NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

FRED D. ROWELL
INTERVIEWED BY REBECCA WRIGHT
FREDERICKSBURG, TEXAS – 2 MARCH 2004

WRIGHT: Today is March 2nd, 2004. This interview with Fred Rowell is being conducted in Fredericksburg, Texas, for the NASA Johnson Space Center Oral History Project. The interviewer is Rebecca Wright, assisted by Jennifer Ross-Nazzal, and the interview is also attended by Billie Rowell.

Thanks so much for letting us come into your home today. We're looking forward to hearing everything that you can tell us about your career with NASA. Before we get into these details, if you'd provide for us some information about your childhood and growing up and how those interests might have led you into doing what you started doing for the space agency.

ROWELL: I grew up on a farm in Tennessee, and went through high school. I did not go to college. I joined the service right out of high school; went into the Navy. Spent four years in the Navy. When I was in discharged, why, I went back to Tennessee and stayed around for a while, but there was no work or anything there. I came back out to El Paso [Texas]. I had a brother that lived in El Paso, here in Texas. Stayed a while there with him and then wound up going back to Tennessee. That's when I wound up getting in trouble and met Billie. I knew her, but anyway, she was in the service at that time, and wound up going back to California then. That's where I [had] spent all my service time, in California.

We got married then in 1955 and came back [to] Tennessee then. She and I moved back because she got discharged from the service and that's where all of our family was at that time.

There was a little work. Redstone Arsenal [Alabama] was just getting under way good, and I went down there and put in I don't know how many applications, and wound up I took the first job that was offered to me there at Redstone with the government—I had a lot of friends that were working there—and that was an IBM [International Business Machines] keypunch operator. So I worked at that I don't know just exactly how long. But anyway, I had also taken the apprentice exam to get to be an apprentice. I wanted to be a machinist, but the first opening that came was experimental metalsmith, so I said, "What the heck, I'll take the first thing that comes along." So I went to work in the apprentice program there at Redstone as a metalsmith.

I stayed there then until 1958, when NASA took over. I was working with the Army at the time, and then NASA took over in 1958, so I wound up as more or less in a reduction-in-force-type thing, but I got transferred back to the Army then. I didn't like that. I was put in just a regular old sheet metal shop. I was doing gutter and downspout work, is what I called it, ductwork and stuff like that. Maintenance of the base, more or less, there at Redstone.

So after that happened, why, I started looking for somewhere else to go, and listening and whatever. After I got hired on, then Billie got hired on also at Redstone. Then we both wanted to go somewhere else, because I wasn't happy day to day in going to work. I heard about them starting to build a space center thing out in Texas somewhere. Then I put in an application, and Jack [A.] Kinzler came through then, was interviewing for that. I went, he interviewed me, and I wound up getting hired.

We came out to Houston [Texas] then in November of '62, right? So that's how I got started at JSC then. We were in buildings at that time, as you well know, scattered all over Houston. Our building, the building that I wound up working in, which was Building 10, was

one of the first buildings that was completed out there. I think it was the second, third, or fourth, somewhere along there. We moved out to the Center then and started to work.

WRIGHT: How did Jack explain the new jobs that would be available?

ROWELL: He just told me about what they were doing as far as setting up [the] type of shop he was going to build.

Maybe I should back up a little bit. I'd had experience, in the short time that I worked for NASA, with the rockets and what have you, because that's what I was in. I was in the test lab there at Redstone. That was doing work on the test stands where [they] static fired the missiles, at Redstone. So I'd had experience in that, and that was similar to what they were going to set up here when they came to Houston. So he just told me that he felt like at that time they could hire me, and I bugged the heck out of them for the longest until I finally got a call. It was taking [so] long till I thought I wasn't going to get hired. But then, like I said, in November of '62, we came out, and that's what more or less started my career as far as being with JSC.

WRIGHT: When you two came to Houston, you said you went directly to the Manned Spacecraft Center site itself, or did you work out in those scattered buildings in Houston?

ROWELL: The first building where we had our shop was at the old Canada Dry Building on the Gulf Freeway. We had our shop there. Then as soon as Building 10 was open, we moved into Building 10.

WRIGHT: While you moved into this area, can you tell us what your first thoughts were about moving to Houston?

ROWELL: I knew the area because I had a sister and a brother both that had lived in Galveston [Texas] for years. Both my sister's husband and my brother were merchant seamen and they had been there for many years. My sister was still living there at the time we moved. My brother had already left; he was, I think, living around New Orleans [Louisiana] or on the East Coast somewhere at that time. But my brother-in-law and sister were still living in the La Marque [Texas] area, Galveston.

WRIGHT: That would be nice to know that you were moving toward family.

ROWELL: Yes.

WRIGHT: Tell us about Building 10 and what you found when you moved there.

ROWELL: We were happy to get moved into it, being a nice large shop and a lot of new equipment and all, after being in such a small area there at the Canada Dry Building. Once we got going there, our work consisted mostly of just supporting any and all types of ideas and things that people would have in support of the missions that were going to be launched. We did not build multiples of things. Most of our work was a one-type, one-shot deal. It was something that at the last minute, or something that someone had an idea about, that they wanted to get on a

flight and that sort of thing. Of course, everything that we built was a prototype, trainers, and then the flight item, that was the three categories that was listed.

In that area, our items would be—like the prototype would usually be one. That would be the concept that you would give to whoever had brought [it] to our division to build. Then they would go from there. But then once the concept was approved, then we would build *x* number of trainers. It might be one, it might be five, or it might be more, but that was for the astronauts and all to train with and everything. Then once they were through with the training and all, then we had one item that was the flight item that was never used as far as training or anything like that. It was just what it said; it was the flight item. It was the final item to go on the flight.

WRIGHT: What were some of those first ideas that you helped turn into reality during those early days when you were there?

ROWELL: A lot of our first work there was building trainers, mock-ups, and items like that. We worked even from photographs on a lot of it. Like the first Apollo capsules that would be out in California, where they were being built, our engineers, or even we, were sent out sometimes to make pictures of it to see what was going on and trying to keep pace with the training of the astronauts. We would build wooden mock-ups and what have you, wood and metal combination, because we worked directly with the modeling, plastics, and woodworking people. So a lot of the first items that we would build might be made out of wood [or] it would be wood and metal combination. That way we kind of kept pace with what was going on with the capsules that were being built.

