEN: This is an interview with Al Rochford on September 15, 1998, in the offices of the Signal Corporation in Houston, Texas. Interviewer is Summer Chick Bergen, assisted by Carol Butler and Frank Tarazona.

Thank you for coming and talking with us today.

ROCHFORD: Glad to be here.

BERGEN: Let's just begin at the beginning, when you were in the Navy, your experiences there and how that led you to NASA.

ROCHFORD: I was stationed at Pensacola, Florida, from 1958 to 1960, working in a low-pressure chamber, and we were teaching pilots the use of oxygen equipment and throwing different malfunctions at them and this sort of thing, doing hypoxic demonstrations. During this time frame, the Mercury astronauts came down to Pensacola with a hospital corpsman chief—he was retired—by the name of Glen Shumake [phonetic], and Glen was looking for corpsmen that were getting out of the Navy that would be interested in working at Cape Canaveral at that time in a low-pressure chamber they had at Hangar-S. I was planning on leaving the Navy in 1960, so I applied for a job. I was discharged in [August] of 1960.

Then in late October I got a letter from NASA asking me if I was interested in joining NASA. I can always remember getting that letter and, being a single fellow, I was visiting my folks up in North Billerica, Massachusetts. My father was an Air Force colonel. I turned to him and I said, "Dad," I said, "can a single fellow live on $5,500 a year?" and he quickly

ushered me to the writing table, where we sent an air mail letter out to NASA, quickly accepting the job offer. So we sent in the letter.

Then I guess a week or so later, I had a phone call from NASA, around Thursday, asking me if I could be at work the following Monday. So I was down there at Langley Field, Virginia. That's where I hired in.

BERGEN: Did you work at Langley or did you work at the Cape?

ROCHFORD: No, I worked at Langley. In fact, the first day I was there, they gave me a mountain of paperwork to fill out saying that, "We're sending you down to the Cape this afternoon." So about halfway through the paperwork, they said, "You can slow up a bit. There's been a slip at the Cape." There were a lot of slips in those days. They said, "You won't have to leave for several days."

My boss at that time, Jack [A.] Kinzler, who was the division chief at Tech Services Division, he took me into town and introduced me to a woman who was running a boardinghouse. They and several other fellows lived at the house. It was not too long after that that I was sent down to the Cape—this was TDY [temporary duty] to the Cape—to set up an altitude chamber along with Glen Shumake and a couple of the other fellows that we were working with. When we get down there, the chimps from Holloman Air Force Base, that's who had to go through the altitude chamber first in their little capsule. There were many slips in those days. We were working out of Hangar-S at that time.

When we got through with our tests, then we'd come back to Langley Field, and we worked for Space Task Group at that time. There were three areas in this building that we worked at. The second floor was occupied by the astronauts, the suit room was directly below their offices, and then we had a survival lab that Glen Shumake headed up, we had the suit lab that Joe Schmitt headed up, and then we had the environmental control system that

Harry Stewart headed up, along with a fellow named Frank [H.] Samonski. I worked primarily in the suit lab with another fellow that hired on the same day I did, by the name of Tom Gallagher. Yes, Tom Gallagher and I. He came out of the Air Force; I came out of the Navy. We hired in the same day, and we went to work in the suit shop. It wasn't too long after, that that they kind of split us up and Tom went to work in the survival lab with Glen Shumake and I went into the suit lab with Joe Schmitt. That's how we started off.

When we weren't in the suit shop, we were generally—Glen Shumake and myself and Tom Gallagher would go down to the Cape on TDY to support some chamber runs, and then once we got through the chamber runs with the chimps, then we went back up to Langley and then we got the astronauts, and then we went down to the Cape with the astronauts. So I did a lot of traveling in those days. In fact, my whole career, I've traveled. But I was a single guy, so it wasn't too bad.

BERGEN: When you worked with the chimps, was there anything unusual or different about working with them?

ROCHFORD: Well, we didn't support them. The Air Force personnel at Holloman Air Force Base took care of them. They had a little complex behind Hangar-S, a little gated complex with trailers and stuff like that. So those fellows supported the chimps. The chimps had a little capsule that they were placed in, and we acted as chamber observers and chamber operators on the chamber in Hangar-S. So our job was to monitor. I remember there was a Beckman gas analyzer in the altitude chamber, in the airlock there, and our job was to monitor the gas analyzer. Glen Shumake ran the chamber.

So that's how my background brought me into NASA, was working at the low-pressure chamber in Pensacola, Florida. So that's how I got into the system.

BERGEN: What were your daily activities like when you were at Langley?

ROCHFORD: Generally we participated in a lot of suit fits and a lot of training with the crew members. As I remember, tech services at that time was building some mock-up Mercury trainers, and I think there was a Mercury trainer there at Langley. I think there was. I know we went TDY with the crews up to—one particular trip was Johnsville, Pennsylvania. That's where I met my wife, up in Johnsville, Pennsylvania. She lived about eight miles away from there. I think we were up there for over six weeks, rotating the crew, suiting them up, strapping them in the gondola, that sort of thing, assisting the medical doctors in whatever they needed, because being a corpsman, I had that background that we could assist the medics in anything that they needed. Primarily the crew was sensored up with the heart rate and respiratory rate and temperature probe. So we supported primarily all of the suit support for the crewmen, took care of any modifications to the suits that we needed to do, install fittings in the suit that they didn't particularly like to have installed in their suits.

BERGEN: Like what?

ROCHFORD: Well, blood pressure cuff comes to mind. They had no inkling that this blood pressure cuff and fitting was going to be installed in their suits. It was a homemade piece of stainless steel that had a ninety-degree elbow on it, that just happened to sit right on the rib cage, and, of course, you're pulling three Gs, that's not very comfortable. So we had more than a few adverse comments on that blood pressure cuff and that fitting. Nonetheless, they all had it installed in their suits and even had them removed from the suits per their request. So we had a few patches on that suit where blood pressure cuff fittings used to be, then finally this fitting was refined and the profile was made a lot lower and a lot smoother, so, more comfortable.

BERGEN: Did you make recommendations for the suit, or did you just implement recommendations that were made? Did you work with the engineers? How did that work?

ROCHFORD: The engineer that we worked with at that time was Jim [James W.] McBarron. Jim still works for NASA here. Basically what we would do is, we worked very closely with the crewmen. We developed a good rapport with the crewmen, and because we went all the way from the very beginning with them to the Cape, strapped them in the spacecraft, and this sort of thing, any comments that they would give us, we kept a green record book on every one of the missions that we supported. So all these comments, then, were forwarded to the engineer. A lot of them were adjustment things that we could do ourselves. We would always forward the comment on, but we could make the modifications ourselves, whether it was adjustments to the suits or whether there were pockets to be sewn onto the suit, because a crewman would like a knife pocket in a particular location, and we were able to do this ourselves and just whip-stitch pockets on the suits.

The B.F. Goodrich Company was an easy suit to work with. It was only made up of two plys, a bladder and an aluminized nylon restraint, so it was fairly easy to work on.

BERGEN: Who were your fellow suit technicians that you worked with during the Mercury Program?