They also had a large number of boilerplate capsules, we called them, built. A lot of them were used for drop tests from airplanes. A lot of them were used in buoyancy tests out in the bay. Then as the Apollo got farther on down the road, when the mishap of the Apollo-[1] fire happened, that's one of the times that we really spent many, many hours in that shop. I don't know that our shop was hardly closed during that time, because a lot of different stuff had to be replaced in those capsules.

Everyday we would mock-up these boilerplate Apollo capsules, we called them, and put different types of material, wiring, all different sorts of things in these things. When we left then at eight o'clock at night, we were working twelve-hour days; the riggers would be there, take the capsules over to the old thermochemical area, which was where a lot of the test cells were. They'd take them out there in that area and then set fire to them, inside of them. They'd pump oxygen into them and ignite it and burn whatever we had put in there, [to] see how it would hold up and this sort of thing.

Then the next morning when we'd come in, here would be this blackened boilerplate, just steel, external, all of it was steel, would be there and we'd have to tear into it, start digging out all of this stuff. Then they'd have another list of stuff maybe we'd already been working on for several days, something else that was to go in there. Then they'd tell us what was to go in this particular one. Sometimes we'd have two going at the same time; we had enough people to keep two going. Then we would mock that one up, put whatever they wanted into it; they'd take it out at night, burn it, bring it back. This went on for I don't know really how long. I've forgotten how long, but until they were satisfied that they had come up with enough stuff that was fireproof or whatever that they could safely go with it.

WRIGHT: Your work, when you began there, did it start with Apollo or did you have some things that you worked with the Mercury and Gemini as well?

ROWELL: No, I worked with Mercury and Gemini also.

WRIGHT: Could you share with us some of the areas or tasks that were specific to them?

ROWELL: Well, let's see. The Mercury Program, I guess, was pretty far along by that time, wasn't it? It was getting to the point of being close to closure. One of the things I remember working on, though, in the Mercury, was a panel that—and I wound up getting to go to the Cape [Canaveral, Florida]—that was my first trip to the Cape on that job. In the old Mercury capsule, part of the instrument panel was an escape route for the astronauts. That's how they came out of it, out through the top. We had to mock up a capsule. We didn't have enough drawings and what have you, not knowing how and actually how it all worked, myself and the supervisor for the model and plastics shop went to the Cape to study and see how this panel was made. It had a lever mechanism that you undid it and the panel came loose and it folded back out of the way and the astronauts went up through the top, out through the nose of the old Mercury capsule, because the rest of the area was the parachute, where the parachute canister was. It was just [a] little [opening] that was big enough that they could go right out through the top of it after they had landed. That was their escape to get out of it.

We were installing that, and I got to stick my head up into [M.] Scott Carpenter's Mercury capsule in the clean room at the Cape before it ever flew. I think that's one of the

capsules that's out at the Space Center now. If I'm not mistaken, I think it's there, and I got to see it and all before it flew at the Cape.

As far as Gemini, I don't recall any incidents, anything in Gemini. That was just kind of a follow-on to the Mercury, and I don't recall. I'm sure there was; I know there was things that we did and all, with being involved in a lot of it, because that was the transition in the docking. That was where they perfected the docking, and I know that we wound up doing stuff for that, but I just don't remember any of that right now.

WRIGHT: When you were given a task, especially in those early days, as you were developing things, how were you able to find out enough information to be able to know what you were doing was going to fit in with everything else?

ROWELL: Well, we didn't on a lot of it, but anyway, the engineers would have the task, and many times we wouldn't have completed drawings. A lot of our stuff was such a rush, rush deal, bang, bang, get this done, this, that, that they might not have anything but a sketch or whatever, and come over to our shop and talk to our supervisors and to the technicians, whatever it took. They'd have an idea and a concept of what they wanted and all, and if we'd been given a short period of time to get it done in, that's the way we had to work, [then] they would develop the drawings after the fact. Lots and lots of times they did that because of the shortness of the time that we had. The only way they could do it would be to go—and then someone would usually have to go wherever the object was that we were building something for, it would have to go and be checked out and see.

Then, of course, they ran all kinds of tests, and all the other test areas that was there, the old—what was it—Building 49 there, where they had the vibration and acoustics testing, that was where lots of the stuff was done, in there and in the big vacuum chamber. We worked in that thing for many, many months, building stuff inside that big vacuum chamber and installing it, especially before the lunar module was completed, because that was how they simulated deep space, was in that vacuum chamber. That was one of the things we had to do, too.

Also, we built, I think it was, a one-twentieth scale model of that vacuum chamber, because they had a problem with it when they first pumped it down. When they first pulled a vacuum on it, it started to suck the big door in, it was such a strong vacuum and all, and, well, it wasn't going to work. So they had to figure out where the weak points [were] and beef up around the door. The way [we] did that was that, like I say, we built a one-twentieth-scale model of that thing. We built the whole thing, built the tank and everything and then put the little ribs on it, just exactly like that. I don't know where that thing wound up. It may be in the Smithsonian [Institution, Washington, D.C.] now. I don't know. I lost track of it, so I don't know where that wound up being.

Then along that same line, another one of the things that we built, [and] I built a lot of almost all, except the machine parts, of one-twentieth centrifuge, the old centrifuge that was there. We built a scale model of that, and that stayed there for a long, long time. It was over there in the front part of that building, but it got out, and I understand it's in the Smithsonian now. I don't know. That was quite a job building that thing, building that arm. I built it all out of little tubing, quarter-inch-diameter tubing and stainless steel. It was a working model, too. The arm spun it around. Of course, the machinists made all the gears and the working parts like that. The machine shop had to build that.

WRIGHT: Did you give them the dimensions? Did you take the plans from the big one and then cut them down?

ROWELL: No. See, on that, that was built by some company. I can't remember the exact reason why we built that, but it was something to do with [them] having some problems with it or something. Then we got the drawings from [their] Engineering Division somewhere, came up, and they made JSC drawings of that particular thing and gave them to us, and then we had to build from that. They scaled it down to the one-twentieth-scale model and gave us the drawings, and then we had to build from that, and that's how they got that built.

WRIGHT: You mentioned a few minutes ago about testing, that when things left your shop, they were tested. Did you participate in the testing? Did you watch those tests?

ROWELL: A lot of the times we did, yes. Going back a way, a long ways, I was at Redstone when they first clustered engines to fire, before the Saturn I. As we developed the Saturn I, our machine shop there in the test lab built one-twentieth-model rocket engines that would actually fire. We took them to test cells that would be a concrete bunker-type area, and then [in] our shop, we built the deflector, which was a small deflector, a twentieth-scaled model, and that's how they would develop the hot spots on the big deflector, where you had to drill the holes for the water to shoot out of the deflector to keep it from burning up when they were firing the engine. They started out with two engines and then they jumped to four, and then they jumped to eight.

As we did that, like I say, that's how they developed the hot spots on the deflector plate. Then that's where our shop there then, a bunch of sheet metal guys had to get up in that big, huge deflector, where they fired those engines into and sit there and drill quarter-inch-diameter holes with a handheld air drill into the—I think it was inch-and-a-quarter steel plate, drill it through one and a quarter-inches of steel plate, that's how they kept from burning the thing up. The water would be gushing out of that.

Then the end of the deflector, on tests they found out that there would be more—I don't know what to call it, but more force at the end of that deflector, when it would come down and fire, and then it would be kicking that water out the end of it. We had to make fingers on the end of that deflector plate. It shot back up and it would spraddle out like that and the water would go through it and break it up. Otherwise, we were tearing up the end of the street where this concrete trough was, where we fired it. It fired down into a big trough, concrete trough, and at the end of it, one of the streets went by. Well, it was tearing up the street, so we had to shoot the force of the engines back up into the air some and then break it up as it went through there. So we modified our little model deflector many, many times in order to get what we wanted there to keep it from tearing it up, and also to keep it from shaking so many of the windows in downtown Huntsville [Alabama], which it did anyway. They rattled a lot of windows with the force of those things.

WRIGHT: Did you ever have an opportunity to see a Saturn launch?

ROWELL: Yes. We went to, what, Apollo—next to the last one, or the last one.

BILLIE ROWELL: It was seventeen.

ROWELL: Seventeen? No, was it seventeen? Or sixteen.

WRIGHT: It gave you an opportunity to see some of your work in action, I guess.

ROWELL: But I never got to see the Shuttle launch yet, I'm going to one of these days, if I live long enough.

WRIGHT: Hopefully that will be a time that will come soon, and safe.

ROWELL: Some of them say, though, that watching the Shuttle, after seeing the Apollo, it's kind of disappointing, because the Shuttle just goes "shhhttt" and it's gone. Where the old "um-um-um–um-um-um," it was so much slower. I don't know, but I'd still like to see one of them go up.

WRIGHT: It was interesting as you were describing your work with your tools. Could you share with us how your tools might have changed over the years that you were there, or did they?

ROWELL: They didn't change a whole lot. We did stay up pretty current on what was going on as far as the work and what you had to work with. Of course, we tried to get every new thing that come out if we could. And we had some [awfully] good technicians, both in my shop and in the model and plastics, that they could do stuff on their own.

One of the items what she was just reminding me that we wound up getting was an electron-beam welder, which I was fortunate enough to be picked as an operator for. I'd never even heard of an electron-beam welder when I was told that I was going to be sent to Windsor Locks, Connecticut, to learn how to operate it. So we wound up buying one, our shop did, and I got to operate it. I was one of the first ones, and three of us went up there to learn how to operate it. Two of us were the technician types. One was an electronics man, because they suggested that we send someone if we had an electronics person, that when we had problems with it, they could help us out as far as solving the problems in electronics.

Actually, the school that I went to was not that good as far as operator oriented. It was more how the system worked and all, and myself and the other technician, we couldn't even ask a sensible question hardly about it, but the electronics guy could. So we came back, then we learned to operate it more or less just by doing it on our own initiative.

That was a fun part of my deal, I guess, because the type of work that I got to do on the electron-beam welder was stuff that could not be done in any other way, usually. It was strictly a fusion process. The welding was strictly a fusion, where you heated the metal up with an electron beam and it fused together and flowed together, and it was one of the most perfect welds at that time that you could get, because most of the time you couldn't even see where the weld joint was, except from just the little distortion on the top part of the metal. And if you took a heavy piece of metal that you'd welded together and cut it and you'd have to etch it in order to see where the weld seam was. That's how I would develop, for flight items.

Everything that we sent up, everything that was a flight item, had to be inspected. It had to be certified. The metal had to be certified metal, and so whenever I would weld something in that, I always had to make a sample weld first, because, like I said, you had to destroy, but you

had to cut it and etch it in order to tell if it was a good weld or not. I'd say 90 percent of my work on that was machine parts, so the machinist would make me two of whatever it was, or similar, to simulate the joint that I was going to weld for that product or whatever, so that I could take it and cut through the weld and then take it over to the metal finishing area and they would etch it in acid for me and bring it back.

So then when I'd take that part that I'd welded to QA [Quality Assurance], I would also take the sample piece that I had etched along with it, and that's how they would show that it was—plus, if it was a flight item, I had also an inspector that had to come down and sit with me in the room where I was welding, and he would verify my figures as to what power I was using to weld it with. That was all that we could do. That was as near perfect as we could get with it as far as what the weld would be like.

WRIGHT: Do you recall the first project or the first item that you got to use your new electron-beam welder on?

ROWELL: Well, one of the first ones, as far as the flight item, would be Ed [Edward H.] White's little handheld maneuvering unit, whenever he went outside on the spacewalk, outside of the old Gemini. The little tanks, it was twin tanks. Right there, see, there's two of those [referring to photograph]. There's one on the other side of his hand. The caps on each end of that was welded, and also on the nozzles here. I welded these nozzles on either end of it, and welded the tubing into the block here on the other, and that was his little handheld maneuvering unit that he goes out in.

WRIGHT: That must have been a pretty exciting time for you to know that your—I hate to use the word *gadgets,* but your work's up there in space and it's working.

ROWELL: Like I said, that was one of the first items that I can recall. One of the other items that I welded so many of, and I got so sick and tired of seeing those things, was the astronaut's watchband loop. That's something that probably not a lot of people realize, but the watch that the astronauts used, all the way from the very beginning, is probably the only commercial item that was not modified in any way. It was used, but not modified. It was used as it came off the shelf. Of course, it went through all kinds of shake, rattle, and roll tests to do that, in order to do it.