ROCHFORD: Joe Schmitt was my boss. I worked with Joe Schmitt. Basically he, a fellow named Walt Salyer, Sr. [phonetic], worked with us during the Mercury Program. Harry Steward was another technician. No, he was primarily in environmental control systems. We all kind of worked together. When we got real busy, Harry would come out of the environmental control shop, Glen Shumake would come out of the survival lab, and we had

Tom Gallagher working with us. He was working in the survival lab. We'd all get together and support these different activities.

As the Mercury Program went on, it was primarily Joe and myself and Walt Salyer, and then we had a couple of people at the Cape. Let's see. I'm trying to think of his name. Marty Tessler [phonetic] was a young fellow that worked with us for a short period of time, and the other fellow was Paul Whitaker [phonetic]. Paul supported us with survival equipment at the Cape. I think those were the technicians that worked in the early days, the Mercury days.

BERGEN: When a mission was decided, that there was going to be a mission, were different people assigned to a particular astronaut to prepare for that mission, or did you just take turns? How would that work?

ROCHFORD: Joe [Joseph] Schmitt was the prime technician for all the Mercury flights, and I was his back-up. On [Walter] Schirra's [Jr.] flight, I was the prime technician and he was the back-up. I was supposed to be the prime technician for [M..] Scott Carpenter, but what happened was Scott's flight kept slipping and slipping and slipping, and we had set a wedding date for May 26, 1962. It kept slipping and slipping and slipping, and finally—[Scott] was very understanding. He sent me a very nice letter after [his mission (I still have that letter)]. But I talked to Joe, and I said, "Look, I've had this all planned out, and I've got people coming from all parts of the country, etc. Do you mind if I complete these wedding plans?"

Joe, gracious as he was, said, "Sure. No problem."

I think Scott launched May 24, 1962, and I married two days later in Pennsylvania. That was supposed to have been my first flight.

I took the following flight with Wally Schirra, and we worked hand in hand. The astronauts had three suits to work with. They had two flight suits we call prime and a backup, and they had a training suit. The training suit was used primarily for dirty stuff like water egress training, that sort of thing. The flight suits we used for chamber runs and for simulator training and that sort of thing. We would treat the backup suit just like a flight suit. In other words, if we made a modification to the flight suit, let's say, we'd do the same thing for the backup flight suit, because the crew would kind of change back and forth. They'd find that one fit just a little more comfortably than the other suit. As we got closer to flight time, the crew would pick out, "This is the suit that I want to fly," so we made the other one the backup flight suit. We tested those suits on an equal basis, because if launch morning something happened to the one, then we had the other suit to fall back on.

BERGEN: As backup to Joe Schmitt in preparing for the launches, what did you do?

ROCHFORD: Basically I worked right along with Joe in supporting the crew in their training over at mission control at the Cape, and that's where the majority of the training took place, at the Cape. We supported all their suited activities. On launch morning, I was right there in the suit room with Joe while he suited up the crew. I would follow Joe down, staying out of the camera range. [Laughter] Anyway, we'd go down into the transfer van, and that would be generally Joe and medical doctor and one of the other astronauts, usually one of the other astronauts, usually the backup astronaut for that particular mission, and myself.

We'd go into a big semi van that was set up with bioinstrumentation and a recliner chair and a ventilator to keep the crewmen cool, and then we'd go to the pad. Then Joe and the astronaut and, I believe, the medical doctor would go up to the elevator and go up in the gantry to the spacecraft level. I would remain in the van in the event that they needed some

backup equipment, because we carried like a backup helmet and a backup pair of gloves, that sort of thing.

BERGEN: Why don't you tell us about the first launch that you participated in.

ROCHFORD: I believe that launch was in October of '62, as I remember. It's a little bit different being a prime guy than a backup guy, because you don't feel the pressure on you, you know, you want to make sure [all goes well], but Joe was always a good teacher, so I had complete confidence in myself and I knew that he was right there in case I had problems.

In those days, all through my career, we worked really crazy hours. If we had to make a launch at eight o'clock in the morning, we were up at one, two o'clock in the morning getting ready for this thing. We'd get both of Wally's suits checked out, made sure there were no major leaks in the suit, because we had a leakage criteria that we had to stay under. So basically we'd lay out all his equipment, from urine bag to the underwear to the suit, all the different paraphernalia, the boots, the gloves, the helmets, and that sort of thing.

Wally would get up, have breakfast, etc., and he'd come into the suit room. The photographers would be allowed to come in at a certain interval, after he had his underwear on, etc., and he started to get into his suit. Then still photographers would be allowed to come in, and the motion-picture guys. I remember we had Ed Thomas from RCA [Radio Corporation of America] and Larry Summers from RCA come in. We had another NASA photographer work with us during those days, Bill Taub [phonetic]. As I recall, Bill was in the suit room. But anyway, they were allowed in for a short period of time while [I] did the suit-up.

The Mercury suit was a fairly easy suit to get into, and once [I] had him zipped up and we put his helmet on and his gloves on and we got him on cooling, then we had a couch that he could climb into. He would climb into the couch, and then we'd run a leakage test on

him, a manned leakage test on him, and one that was completed, then he would basically go out fully suited connected to a battery-powered ventilator that was cooled with ice cubes. I'm trying to think of the name of that ventilator. It escapes me for the moment. Sawyer, a Sawyer ventilator.

We were on the second floor of Hangar-S. We'd walk down the stairs and into the transfer van, and he'd be sitting in the recliner. We'd hook him up to ventilation, and then he'd chit-chat generally among the doctor and himself or one of the other backup astronauts, that sort of thing. Then we'd take the ride to Pad Five. The first two flights were from Pad Five. That was where the Mercury Redstone was launched from. Of course, Wally was launched by the Mercury Atlas, which I think was Pad Nine, but I won't swear to that. We'd [take off his galoshes,] strap him in, [and] get him into the spacecraft… He'd have a handhold to grab hold of to swing himself into the couch, and then we'd hook him up to his oxygen system and close and lock his visor and attach all the restraints, the lap belt, the shoulder straps, that sort of thing, and wish him a good flight. The pad leader was Guenter Wendt. And then closed the hatch and then go back to the transfer van and pull back to a fall-back area, wait for the rascal to go off.

BERGEN: Did you have any responsibilities during the mission?

ROCHFORD: Generally we didn't have a lot of things. In the Mercury days, we would fall back to Hangar-S, really, gather our equipment up, and as I remember, we'd head back to Langley Field, Virginia. There may be another crew member that would be getting ready for a training exercise or something like that, but in the Mercury days, we didn't get involved in the recovery during Mercury. The landing and recovery forces for NASA were out on the ships, and that was just fine by me, because I was a dry-dock sailor. [Laughter] I had no desire to go out there at sea.

But anyway, landing and recovery people would recover the suits. They'd bag them up, box them up, and they'd send them back to us, and then we'd clean them up, etc., perform post-flight tests on them, leakages, thorough examination of the suit, make sure it didn't have any tears or nicks or that sort of thing, and then when the crewman came back, then we'd get comments from him how we could improve the suit, etc., etc.

BERGEN: Do you have any anecdotes or any interesting stories about your working with the astronauts during the Mercury Program?

ROCHFORD: None that I can think right off. There were always a lot of fun times. I remember when Scott Carpenter was up at Johnsville, Pennsylvania. This was a little later in the Mercury Program. He was up there evaluating another suit of ours. This was in '63, because my son was born July 10 of '63. He was up there. My wife and her parents were up there with me, and they came over to the centrifuge, and Scott came out of the spacecraft all in the suit, out of the gondola.

I wonder if we could start that over again. Can I repeat what I was saying? Go ahead and repeat your question. You said anecdotes, didn't you.

BERGEN: Right.

ROCHFORD: Okay. I remember one thing that came up, was that Scott Carpenter was at Johnsville evaluating a new suit for us. My wife and my son, who was just born—he might have been less than a month old—they came over to the centrifuge, and I introduced him to my in-laws, and we plopped my son Tom in his arms when he was fully suited and had a picture taken of it. He still has that picture. I thought that was pretty neat.

BERGEN: That's probably very special for your son.

ROCHFORD: Right.

BERGEN: Not everybody gets to be held by an astronaut.

ROCHFORD: Fully suited, too.

BERGEN: After the Mercury Program, the Manned Spacecraft Center was being built and you were transferred down here. How did you and your family feel about transferring down to Houston? Did that change your job any?

ROCHFORD: After the Mercury Program, they asked me to transfer to Houston. This was in '63. This was shortly after my son was born. Basically I closed up shop, transferred a lot of things from the Cape to Houston, and then I drove from Cape Canaveral to Houston, and we went to work at the Lane Wells Building in Houston because the site was still being built. That's where we started working on suits for the Gemini Program.

BERGEN: What type of changes did you as suit technicians have to make when you changed from a one-man crew to a two-man crew?

ROCHFORD: Well, basically we all did the same job. When we took care of a two-man crew, we were both working. We each worked with one man, strapped them in side by side in the Gemini spacecraft. Again, there was two crewmen. Now you had basically four suits to work with, because they had a flight suit and they had a backup flight suit, each one of them. This suit was made by David Clark Company. It was completely different construction than

the B.F. Goodrich suit. There was some modifications that we had to do to those suits during the Gemini Program.

Again, Joe and I worked Gemini III together, and then a fellow came out of the Air Force, by the name of Clyde Teague [phonetic], and they basically split Joe and I up, so Joe headed up one team and I headed up another team. Like I say, Joe and I supported the Gemini III mission with Gus and John, and then Clyde Teague and Joe Schmitt worked Gemini IV, and I worked Gemini V [with Clyde]. Walt Salyer also worked with us during the Gemini Program.

I had to back out of Gemini IX. I started training with the crew for Gemini IX, but due to personal circumstances I had to leave that crew, and Walt filled in for me. Then I basically went back to Houston and started working on other things while the rest of the Gemini Program went on. I kind of phased into the Block One Program and supported tests.

BERGEN: According to my information, you received a GT-IV achievement award. Is that correct?

ROCHFORD: A Group Achievement Award. During that time frame, we received a letter of commendation, but not only myself, but really Joe Schmitt and myself and Clyde Teague, and there was another fellow that worked for us, Jim Garripy [phonetic], who used to work for David Clark Company. I believe all four of us got a letter of commendation during the Gemini Program.

BERGEN: You said you worked on Gemini III, and that was with Gus [Virgil I.] Grissom and John [W.]Young. During the landing, their parachutes deployed and they jarred them such that one of their helmets was scratched and one was broken. Did you have to make any changes to deal with that problem?

ROCHFORD: Yes. See, in those days, the visor was made of Plexiglas. That occurred when the Gemini spacecraft landed, and when it lands, it lands like this, kind of pitches over, and when they pitched over, either the restraint system wasn't locked or—but anyway, Gus pitched forward and smacked the visor on some instrumentation. That's what poked the hole in it. Because John had scratches, like you said, on his visor. We went to a Lexan [phonetic] visor, polycarbonate visor, which is very strong. It scratches a little more easily, but you can polish out the scratches. So that's what we did for the fix for that.

BERGEN: Can you tell us about some of the changes that were made in the Gemini suits during the portion of the program that you worked on? Because it seemed to change a lot as the missions progressed.

ROCHFORD: Yes. It all depended where the space crewman sat, whether he was going EVA [Extravehicular Activity] or he was going to stay in. Like Ed [Edward H.] White [II] with Gemini IV, he had to have a thermal cover layer on his suit, as opposed to a nylon cover layer. He had to have some built-up insulation in there for micrometeorite protection and for UV [ultraviolet] protection. So it was the basic suit, it's just that the cover layer was different. So that was one of the big changes that occurred on the Gemini suit.

As we progressed and we used a backpack called—it was called several names. MMU comes to mind—Manned Maneuvering Unit. I think it was called something else, an APU or something, before that. Anyway, when we used the Manned Maneuvering Unit, and that was scheduled for, I believe, the Gemini 9 mission, because of the propellant in the MMU, we had to have chromel-R, which is kind of a stainless steel mesh on the legs of the suit. That was flown during that mission. But that MMU wasn't used in that mission.

We had some problems during those days with the crew in building up big heat loads, and by he got to the back of the Gemini spacecraft to don the MMU, he had built up such a heat load that the visor would fog, couldn't see what he was doing, couldn't do a real good evaluation on the system, and so there were problems during those days trying to do that particular experiment.

There were always modifications going on. Gas connectors on the suits were changed, extra locking devices were put on so you couldn't inadvertently open the gloves. We used to have one latch on the wrist disconnect. We went to two latches on the wrist disconnect. Then we went to two latches and a locking latch. So it turned out to be a three-fingered operation. So you'd grab the latches with two fingers. When you pull the latches out, you depressed the locking device with the index finger, and then you rotated it. We were looking at safety all the time. So, different hardware got changed out on the suits all through the Gemini Program.

BERGEN: You had a different type of suit for Gemini VII, the long-duration mission. How did that change?

ROCHFORD: Well, that was an interesting suit. That suit had a soft helmet to it. I say "soft helmet." You wore a helmet that was like a helicopter helmet, and the suit was also made by David Clark Company, and it was flexible. There wasn't any neck ring on this suit; it was a zipper. All the vent tubes were outside of the suit. In other words, they penetrated the suit [at the extremities (wrist/ankle), but were routed between the bladder and restraint, so it was not touching the body]… So it was a more comfortable suit to wear. It had a waist zipper. I'm trying to remember if it had a zipper up through the crotch area. I think it did have a zipper up through the crotch area, but you wore kind of a helicopter helmet, and then you took this [soft, flexible] visor and you brought it over [your head], and then you took a

pressure-sealing zipper and you closed it here, and then you had a little gusset in the belly. You could unzip this gusset, and that way you could stand up straight. When you sat down in the vehicle, you zipped it closed so that [when you] pressurized it [the suit] wouldn't elongate on you.