But then the loop that I'm speaking of—see, they did not have a band that would go around the spacesuit sleeve in order for them to mount the watch, so they had to have another little loop. I had to make little bitty stainless steel loops, and they took a Velcro strap and ran through the little pins on either side of it, underneath here, and then this loop just tied that together and brought it back around with Velcro and strapped it on. It was adjustable, where however big their spacesuits was, the watchband could adjust to it. And, gosh, I don't know how many of those things I made. Everybody and their dog must have gotten one of those watches and watchband, because I know I made beaucoups of those, and that was the Omega watch.

I wound up with this [refers to book]. I showed some of the people from—and I think this happened, we were talking about it last night—I think that I got this after I retired, after I was working for Johnson Engineering, that some people came through over there and I gave them a tour over there in Building 9 where all the mock-ups was, and I gave them a tour of that, and got to talking to the people. They told me that they were the ones that had either built the

watches or they worked for this company. So I was telling them about building those little loops, and, lo and behold, then I get this in the mail. They sent me this book then. It's a pretty neat book, tells all about the history of the watch and how the tests and all went.

But that was, like I said, one item. Very little off-the-shelf products was used. They were either modified or reworked or something. But that is probably one of the—maybe the only one. I don't know; I wouldn't swear to it.

WRIGHT: Do you have some other items that you'd like to share with us that you specifically worked on, or you and your team did?

ROWELL: One of the other items I was talking about earlier, about having short turnaround on it, was when we built the little MET buggy, Modular Equipment Transporter, the first rubber tire that got on the Moon. And the guy that I told you about a while ago, Bill [William K.] Creasy, he was the project engineer on that, he and all of his crew, and that was one of the times when they came over to our shop and they said, "We have one week to prove that we can build a transporter that the astronauts can use to transport their tools around on the Moon, and we have this size envelope," and they gave us the dimensions of what it would have to be like [to] fold up and fit in this size deal. That's how much room they had on the LM [Lunar Module] that they had found space that they could mount it. So we had one week to come up with a concept—they did, the engineers did. They said we had one week to come up with a concept, build a prototype, and present it in Washington [D.C. at NASA Headquarters] for approval.

So that was one of the times I was talking about, where they would come over with just an idea or whatever and say, "Can we do this? Can we do that?" You know, "Let's build this

and that." And they stayed over in our shop more than they ever stayed in their office during that week's time, and we gave them what they needed. They took it and got it approved. Of course, then we had quite a bit more time. But if we hadn't have gotten something, I guess they probably would have used that space for something else, if we couldn't have come up with something.

WRIGHT: What were you first thoughts when they came in with this idea?

ROWELL: I thought they were crazy, because I didn't think that we could build something that would fold up. See, this thing had to fold up. Do you know what the little MET is, the little buggy. Okay. Have you ever seen it folded?

WRIGHT: I don't think so.

ROWELL: All of that folds up. The handles break loose; it folds in. The wheels are hinged; they fold up underneath it. Then, of course, everything that was above that, that helped hold the tools on, all that folded down, and it had to fit within a certain envelope-size slot. So that's how that thing got developed. That's a loaded picture of it right there [refers to photo]. That was the day we took it over to the centrifuge. We used the old centrifuge. At that time, they wasn't even using it, but it was still there in the round portion of the building. I forget the building now, what that building is.

We used the arm of that thing, and they had a lift mechanism developed that they swung off the arm that would pick the astronaut and the buggy up to one-sixth G, one-sixth of their

weight, so that they could bounce around. They put rock around on the inside of that round room there, gravel and whatever. He would be out there, in full spacesuit, and pulling that thing by the handle around that track, and in only one-sixth G, and then he would bounce around. It acted on the Moon then just exactly the way that they showed there, because it would hit rocks and it would bounce up off of the deal and skip. And there's pictures that they made of it showing the skips on the Moon, where the tracks—there wasn't any tracks there—that jumped away. And it had done that same thing over there in the old centrifuge building.

WRIGHT: That must have been a sight to see.

ROWELL: Yes. So it proved out that their testing turned out to do exactly what they had—and we built about, I want to say about, six of those things, maybe, and there's a world of work in that little buggy there. The hard part was heat-treating it after you [welded] it, because all of it was welded up. I say "all." Not all of it, but the main frame of it was welded. Of course, you weaken all the aluminum. When you weld the aluminum there, you weaken it. Then you have to go back and heat-treat it, and there was so much stress built up in all the different joints that it was a pain to have to try to keep it from going every which way. Then we'd have like thirty to forty-five minutes to straighten it out, after it came out of the oven, to get as much of the twist and distortion out of it. That was one of the hardest things, to get the frame right. Once we got that, then from there on, we were in pretty good shape.

But those astronauts, they beat those things up. They took them out to the—what's the meteor crater? They took them out there and drug them around all over the place out there, out in the desert. I don't know where all they took them, our trainers that we had. Then when they

would find something that they liked to change about it or that would make it easier for them and all, they'd always have some engineers that would be with them and, of course, they'd come back to the shop and they'd say, "Hey, we need to redo this," or, "We need to build something else to add on to it," and this sort of thing, till they finally decided and finally got down to the last thing on them.

WRIGHT: Was there a lot of modifications from the first prototype until you got to the final flight item?

ROWELL: Oh yes. There's always, in anything that we did, almost, because not only did they have to satisfy what the item was supposed to do, but they also had to satisfy the astronauts. They had lots of good input and they had lots of stuff that sometimes it wasn't so good and it would be hard to try to get [done].

WRIGHT: Do you have an example of that that you can share?

ROWELL: Not right off the top of my head.

WRIGHT: We talked about how some tools changed. Can you talk to us about the materials and how they changed from when you were at Redstone until the time that you got ready to retire? Were there a lot of different types of materials that you used that were new?

ROWELL: Not a whole lot. There was a few things. Like in the electron-beam welding, there's some metals that could not be beam welded because they wouldn't flow together; they wouldn't fuse together. Plus, they would outgas in the vacuum chamber. See, that was done in a vacuum chamber, something I don't think I said a while ago, but it was done in a small vacuum chamber, and I was limited as to the size of the items that I could weld on account of the chamber, size of the chamber. Like zinc, for instance, zinc you can't weld; brass you can't weld like that, not electron-beam weld. You can silver solder it and that sort of thing. And copper was very, very hard to weld because it had so much impurities and outgassed a lot [so] it was very hard to weld. I did do some copper. The good metals was the stainless and the monel. Certain types of aluminum you cannot weld. In fact, it's not feasible to weld certain types of aluminum in any shape, form, or fashion. There are different alloys and, of course, you have to know which alloys is weldable and which is not.

WRIGHT: Did you have a variety of materials that you had to use all the time, or were you specifically mastered one more than the other?

ROWELL: We used whatever the engineers called for. We had to go that route, and if we didn't have it, we had to get it. Of course, they knew what could be made out of what and what alloys were weldable and what was the best machinable and that sort of thing. That we didn't have to worry too much about. It was all spelled out on our specs [specifications] and drawings, so we didn't have to worry there.

But for flight items, everything had to be certified. The metal had to be certified. Every piece of metal that went into the flight item, it had a paper trail along with it that stated that, yes, it is thus and so type of material.

WRIGHT: Were there certain vendors that you bought certain materials from to ensure that they were certifiable?

ROWELL: Yes, plus, they would also send off coupons of the metal. Most of the time we did not try to buy stuff that was certified, because the QA would not accept a vendor's bill. We had to send off the coupons to a laboratory and have it certified, and then it came back and that certification was kept in the QA office then, in the file. What we would do, after the coupon was taken out of a certain piece of metal, we had a log number. It would be marked onto that sheet of metal, and it was logged in the QA office. Then when we'd go to draw that out, that was under lock and key. All of our certified metal was usually kept separate; it wasn't used for, of course, everyday stuff and all, because it cost to get it certified. So then we would have to go and draw out certified metal when we got ready to build a flight item.

WRIGHT: How big was your group that you worked with?

ROWELL: It varied, but I would say the sheet metal and welding probably about the most would [be] between twenty-five to thirty guys. Then, of course, on the other end of the shop, electronics was upstairs, then the machine shop had two different machine shops on the other end of the building.

WRIGHT: You mentioned, when we were talking about the tragedy with Apollo-1, that you guys were working twelve-hour shifts and working around the clock. Was there a typical normal workday for your group as you went through the Apollo days?

ROWELL: Normally, if we didn't have anything rushed and what have you, was just an eight-hour day. But we worked an awful lot of overtime. I put in many, many hours of overtime. In fact, I got to the point where I just didn't want to work overtime; it was just too much.

You mentioned Skylab in your question. When Skylab came along, that was another time that we did not close the shop. It was not closed for that. I think we had about a week there, because that was a time schedule thing that they had to try to save that thing. I never will forget, they came in one afternoon, and at that time, I wasn't a supervisor; I was lead man. My supervisor was on vacation, though, and I was in charge. My division chief told us that we were going on twelve-hour days, two shifts, twelve-hour days, and he said, "Divide the shop up. Anybody that comes through here with an idea of how to save the Skylab, you're to support them." So that's what we had to do. Like I said, the shop wasn't closed for whatever length of time that was there, until they developed that parasol.

WRIGHT: Did you have a lot of hands-on involvement with the development of the actual tool that went up?

ROWELL: Yes. Like I said, anybody that come in with any sort of idea, we had to go along with it, and if somebody came to me with an idea, I think my boss was gone that whole time that we

were on so much of that, and I had assign a guy to it. There was two lead men at that time, so I took one shift and he took the other one, and if someone came through there with an idea of something, you had to put some guys on it. Normally, they would stay with the technician and work right with us there in the shop until they were satisfied that whatever they'd come up with wasn't going to work, or would work. We'd build what they wanted; they'd take it off somewhere to test it. A lot of that testing was done over in the big chamber area then, there, too.

WRIGHT: It worked, and they were able to get it shipped off at the last minute to make it work, so it must have been a proud time for all of you in your shop.

ROWELL: It was a hectic time, that's for sure.

WRIGHT: Speaking of Skylab, once the Apollo efforts were closed down or starting to close down, and the Space Center was starting to move into Skylab, how did your shop adjust to that? Were you given new projects to do that were going to be for the Skylab?

ROWELL: Yes. They just moved right in to that. The engineers would come over with jobs that they wanted to get on Skylab, and we had several things that we had built that went into Skylab. Like I said, our work was items that someone wanted to do, some experiments or whatever, in addition to everything else that was on there. They'd come up with an area that they could do something or whatever, and they had that old Skylab there, before they moved it to the Space Center [Houston, Houston, Texas], had it set up. Then, of course, we'd build things, and they'd

go over and check it out over there and fit it into it or whatever, until they were satisfied with the job.

WRIGHT: In 1975, ASTP [Apollo-Soyuz Test Project] flew, and then the space agency was looking forward to Shuttle. That didn't launch till '81. What all was your shop doing during that time period, and how were you involved in how the new era began at NASA?

ROWELL: ASTP, what was that?

WRIGHT: The Apollo-Soyuz. That was the last of the missions.

ROWELL: We worked on that, too. We had some areas. I don't remember exactly now a lot about that, but most of that, we supported work that the machinists would do, but a good portion of the items, if I recall right, that TSD [Technical Services Division] did for the AST[P], was for machine work, because that was more of the docking and the locking. That was heavier stuff and had to be machined parts and that sort of thing, and most of that was machine work, if I remember right. But we would be responsible for helping out with the welding and that sort of thing, though, when they'd need welding.

WRIGHT: It must have been an interesting subject for all of you who started during that first days of space race, and here it ends with the United States working so closely with Russia to have a joint mission.

ROWELL: Yes.

WRIGHT: How did the shop move toward working for the Shuttle, and how did things change for your task?

ROWELL: It seems to me that we didn't have a lot of items. We did have a lot of stuff supporting experiments and that sort of thing that would be sent up on the Shuttle and all, but as far as anything to do with the Shuttle itself, I don't recall doing any work much for that.

The only item I can remember, I had to make a little shroud or a strut cover for when they first brought the Shuttle from California, that was the one that never flew, actually, I think was what it was used on, but later, they built more of these things. But anyway, the strut that held the nose part of the Shuttle on top of the—

BILLIE ROWELL: The Guppy.

ROWELL: No, it wasn't on the Guppy. What was the big plane?

WRIGHT: The 747?