It was an interesting suit to work with. We only flew that one mission. [L. Gordon] Cooper [Jr.] and [Charles C. "Pete"] Conrad [Jr.] flew that, as I remember. Is that right? Gemini VII. No, that's not right. No. It was [Frank] Borman and [James A.] Lovell [Jr.]. Borman had EEGs [electroencephalograph] on his scalp, and I remember that the medical people at that time used Eastman 9-10 cement. [Laughter] That's some strong stuff. I was really surprised that Frank went along with that. I think Jim had a double-leg venous blood pressure cuff, one on each leg, and Frank Borman had the EEG leads on his scalp, and I don't think he had them on too many days during the mission before he said, "Enough's enough."

BERGEN: That was one of the first missions that the astronauts took off their suits in space, right?

ROCHFORD: Right.

BERGEN: Did you have special training for them to be able to put them back on?

ROCHFORD: Well, they knew how to put the suits back on. They practiced that. As I remember, that wasn't any recommendation of ours, to take the suits off. We had always felt that they should leave the suits on. But that was a fourteen-day mission. We knew, of course, that they would be taking the helmet off and unzipping the pressure sealant zipper and that sort of thing and make it partially doffed. As far as I know, they could have taken that suit down to their ankles or even taken it off. I don't anybody officially came out and

said that the suit was completely doffed, because I don't think they were supposed to do it at that time.

BERGEN: When you were working down at the Cape, did you work with Guenter Wendt much? You mentioned his name earlier. Did you interact much with him, or were your duties separate?

ROCHFORD: Our duties were separate. We'd catch up with Guenter at the pad, basically. There were interface tests that we did with the suit and the spacecraft hardware. Guenter was the pad leader. Anything that went on at the pad up at the spacecraft level, he was responsible for. So there were times that we'd physically bring the suit up, and we'd interface the suit with our equipment, the shoulder harnesses, the gas connectors to make sure they were oriented properly, the communication leads, the biomed leads, that sort of thing. We interfaced with Guenter quite a bit.

We were responsible for writing up procedures on ingress to the spacecraft. We kind of did it on a non-interference basis, but Guenter was right there at the hatch making sure that we didn't bump our heads. Occasionally you'd feel Guenter's hand on your back or on your head, because in the Gemini and in the Mercury, especially the Mercury spacecraft, when you laid in there, you were laying right on the crewman's chest, and your head was just that far away from the switch panel, so you always had to stay low, and Guenter was right there at the hatch.

BERGEN: In Gemini, the astronauts began doing EVAs, and they had to train for those. How did you participate in their training for the EVAs?

ROCHFORD: We did our training over in Building Five and in Building Seven. We had a chamber, an altitude chamber, built in Seven, where we practiced. We did this after hours, because no one really knew that we were going to do an EVA on Gemini IV. That was really kind of a hush-hush type thing. We trained in the mock-ups over in Building Five with Ed White and Jim [James A.] McDivitt. All the training that I remember we did in those two building and after hours, generally.

BERGEN: On later Gemini missions, they discovered that they didn't have a very good grasp on extravehicular activity, and Buzz [Edwin E.] Aldrin [Jr.] began training in the WET-F [Water Environment Training Facility]. Did you participate in that? How did that change the suit tech's job when you were training in the water?

ROCHFORD: I didn't get too involved in the latter Gemini missions, that I recall. I think at that time, after Gemini IX, I started working the command module for Apollo over in Building 32, and the LM [Lunar Module], LTA-8 Program, the spacecraft 2TV-1. I got more involved in that activity than I did in direct support of the Gemini missions. We were pretty well spread out. We had technicians, we had contractors with us during the Gemini Program, where we didn't have contractors working with us in the Mercury Program.

In the Mercury Program with B.F. Goodrich, we'd have a rep come down occasionally. If we had to do a repair job that we weren't proficient in, we'd get the expert from B.F. Goodrich to come down, and he would do the fix, or we had to send the suit up to B.F. Goodrich Company to put a new zipper in, that sort of thing, have it sent back.

Joe Schmitt and I basically were our own quality control during the Mercury Program. In Gemini that changed, because we had quality control inspectors. We also had contractors working with us. So we had a lot of support in those days. As a NASA technician, it wasn't until 1969 that we got some additional technicians in from the Air Force

that were still assigned to the Air Force [M.O.L. Program (Manned Orbital Laboratory)], and they worked with us. They worked with us all through the Apollo Program. We were spread out. We were divided kind of in teams, and we did a lot of support in-house, in the field, that sort of thing.

BERGEN: The contractors in Gemini that you had working with you, were they from Clark Company?

ROCHFORD: Yes. They were with David Clark Company, and they had a field office down here. They worked right next door to our suit lab.

BERGEN: Did they participate in the training with the astronauts or just on maintaining the suits? What exactly did they do?

ROCHFORD: They basically maintained the suit. Their job was to maintain the suit, test the suit, that sort of thing. The bioinstrumentation primarily took place at the Cape, let's say. It was done by bioinstrumentation techs at the Cape. The suit-up involved the suit technicians, the NASA suit technicians. The contractors were there to maintain the suits, but that was their responsibility.

BERGEN: Do you have any special memories from the period you worked in Gemini?

ROCHFORD: I can always remember things like receiving a suit and finding that the arms and the leg liners were twisted and stuff like that. It was one of those things where things that aren't supposed to happen, but that's why you come to work early and check out the suit, to make sure that things were done right. So you have to unzip this thing. Sometimes that was

a little bit of a hassle, because you had to completely unzip this thing from the inside, reaching in just by feel, and then straightening out the twist and zipping it up correctly and that sort of thing. We had a good bunch of people working with us. They were conscientious folks. Mistakes happen, but fortunately we caught all these mistakes.

BERGEN: Why don't we take a short break before we get into Apollo. [Tape recorder turned off.]

Let's pick up where we left off. You went from the Gemini Program over to the Apollo Program. What were you doing initially?

ROCHFORD: Basically I worked the 2TV-1 Program, which was in Building 32. That was the spacecraft command module check-out in Chamber A, and we had three suit subjects, three engineers, that we suited up. They spent I can't remember how many days in the command module for a systems evaluation of the command module, etc. We supported that test.

Then also we had a test called LTA-8, which was with the lunar module. Grumman was the contractor on that. We had two astronauts that I remember, a fellow by the name, I think, of Jim [John S.] Bull and then there was Jim [James] Irwin, and there were some engineers involved as suit subjects during that. That was an interesting program. That was one of the most interesting programs, because it was kind of a day-and-night program. I mean, it was a busy, busy program. These fellows would start off in the airlock in Chamber B on a set of umbilicals, and there used to be a long tray that would go out into the main chamber, because they had duplicate connections on the suits. These were flight-type suits. Through a series of disconnects, they'd swap over from the chamber system to the backpack system, climb up the ladder, get inside the LM, get into the LM system, and then hang up their umbilicals from the chamber outside the door of the LM, and then get from the LM system onto the backpack system through a series of valves that they wore, that were

dangling from the suits. This was strictly a test article on the suits. It wasn't a flight configuration.

That was an interesting test, because they would test these suits, go through the procedures, evaluating how things worked, how the backpack worked, how the suits worked, etc., and then they'd come back, they'd do it in reverse, come down the ladder into the airlock and down to ground level. Then, that night we'd be testing the suits, getting a suit ready for the next couple of guys that were going to go up and do this.

We worked over in Building 36 in an immense clean room over there. We put in some long hours on those tests, but a very fruitful program. That was a couple of the best programs that I supported.

BERGEN: How were those programs helpful?

ROCHFORD: Because they basically got both the spacecraft, the suits, qualified for flight. If I remember correctly, Chamber B had both—you could do cold temperatures or you could do the hot side of the temperature scale, plus 250 and minus 250, that sort of thing. My memory may not serve me right when I say we ran those temperature ranges on those two programs. I'm not sure that we did. I don't really remember on LTA-8 whether we ran the—I know we did it on other tests. Those were two programs that got the spacecraft and the suits that much closer to launch.

BERGEN: After you finished working on those test programs, what did you do next?

ROCHFORD: We supported a lot of in-house tests. We supported a lot of tests out on the lunar rock pile out here at JSC [Johnson Space Center]. I didn't get to go to Flagstaff, Arizona. Walt Salyer covered that particular test. There was a lunar terrain, and I think Walt

Cunningham and a few of the other astronauts participated in that exercise. We had a lot of programs in-house that we supported, in the trainers, command module trainers, in the lunar module trainers. We supported the different crews. I did support Block One, but my first Apollo flight that I supported, I believe, was Apollo 10, and I worked Apollo 10, Apollo 14, and Apollo 17. We had about three teams working at that time. We had the fellows from the Air Force with us, Troy Stewart and Frank Hernandez and Barry Lewis and Byron Smith. George Summers was the lead fellow, master sergeant, during those programs, and those guys were a great support to us, because we didn't have enough personnel, NASA personnel, to support all these flights.

BERGEN: You said the first crew you supported in the Apollo program was Apollo 10.

ROCHFORD: Yes.

BERGEN: So how did the support of this crew differ from supporting the Gemini crews that you worked with?

ROCHFORD: Of course, you had a different suit altogether. It was made by International Latex Corporation. It was designed different. You had to have more mobility in that suit. The suits—I guess I should have said in the very beginning that the Mercury suit, the only mobility you really needed in the Mercury suit once you got in the spacecraft was in the arms. So the arms had to fit properly, whether pressurized or unpressurized. You had to have mobility in the arms. In the Gemini suit, if you went EVA, then you had to have some dexterity in the fingers and the legs, you know, bending the legs, getting out of the spacecraft, that sort of thing.

In the Apollo days, especially after Apollo 11, you had to have the capability of walking, bending over, picking things up, that sort of thing. You had to have good arm mobility. There were bearings that were built into the suit that we didn't have before, in the arms, anyway. Each crewman had two flight suits and one training suit. There was a lot of maintenance on those suits, because those suits were made at that time—they had a beta cloth cover layer on them from the first Apollo flight up through Apollo 14. Whenever the crew wore backpacks, when they did lunar surface training, that sort of thing, they'd wear holes in those cover layers all the time. So every day, after we got through training, we were making patches to patch up those suits to get ready for the next day or whenever their training session occurred.

BERGEN: Were there concerns that something similar would happen when they were on the lunar surface, that they had to be prepared for?

ROCHFORD: Well, as I remember, I think in the flight suit we had some abrasive patches. I don't think we had that concern because the missions weren't that long. I mean, on the ground, you were wearing these things for like eight hours. You got a lot of just 1-G weight on your body. The rubbing, the friction on the suits would cause the wear and the tear. If it didn't tear the first time, then it would probably tear the second time or the third time. I really should say, it's not something that happened just like that. It was an accumulation of several days of training or maybe even weeks. It all depended. But finally holes would start wearing in the stuff, and then once it started breaking down, then we found ourselves doing a lot of additional patching. That didn't stop until Apollo 15, when we got a Teflon-coated beta material, and then I don't think we had to sew a patch one after that, because it really wore like iron. We were glad to see that.

BERGEN: I'll bet.

ROCHFORD: That was lot of work.

BERGEN: Was there any specific mission that you have special memories of during Apollo that involved some type of involvement from you?

ROCHFORD: I remember reading, Al [Alan B.] Shepard [Jr.] was talking about practicing with his golf club, you know, and nobody really knew he was going to do that, but one day when we were at the Cape, he asked me to come back into the suit room, that he wanted to try something. I can't remember whether this was at the end of the day or like that. There weren't any people around. We went back, and he asked me to pressurize his suit in the suit room, he wanted to practice something. Lo and behold, here he had this golf club, which was an extension of a tool that he had, and he was practicing. We pressurized him, and he was practicing his swing at that time. I remember that vividly. We had good times with the crew. We worked close with the crew, developed, like I say, a good rapport with the crew.

BERGEN: Were there any astronauts in particular that you had an especially close relationship with?

ROCHFORD: No, I think basically it was a working relationship. It wasn't a social relationship, but we always had a good time. We always felt like we were doing our job and they were respectful that we were doing our job and had confidence in what we were doing. I was taught by a fellow by the name of Joe Schmitt, who I worked with in the very beginning, who had excellent work standards, and Joe was very meticulous in everything that he did, and I like to think some of that rubbed off on me.

BERGEN: After the Apollo Program, Skylab began. Were you involved with the Skylab Program?

ROCHFORD: Yes. I worked, I think it was the second Skylab flight with Al [Alan L.] Bean [Jr.] and Owen [K.] Garriott and with Jack [R.] Lousma. I worked that particular flight, and that was a different trainer altogether. That was over in Building 5 also. Building Five changed a lot during those days. There were many different kinds of trainers that were put in that mock-up over the years. We did a lot of training, command module training, training of sorts in Skylab, though they weren't wearing suits in there. They'd have the suits off, and they'd be doing other kinds of stuff in there. Basically, the Skylab suit was basically the A7-LB suit that we flew for Apollo 15, 16, an 17. We wore that same suit for Skylab Program.

BERGEN: Since they didn't wear it once they got up there, you were just involved with working with them on training on the launch portion and the return portion?

ROCHFORD: Yes, basically that's so. They wore a garment that they called an in-flight cover garment, ICG, I believe it was called, a Teflon-coated garment. It was quite heavy. We had to make sure that that equipment was available to them and any other support equipment that they needed. But suits were used primarily in the command module.

BERGEN: In Apollo-Soyuz, did you participate in that program?

ROCHFORD: I did participate in that program. I wasn't the lead tech on that program. One of the Air Force fellows that was with us, Frank Hernandez, he was the lead tech on Apollo-Soyuz Program, but there were three of us that worked together on that program.

BERGEN: So how did that differ?

ROCHFORD: As I remember, we still had the three astronauts to work with: [Thomas P.] Stafford, [Vance D.] Brand, and Deke [Donald K.] Slayton. I do remember at that time that one of the Russian cosmonauts came in and wanted to get into a suit, and we put him into—I think it was either Tom Stafford's suit or Deke Slayton's suit at the time, and he had a translator with him. [Alexei Arkhipovich] Leonov—I can't remember his full name. Anyway, he came in. He was the Russian commander of Apollo-Soyuz, and we put him in a suit. Then Tom was supposed to get in one of their suits when he went over to Russia. I don't know if he ever did or not. It was interesting.