ROWELL: The 747. They came one afternoon, and I'll never forget. It was one afternoon and another one of the rush job things. They needed this thing because they had experienced turbulence before when they had flown it just short periods of time, somehow or another on the nose of that Shuttle, riding on the 747, and they wanted a cover to cover that strut that mounted

the nose of the Shuttle to the 747. So they wanted someone to stay over on a Friday afternoon and work, and I had to work Friday, Saturday, and Sunday on that thing, form something up, just metal, that would cover that strut and then mount down to the—and had no real good drawings or anything. We had some sketches and rough dimensions and what have you, but we wound up getting it fixed. Then the only time that I actually was up close and saw a Shuttle then was out at Ellington [Field, Houston, Texas] there, when it came through going to the Cape and I saw my part was on there, on that deal. But they said it worked, so that was all that mattered.

WRIGHT: What type of work did you do for the experiments? You mentioned that a couple of times, in Skylab and in Shuttle.

ROWELL: I know on Skylab we built some containers that had to do with a lot of the medical stuff that was done on Skylab. Of course, they were weight-conscious and all of that, and this was made out of real thin aluminum, like .020ths-thick stuff. I remember that it was so thin that when we'd countersink the metal for riveting, we would dimple it instead of countersinking it for rivets.

Then they had some containers, little cylinders, and this was for some sort of medical deal. It was for some sort of medical—to return samples from there, and they were put into canisters and kept in dry ice or frozen, one or the other. It was kind of like a little miniature iceboxes, but they were round, and these things stacked in there. They were machined-out in piecemeal, and then the lids were welded. I electron-beam welded them onto it, and then they would put whatever it was into them and they had a screw-on lid then.

That, and I don't recall a lot of the other. As far as the Shuttle, I don't recall any specific items that we built. A lot of that was machine work, too.

WRIGHT: Through the years, the work that your shop did, did you also employ or work with contractors that helped you?

ROWELL: Yes.

WRIGHT: Could you share with us what kind of arrangement that was?

ROWELL: Our metal finishing was a contract shop. It was in the same building as the model and plastic, so all of our anodizing and chemical treatments of metal that we had to have done, that was done by a contractor. We had what they called routing slips for everything, if it was a flight item. If it had to go through metal finishing, it had to have that routing slip with it when it left our shop. It'd go over there, then their QA would stamp it off. Then it would come back and go through NASA QA, and all of it had a paper trail with it, the whole bit.

Let's see. What other contractors at that time? Most of the time, whenever I was there, that was about the only contract. Then later on, our electronics shop was taken over by the same contractor that was doing the metal finishing. That's the same way; if we had to send something through the electronics shop, it had a paper trail and it went through there with it.

WRIGHT: Over the years, how did your role change?

ROWELL: Well, like I said, I started out as an apprentice, and before I came to Houston, I had already finished my apprentice program. I worked enough overtime there, plus the previous experience that I had, that I finished my apprenticeship in three years instead of four, and came out to Houston. Then I worked on up through, and I wound up being supervisor over the Sheet Metal and Welding Section when I retired.

One other interesting item I just thought about, which we hadn't gotten into much of the Apollo, but in the lunar landing, the plaque that was on the leg of the LM, we made the plaque. That was done in the photo-etching-type deal, that plaque was made, and then we built the brackets and all that held it onto the leg and rolled it. We had to roll that thing to fit that leg, the way it's mounted onto the leg. And we made all of the plaques that's on every one of the LMs that's on the Moon.

WRIGHT: That's really special. What about the flags that went up? Were you involved with making [them]?

ROWELL: Oh, just a little bit, yes. That was a joint deal with the machine shop and our shop. The tubing and all that was used as the flagpole and all, we made those little items. That was one of the small items that was done.

WRIGHT: Do you remember where you were when Apollo 11 landed?

ROWELL: I was, yes, at home in League City [Texas]. We wound up having our youngest son christened after the landing, at what time? Eleven or twelve o'clock at night, we went over. We

had already had this planned, because we thought it was going to be earlier and all, and it wound up in the wee hours of the morning. But we called the minister up and he said, "Sure, bring him on over." So we went over. We didn't have all of our godparents there, but we had some stand-ins. The oldest son was born on the Fourth of July, so we thought, well, the next one, we'd have something to remember his christening by, so we had him christened on the landing on the Moon.

WRIGHT: What a memorable time. Apollo 13, when so many people came from everywhere to come back to the Center that night, when they heard about the accident, was your area involved at all in the recovery of that spaceship? Were you able to offer any expertise?

ROWELL: I'm sure that we did. The one thing that I recall in that area, I wound up going to California to an electron-beam welding place that did some of the welding on one of the tanks that exploded on that thing. I know that we probably did some items. In going out there, I'm sure that that's one of the reasons why we went, but right now it's slipped my mind. But I know that we did, and they mocked-up some stuff and then ran tests on it. That's usually what we would be wound up involved in. They'd want to do a test on a certain item or something like that to see if they could simulate what happened. I'm sure that we wound up doing some of that, but right now I just can't.

WRIGHT: During the course of the time that you were with NASA, did you work on any other projects that maybe weren't associated directly with NASA, but NASA was doing some kind of cooperative effort?

ROWELL: Yes. One thing—I think this would be considered what you're asking. This was a contractor that we supported, but we did some work in the area of when they were trying to see what made the astronauts sick, in other words. We built several items or modified them or what have you, for them to do these tests. Like the revolving chairs over in the lab over there where they do that testing. They would try to see what made some of the astronauts sick and others didn't get sick. I wound up volunteering as a guinea pig on that Vomit Comet. I don't know how many times I flew on the thing, to do experiments for them. We had these people that would come over there to get us to do little items, like building them fixtures or hold-downs or whatever for the Vomit Comet to take their experiments onboard the plane to fly.

There were two women that I got to know, and I was always cutting up with them, so I told them one day, I said, "I want to fly on that thing."

She said, "Fine. Get your approval from your division and go take your physical and what have you." She sent me all the details on it.

So I said, "Okay." So I did. I flew on the thing, like I said, several times; did several experiments for them. And they made me sicker over in the lab than I ever got sick on that Vomit Comet. I never did get sick flying on the thing, but over there, riding some of those revolving chairs, and then they'd say, "Okay, then we're going to unwind you." Well, going one way—and, of course, you're blindfolded the whole time. Going one way, it's not bad, but when they start you to go the other way—then they would ask you, "Which direction are you going?" And nine times out of ten it would be right the opposite of what you think you were going.