BERGEN: How did you feel about working with the Russians at that time?

ROCHFORD: Well, it was a new experience. We didn't have too much contact with them, because we just saw them on rare occasions. I got more experience with them during the Shuttle Program.

BERGEN: There was a long span of time between the Apollo-Soyuz and Shuttle. What did you do during that period of time?

ROCHFORD: Let's see. Apollo-Soyuz was in 1975. There was even a gap between the end of Apollo and Skylab. I think I went to night school for a couple of years on my G.I. bill. So I wasn't doing any traveling at that time. In 1979, we started getting ready for the altitude landing test at Edwards Air Force Base, where we had the Shuttle piggybacked on a 747. That was an entirely different equipment that basically comprised of a flight helmet and a

harness assembly and an oxygen mask and a seat pack with emergency oxygen in it, that sort of thing. So we started working with that equipment.

One of the things that we worked with primarily keeping track of all this stuff was checklists. When I first went to work with NASA, I can always remember Joe Schmitt having checklists to work by, and we continued with those checklists all through the program. We got away from it for a while at the beginning of the Shuttle Program. Joe had retired in '83, and I was the lead technicians, and for some reason, I don't know why, but we had more personnel and we were going hither and yon for all different locations, Edwards Air Force Base to the Cape to what have you, and I quickly determined that we couldn't keep track of the stuff by memory.

So we quickly got together again and assigned everybody to start writing up preliminary checklists so we could support these programs without forgetting something. So we started back in on those checklists, and we use them to this very day. We train a lot of people. Contractors work with us now, side by side, and they're taking over the—you know, NASA's phasing out, and it's taken over by the contractors. So we spent a long time training these people. We're training them now to do the job that we're doing. So the checklists came in very handy.

BERGEN: Can you tell us about the progressing of changes dealing with the suits through Shuttle from the beginning? What did you start with in the beginning, and then how did those changes occur?

ROCHFORD: Are we talking about suits now, talking about the B.F. Goodrich suit? That was a two-ply garment. There was a bladder and it was aluminized nylon, and it was pressurized. In an emergency, you would pressurize to 5 psi [pounds per square inch]. Normally we inflated it to check it out with a man in the suit, and the only other time it would be inflated

was if he lost cabin pressure, which he never did during the Mercury Program. That only required arm mobility, basically.

In Gemini, that suit was pressurized to 3.75 psi, and that had a different construction on it, a different construction altogether. You had a liner, a comfort liner in the suit, you had the bladder, you had a link net restraint, and then you had a Nomex cover layer on the suit, and that required a bit more mobility to it. You had wrist disconnects with lock-lock features on it. You had gas connectors that were self-sealing when you disconnected. You had a different type of neck ring that had a safety for unlocking the helmet.

Then Apollo was a carry-on from that, still had those safety features, a little bit of redesign in the helmet, there was a different type of helmet altogether for more mobility. You had a com cap that you wore. Communications wasn't built into the helmet, so you had that. You still had bioinstrumentation on Mercury, Gemini, and Apollo suits, more mobility, even more mobility when it came to Apollo 15, because they you were on the lunar rover, so we had an extra zipper put in. We had a different configuration zipper that went around the waist, rather from the crotch up the back that we did in all the other programs. This was a zipper, the pressure-sealing zipper that went around the waist and up the hip over to the shoulder, and that had to have more mobility to it, more bearings, shoulder restraints, this sort of thing. Like I say, that suit carried over to Skylab.

When we started the ALT [Approach and Landing Test] Program, we basically didn't have a suit; we had what I described as the helmet, the oxygen mask. They wore their own flight coveralls, a harness assembly, and a seat pan, that emergency oxygen system.

After that, we went into the Shuttle Program, and these were basically off-the-shelf Air Force suits that we bought from the Air Force for the first four Shuttle flights, because we had ejection seats in the Shuttle, and there was an evaluation on the different type of escape mechanisms. Anyway, we had ejection seats for that. I forget the designation right

offhand on the Shuttle suit, but the first four flights were two crews, and the suits were kind of basically like what we're flying now, as I recall, the same type of mobility, what have you.

Then after the fourth Shuttle flight, we increased the size of the crew, so the ejection seats were in there for STS-5, I believe it was. We removed the pyrotechnics from the two ejection seats because the other fellows wouldn't appreciate two men leaving them behind. Then we eliminated the suits, and we basically flew a clamshell helmet, a Gentex helmet, and a pair of coveralls, flying coveralls, Nomex coveralls, a pair of gloves just for fire protection. The harness assembly had two life vests on it. We flew that all the way up through the disaster, the Challenger disaster.

After that, it was felt that we needed to offer the crewmen more protection, both for launch and for landing, and the capability of getting out of the Shuttle in the event of emergency. So evaluations went on with both suits and with side hatch bailout, and we weren't responsible for the bailout on the side hatch, but we supported it with suited crewmen to determine what kind of mobility they had, that sort of thing, their comments on whether it was feasible or not, etc.

BERGEN: Were there any other aspects of your job that we didn't cover somehow in these different phases?

ROCHFORD: I guess my last Shuttle mission was STS-87. That's the last flight that I supported. Basically I supported a lot seven-man crews. The smallest crew we had was a five-man crew once we started it actively in the Shuttle Program. It was much easier to work with a five-man crew than it was a seven-man crew—seven-person crew. It's surprising, the workload that those other two people create. I don't know why, but it is. But we had three different teams working that, and I was always drawing short straw because I ended up with seven-man crews all the time.

I guess one of the more interesting things that happened was, I guess it was STS-39 and 40. I was working back-to-back crews, and what happened, we were sitting, briefing I think it was the STS-40 crew down at the Cape, getting ready for TCDT, and STS-39 was flying. All of a sudden it came over the radio that 39 was landing at the Cape. So we immediately scrambled, left the meeting, got ready to support the landing of the 40 crew, and fortunately we had all our personnel ready to support this. So we got 40 squared away, retrieved all our equipment, everything out of the Shuttle, and then got them gone and all their equipment inventoried and all that stuff, and then we went back to supporting 39. So there was a lot of hustling going on for that. I've supported back-to-back flights before, but there was a little bit more space between two flights.

BERGEN: Do you have any other special memories from your years that you worked at NASA?

ROCHFORD: Well, I enjoyed working. I enjoyed working with the Russian crew members that came through on the Shuttle Program. I do remember that I got to support the first flights with a group that was flying with Norm [Norman E.] Thagard. I briefed six Russian cosmonauts. They had their translators with them, and we briefed those crew members, and then we had to make sure that two of the Russians that were launching from Russia and the two that were launching from the United States could both wear the same equipment, as close as possible, and still do their jobs. That was a little bit of a challenge, because the more stuff they could share, you wouldn't have to store suits on board, there wouldn't be so much weight involved, and that sort of thing.

Fortunately, we got all those four guys in the same paraphernalia except for, I think, one pair of boots and one pair of gloves, and they were able to share everything else. I thought that was an accomplishment, getting that done, and working with those fellows with

the translators. Things go a lot slower when you're doing that, when you're briefing these crew members, because generally it takes us anywhere from two hours, two and a half hours, to brief them and to do fit checks with them and that sort of thing, and you want to make sure they understand the equipment and they're able to use it. Fortunately, then you start working with these crewmen all through their training.

BERGEN: What were some of the challenges of your job?

ROCHFORD: We were primarily responsible in the Shuttle Program for keeping—we weren't responsible for the maintenance of the suits. At that time, Boeing Company was responsible for maintenance of the suits, but to keep track of everything, to keep track of what these crewmen wanted to take with them. They had a whole menu of items that would completely cover this table of things that they could take with them for launch and for entry, and they could pick and choose. We had a menu of items that we called a crew carry-on drawing that we kept from the time we suited them up and briefed them initially right through launch. They could pick and choose all through their training exercise whether they wanted to take one of these or two of these. These amounted to watches, pencils, pens, mirrors, barf bags, anything that they could put in their suit pocket or carry in a flight data file bag [attached to their seat].

So, keeping track of all this stuff plus keeping track of comments, stuff like that, because as the lead guy, you've got to keep track of this stuff, and when you get three or four of them talking at the same time, you know, saying, "I want this, I want that," and you've got a room full of techs trying to do their job, gather up equipment, etc., sometimes it gets a little hairy. So I enjoyed much more working with five people than I did with seven, because it was a real hassle. It was interesting, but I guess after forty-one years of government service, I was ready to retire. They wore me down. [Laughter]

BERGEN: Looking back, what were some of the rewards of your job?

ROCHFORD: I think the reward was just being part of the space program. I got in on the ground floor and I got to work with these fellows. I don't think you get much closer to the action than we did, working with these guys and gals over the years, from the time we briefed them, suited them up initially, went to the pad with them, strapped them in the spacecraft, caught up with them on landing. It was really a great program to support. I enjoyed every bit of it.

BERGEN: Is there any other comment you'd like to add before we close?

ROCHFORD: I think that ought to do it.

BERGEN: Let me ask my associates if they have any questions. Carol?

Butler: This is going back to Gemini and the astronauts. You mentioned that they were experiencing overheating difficulties on the EVAs as well as their other troubles. Based on some of those problems, did you make any specific modifications to the suit like for cooling purposes or to keep their visors from fogging?

ROCHFORD: They had antifog on board that they could apply to the inside of their visor before they went EVA, but I think it was the system itself that just wouldn't cover the workload, the amount of heat that the crewman put out. It just wouldn't take care of that workload. I do recall that during Cooper-Conrad training, there was a chest pack that they used, it was really what I'd call negative training, because at that time, with this particular

chestpack, you could close and lock your visor, you could put on your gold shield, the UV shield, the gold visor protector. It used to latch into the pivot points on the side of the helmet. Then what you'd do is you'd dial in this back pressure valve to pressurize the suit. That's the way they trained. But in reality, when you used the flight pack, the moment you closed the visor, you started to pressurize.

I always remember that because my recollection was they were doing it just backwards in training, because they would close the visor, but the suit wouldn't pressurize until you'd turn this little knob to back pressure the suit. But here in flight, when they got in orbit, they closed the visor, and then they started to pressurize. Here now they're trying to put on this visor as they're starting to pressurize or get fully pressurized, and some of these guys were big sweaters to start off with, and now he's fighting trying to get this visor on and building up all this heat load, and it just wouldn't take care of it. So I felt that that in a way was negative training.

They built a better product. I guess it wasn't until the latter Gemini flights that we had some successful—well, I guess when Buzz went in the back and worked with the tools and stuff like that, but I didn't support those missions, so I don't know too much detail about that.

BUTLER: Skipping out to Apollo-Soyuz now, you mentioned that you worked with the Russians when they came through. You mentioned that one cosmonaut put on one of the American suits and then that Tom Stafford was going to try on one of their suits. When the cosmonaut put on the American suit, were there any comments on differences between the suits? Did anyone do any comparisons?

ROCHFORD: I'm sure there were. I don't recall at the time. I know that the Shuttle suit that the cosmonaut wears is considerably different than our present suit, but I don't know if that

was the same suit that he wore during Apollo-Soyuz, to be quite honest with you. I don't remember. I honestly don't remember what his comments were. I had to write out—after I got through with that fit check, I have it in my notes at home what was said at the time, but I don't have a recollection of it.

BERGEN: Just now you mentioned that the suit that the Russian cosmonauts use currently is quite different than the Shuttle suit. Can you describe some of those differences? Do you know that offhand?

ROCHFORD: Well, basically, their suit that they get into now for launch, they get in through the belly of it. In other words, it has a big bladder that opens up like this. The neck ring is fixed, but it's hinged, it comes back, and they have locking mechanism on the gloves. So when they get into the suit, they get in through the opening of the bladder. They put their legs in, put their arms in, swing this neck ring over, latch in position. And then what they do is they accordion-fold the bladder, and then they take this elastic cord that's attached to it and they wrap it seven times, and then they slip it through a loop. They also have the same thing down below in case the crewman wants to urinate, and they wrap that also. Then they fold all this stuff in, and then they zip up a restraint zipper over it, and they connect some cables up on the chest. That's the big difference in the suit.

We have a couple of the suits here. We might have given them to Smithsonian [Institution], but we had Shannon's [Lucid] suit and we had, I believe, Norm Thagard's suit here that they wore. That was the big difference that I remember.

BERGEN: Talking about differences in suits, did you ever do any work with different experimental type suits like hard suits at all?

ROCHFORD: I didn't get involved in that much at all. Joe Cosmo was the lead engineer on those particular suits, and Joe still works for NASA there. Frank Hernandez worked with them. Several technicians over there, Wendell Smith and Case Urban [phonetic] is over there. But anyway, I didn't get involved in those. Now, we had some experimental suits during the Gemini Program, or maybe it was toward the latter part of the Apollo Program, where we had a rescue sphere that we were evaluating in case one crewman on the Shuttle or crew became incapacitated, talked about transferring him over from one Shuttle to the other. So we had a big thirty-six, thirty-four-inch diameter ball that they put a crewman in, and in this ball, he'd have a chest pack on.

Previous to that, there was a bid out on building a suit that would contain this chest pack. So here came this suit that had a big old chest on it that you could put the chest pack in, see, so this would furnish him emergency oxygen while he was transferred. I think four different contractors submitted bids and actually furnished us suits to evaluate, but that didn't go anywhere.

What they settled on was the rescue sphere, which we haven't flown as yet. We use it primarily for claustrophobic evaluations, when new crewmen come over and get into the program or are applying for the program, we take this ball over to another group that go through some evaluations, and they put these guys and gals in this thing for, I don't know, five, ten minutes and flow breathing air to them just to see how they react, that sort of thing. That's the only use. We only have a couple of them in existence.

BERGEN: I guess claustrophobia is a definitely good thing to test for. [Laughter]

ROCHFORD: I think so, yes. [Laughter]

BERGEN: You did mention for astronauts possibly applying for the program. Did you guys get involved in any other aspects with applications?

ROCHFORD: No. When they got accepted to the program, at a certain time interval we had to give all these people [Astronaut Candidates [ASCANs] suit briefings and suit fits, because they would get involved in—they weren't selected to a crew, but a lot of times they'd be asked to come over and evaluate something for us.