The worst thing was making head movements. You've heard, probably, that that's what the astronauts say, if they make quick head movements. Well, they had me revolving in this big

chair. I was blindfolded, and then on a beeper count, you lean your head over this way, back up, back, up, four times around, and forward and back up. Oooo, I got so sick on that that I was just—finally, I just told them—I broke out—that's the coldest, clammiest sweat that I have ever experienced. I finally just told them, "That's enough."

WRIGHT: I can understand that. What a brave man you are. Gosh.

While you were at NASA, one of the other side jobs that you did, I understand you were president at the union area.

ROWELL: Yes.

WRIGHT: Could you share with us why you wanted to do that leadership position, and what kind of responsibilities were involved with that?

ROWELL: For one reason, it was kind of a self-preservation-type thing, I guess, because at that time a lot of the working people, they [weren't] getting what they should have in wages and what have you. Out here—let's see. How to put that? We were on Wage Board scale, to begin with, and they did not like to go out on what they call a Wage Board Survey. And when they did, they only went to like production-type shops, where one man would be doing one little item. He didn't take a complete job and build it all the way through, which was nowhere near in comparison to our type of work, the type of work that we did. Because we would take a job, we'd get the engineering drawings and everything on it and we would build it, see it from start to finish, all the way through. So we felt that we [weren't] getting a comparison.

This started, though, way back at Redstone Arsenal. We were both involved in the union, and it was the same way back there. We had to fight for everything that we were getting. I had established a good rapport with the personnel director at Redstone. He was at Redstone, then he wound up being out here; Stu [Stuart H.] Clarke. So once we came out here, then we just continued on and we started the union out here.

BILLIE ROWELL: It was Jack [R.] Lister.

ROWELL: It was Stu Clarke first and then Jack. In fact, from Stu Clarke was where I first heard of the SMA files. He told me, sitting right there in his office, he said, "You can better believe I got my SMA file."

WRIGHT: Do you want to tell us what that is on the record, so we'll know?

ROWELL: Save My Ass file. But, like I say, we wound up going that route. After we got the union going and all, then I went out on the Wage Board Survey with the man from Personnel, one of the Personnel reps [representative], and I'd go out on the Wage Board Survey.

Every Monday morning, the first thing, I'd be in Stu Clarke's office, and I'd sit down with him; any complaints and questions and stuff that had come up from any of the areas, I would take and present to him. Then I'd have our union meeting then after that and would tell them whatever I had come up with from Personnel.

Stu was not anti-union or anything like that; he was good. Same way with Jack Lister after he became Personnel Director. I'd also known Jack Lister at Redstone. In fact, he taught

me. I don't know what grade and all that he was back there, but he was a teacher that I had in the apprentice program in one of the math classes—I think it was math—that had to take. I had known him from Redstone, too.

WRIGHT: How long did you serve as president?

ROWELL: Oh, gosh, I don't really know. Not that long. I don't know whether it was two years or four years. Something like that, maybe.

WRIGHT: After you left NASA in '87, I believe you mentioned earlier you went to work for Johnson Engineering.

ROWELL: Yes.

WRIGHT: Could you tell us what you were doing there? Were you still working on things for the space agency?

ROWELL: Yes, doing the very same type of work. I got out of any of the—I thought I was getting out completely, out of any of the management or supervision and all, and I did for a while. They were doing a lot of the mock-up stuff for the Space Station mock-ups. At that time, they were just getting started good into making all the big Space Station mock-ups. So that's what I was doing there.

WRIGHT: How long did you work with them?

ROWELL: I worked till ’97 I guess it was. Ten years.

WRIGHT: Goodness.

ROWELL: I wound up being supervisor for them before I left there.

WRIGHT: During all that time that you worked, when you look back, what do you consider to be the most challenging aspect or the most challenging project that you had to deal with?

ROWELL: I guess maybe it was during Skylab, or the Apollo fire and Skylab. Both of them were very trying times, and didn’t have a whole lot of time to get something done, and people breathing down your neck the whole time. But I suppose that would be about the most trying.

WRIGHT: So much of what you did is little by little in so many of the missions and so much of the successes of the agency. Is there one or two of those projects that you feel you’d like to think about as your greatest contributions?

ROWELL: Well, I like to think about the little MET buggy that we built that, like I said, the first rubber tires on the Moon. I wish I understood more about how the tires worked, because I understand they wound up, they pull a vacuum on them before they get up there. I mean when

they leave here, they're under a vacuum, and then they inflate. But that is over my head and I just didn't understand how that worked. But it seemed to work, anyway.

We had a lot of fun with that. I had a lot of good guys that I worked with, and some of the best engineers that you could ever hope to have worked with there, with Bill Creasy and his bunch, his section. We were all a lot younger then, but some of his were real young. The one young man I remember—I think he was an Aggie—he come up with the fold-up of that handle on there. They wanted to be able to fold the handle. Let's see. How much was it? The handle and the legs, all, and make it release with one pull pin, make it as simple for the astronauts as possible. And he came up with the bracket and everything to hold all that.

I forgot; I wish I could remember how many pins it was that they had to—and they were those pit pins that you just pull them. They were all mounted with little stainless steel cables in the rings of the pit pins. And all they had to do with those big bulky gloves, of course, was just pull, pull, pull, pull. It was either five or six, was all it was to fold up that whole thing. And that one that involved the handle and all, we kept telling old Larry that there was no way that that thing was going to work. It wasn't going to work. It wasn't going to work. But it did.

Of course, they tested all that in the vacuum chamber. They put a suited guy under the vacuum, in the vacuum chamber, like they would be on the Moon, and had him do that, unfold it, set it out, and it all worked.

WRIGHT: It's still amazing, after all these years, just thinking about it.

[Tape change]

WRIGHT: You were talking to us about being down those first days down at Redstone.

ROWELL: When we first started clustering engines, I remember when they came and brought us drawings and all to say that they were going to be firing multiple engines at one time, more than one. When we first saw the mock-up, actually the mock-up of the old Saturn missile, we just couldn't believe how much stuff was going into that thing. Just to think that they could get all of that stuff together and make it fire at one time. There's miles and miles of wiring and tubing and what have you where those engines are. And that's all we had; we had one of the big tanks and the engines. Of course, everything up above, they had no use for, because we were testing the engines and what have you, and firing them.