I remember all of a sudden they wanted twenty-eight of these crewmen [ASCANs] put in suits over this time frame, and we were suiting up three and four people a day for several weeks and briefing them. That was kind of a challenge to do that, and we did it and got through it, but we told the trainer for our schedule from then on, "Look, don't do that again to us. Plan a little bit earlier so you can trickle a few over at a time, rather than squeezing us into a two- or three-week time frame." That happens. What do they say? Stuff happens. [Laughter]

BERGEN: Looking at space suits, you have to maintain them carefully and so forth. For Space Station—and I don't know how much you were involved in planning for this—are there any special changes that were made so that the suits could be maintained on orbit?

ROCHFORD: That's not really in my line. I think what you'll find is probably the capability of interchangeability. There's going to be a lot of EVA on Space Station. EVA suits—I worked through, like I say, Skylab, Apollo Program, with suits. Those were the same suits we launched in. I'm assuming that we're going to be launching in launch entry suits like we have now initially. But once you get on Space Station, those suits will be stowed. Suits that will be used for EVA will have to fit a bunch of different people. You're probably going to

have a stockpile of different arm sections and different leg sections and different-diameter rings so you can basically piece this suit together to fit an array of size ranges.

Right now, we have from 5-percentile people to the 95-percentile people, and that's a pretty good range, selection of suits, to have on, because in the Shuttle suits we go by the Air Force sizing system, twelve different suits. We didn't buy twelve different sizes, but we had suits anywhere from small short to extra large long, and then we had a few custom suits made for guys that had big torsos, big arms, that sort of thing. In Space Station, like I say, for EVA, you're going to have to have interchangeability of suits for different-sized people. That's the way I see it.

BERGEN: Talking about different-sized people, were there any significant changes when women were brought into the astronaut corps?

ROCHFORD: No, there weren't. Initially, basically, the woman had to wear a size suit that was sized for a man rather than for a woman, so the women had to wear those suits. We have a lot of take-up capability in suits. It's really surprising, the gals did a great job in their training, go through their training program, they did the same thing the guys did. Some of these gals, all the equipment that they wore practically weighed the same amount they did, you know, and they had to go through egress training, climbing out of the shuttle mock-up, that sort of thing, with this equipment.

We've gone to a full-pressure suit now. We're phasing out of the partial pressure-suit that we wore during the Shuttle Program. After the Challenger accident, we then went to a different suit altogether. We went to a partial-pressure suit. I forgot to mention that in your earlier questions. A partial-pressure suit is a suit that squeezes on your body when it pressurizes. It's not a comfortable suit to wear if it has to pressurize.

We then phased in what we call an ACES [Advanced Crew Escape Suit] suit, which goes back to the full-pressure suit that we wore on previous program. They have a little bit more adjustment capability, but we have ordered some—and I believe it's extra-extra small suits that we're starting to get in, because if you get a 5 percent Oriental woman, Japanese woman—we fly Japanese crewmen now—you've got to accommodate those people. So you've got to get down into the lower-size ranges. You have arm adjustments, you have leg adjustments, you have circumference adjustments. So I think that's what the plan is. When I retired this past December, we hadn't yet got in those smaller suits, but I think that's the plan, is to order a couple of them.

BERGEN: As you went through your career and you changed from one suit to another suit, what kind of training did you and your co-workers go through to learn these new suits?

ROCHFORD: Well, basically, in the early days a lot of times we'd go up to the factory for a week. We'd go up to David Clark Company during Gemini. We'd go to B.F. Goodrich Company in Akron, Ohio, for a week to see how they built up these suits. We went to ILC [International Latex Corporation] during the Apollo Program and worked on suits, observed, did some hands-on with those suits, got to see how they were done.

In the old day, in the Mercury-Gemini days, the astronaut would go up to the factory and spend a day or half a day, what have you, at the factory getting sized up for a suit so it fit him a little bit better. I don't recall us doing that during the Apollo Program. We might have, but I don't recall doing it. We didn't do it during the Shuttle Program. We bought different-size suits. If one didn't fit, then we'd try another suit, because, like I say, we had enough lacing adjustment capability that we could pretty well size them.

We went through a lot of glove changes in those days, and gloves are still a big problem, especially when a crewman's got to go EVA. You know, hands, fingers become tired. So they do a lot of strengthening exercises in their hands. Gloves are a big problem.

BERGEN: In your opinion, was any one suit or one suit manufacturer better than another?

ROCHFORD: No. I think they all did a good job with what they had. They were all receptive to improvements on the suit. They got a lot of feedback from our engineers. A lot of our engineers were involved in suit changes, improvements on the suits, that sort of thing.

Butler: When Apollo 11 landed on the moon, where were you and what were you thinking at the time?

ROCHFORD: As I remember, I was home that day waiting in anticipation, like everybody else. I didn't work Apollo 11. I was glued to my TV, just like I think everybody else was.

BUTLER: When you first started with the Navy back at the beginning of your career, would you ever have imagined where it would lead you and what you would be involved with?

ROCHFORD: No, not really. I went into the Navy with the goal of going to submarine school, and that didn't work out, so I ended up in Hospital Corps school, and I worked in pediatrics, newborn nursery, until a Navy buddy of mine, George Bates, convinced me that we needed to get the hell out of Great Lakes and go to the School of Aviation Medicine down in Pensacola, Florida, because we were working port and starboard, which means every other night we were pulling duty, night duty.

So we both applied for the school and got the school and went down to the School of Aviation Medicine and went through the twelve, sixteen weeks of School of Aviation Medicine. Then I worked in the eye clinic for a while, and George worked over at the centrifuge, and then I went to work in low-pressure chambers.

So here came NASA down, looking for chamber techs, and that's how. But I had no earthly idea [what I was going to do]. I was tending bar part time at the O Club and the BOQ. [Laughter] I was getting out of the Navy. So I went to work as a bartender at a country club, and here come a letter from NASA. That's how it all got started.

BERGEN: We thank you so much for coming down to talk to us. It's been wonderful.

ROCHFORD: You're welcome. I hope I answered all your questions there. I appreciate your sending me those lists of questions. At least it gave me some idea of what was coming down the pike. I meant to bring, if I hadn't have bailed out of Galveston like I did, if I would have brought some of these green record books with me to kind of show you, because it was a daily log of things, crew comments, all the different tests that we supported, crew comments, that sort of thing.

BERGEN: We'd love to see those sometime.

ROCHFORD: I didn't want to leave them at NASA because I felt like the people that I worked with, very few of them knew the program, but they've asked me to start bringing them back so they can make copies of the thing. I agreed to give it to them one or two at a time, see how quickly I get them back. It's a lot of history. It's not like reading a book, you know. You've got these comments from this crewman, this sort of thing. He's got a pressure point

here, he wants a knife pocket here, he wants a scissors pocket here. I mean, it's historical. That's for sure. It is.

BERGEN: We'd definitely love to see those sometime.

ROCHFORD: I'm sorry I didn't bring them this time. Thank you very much.

BERGEN: Thank you.

[End of Interview]