Our test stand there at Redstone, when they fired, first went to, I think it was four engines, after they'd gone to two. I think it was when we went to fire four engines, we used to have this one platform that was on a rollout, that you hook a crane to it and just pull it out on tracks, out from right underneath the engines. We didn't tie it off or anything; we just pulled it out on those tracks and it was sitting there. The first time they fired four engines, this thing vibrated back underneath, the fire of those engines, and it just hit I-beams and just really burnt into them, just burned them, cut a big gap out of it. So, of course, they had cameras and everything on it, and as soon as they saw what was happening, they got it shut down as quick as they could. But to see how that thing would do that much vibration on that stand and vibrate that big heavy steel platform back underneath it. So then they had to hook it up to the hydraulic and have it locked off, to keep it from vibrating underneath.

But for them to be able to rig up all of that stuff, wiring and all the tubing, for that fuel to be fired in there, it was amazing to me to see that. Of course, the first time that we went to put a

missile in the stand, a complete missile, we had already put in all the hold-downs and everything, but the afternoon that we was going to hang the one missile in there, with the six tanks and the engines, we got it up there and it would not quite fit. A couple of the mounting brackets wouldn't fit. We were able to get, I think, half of them in, and then three of them [were] out of alignment.

And it was bad weather. It had started raining that morning. It was icy and cold, and they told us to get some brackets on to hold that thing down, because the weather was supposed to get really bad and snow. They said, "Once you get half of them and get those three mounted, it'll stay there; it's not going anywhere," and then we were to go home. They were shutting down.

But it was something else to see them develop that. And that thing was so much bigger than what we had been seeing with the little Redstone missile, the deflector and everything. We had had to enlarge that thing so much and make it so many times larger to be able to fire up to the six engines on that thing. And I left there then, before they got the Saturn V stand completed, so I never got to see the Saturn V test fire. But I saw many of the old Saturn I. I saw plenty of those.

WRIGHT: Did you have any interaction with the German scientists that were there to be developing all of the engines?

ROWELL: Not the scientists, but my division chief was a German, Fritz Vandersee [phonetic].

WRIGHT: Can you share what it was like working under him?

ROWELL: Fritz was hard to work for. He wasn't one of the better ones, I'll say that. He was the type if he saw you doing something out in the shop and he didn't think you [were] doing it right, he [would] come over and tell you, "No, that's wrong. Stop doing it."

In fact, another old German that was working there, one of our technicians, he chased him out of the shop one day with a hammer. That was one of the first times that I got involved with Stu Clarke, the Personnel Director, because I was the union steward at that time. Stu had to finally tell Fritz, "Hey, if you don't want to get hurt," he said, "you better stay out of the shops. If you got anything to say to the technicians or the workers in there, you go through their supervisor. Tell him and let him explain it to them." He said, "You better stay out of the shop." And he did from then on. He had sense enough he stayed out of it from then on, but he was hard to work with.

Then another one was—I can't think of his name, but it would not be anything to see him come up on the test stand, when we'd be working out there, and he was actually over our lab, and especially if we were working overtime, like after hours or on Saturday. We had strict break times that we would take a break and all, and if he saw you taking an extra break or whatever, or if he saw you—we were not supposed to bring any coffee or food or anything out onto the stand, and back out to work with you—it'd be nothing to see him walking up the back stairs of that stand and checking on you to see what you were doing.

WRIGHT: Was it a close-knit community when you all were working out at Redstone? Was it a group where the workers spent a lot of time with each other on their off hours?

ROWELL: No, not really, not near as much as it was after we moved here. One reason maybe being it was an older group, I guess, that I worked with there. See, when NASA came in and took over, these were people that had been working there under the old ABMA that she was talking about, the Army Ballistic Missile [Agency]. There wasn't any socializing very much at all that I can recall. Not like it was, say, when we came down here. When we came down here, there was more of the same age type of people. A lot of our technicians [were] hired from San Antonio [Texas] down here that came [to] Houston. Then later on, we got a good many from Barksdale [Air Force] in Louisiana.

WRIGHT: And you all chose to reside in League City, is that correct?

ROWELL: We lived in Houston, then we lived in Friendswood [Texas], and then we lived in League City. League City's where we bought our first house there.

WRIGHT: The many years that you spent there, of course, with Johnson Engineering, it was over forty [years] that you were working with the space agency, and a lot of hours, a lot of tasks, lot of pressure at different times. Did it help part of that time that your wife worked at the Space Center? Did that help explain a lot of the reasons why you were there? I know sometimes, when we've talked to other people, a lot of the hours put a lot of pressure on families. I was just curious if it helped with knowing that somebody else understood that.

ROWELL: See, we didn't have any kids when we came out here. That was one of the reasons why I got to where I was tired of working overtime, because all we were doing was paying it out

in income tax, see, with both of us working and all. I finally just refused to work. Then that was another thing, that the supervision, they were going to make me work overtime. So I called Stu Clarke and asked him if I had to work. He said, "Well, if they give you a direct order," he said, "I'd advise you to go ahead and work." Well, I did. I went ahead and worked that one time that we had the confrontation. Then after that, they didn't care. They never asked me then after that.

Then we decided to adopt our kids, so once we decided to do that, then I went to supervision and I told them, I said, "Hey, I'll go back to work now." I said, "I'll work the overtime." And it wasn't that they really needed me. If it had have been, I'd have worked. But it was just that they had projects that they wanted to get done or whatever, and they would just schedule you. A lot of the times we worked a lot of overtime that I really don't think would have been necessary, but that's neither here nor there. It's my opinion.

Anyway, like I say, when we decided to adopt the kids, why, then I went ahead and worked, because I knew that was going to be an expense and would be from there on out.

BILLIE ROWELL: My hours were worse than his hours.

WRIGHT: So you were working overtime as well?

ROWELL: Yes, lots of times she did.

WRIGHT: One of the projects that we were thinking about during our break that I think we haven't had a chance to talk about are the tools that the astronauts used on their missions. Did your shop have a lot to do with that, and what involvement did you have?

ROWELL: Yes, they were all built right there in TSD, in both ends of the shop, machine shop and our shop. Like these small things that were on here, you can see a bunch of the stuff on there [gestures]. But all of that stuff had to be polished to start with. As it turned out, though, it didn't have to be, but, see, this was one of the unknowns. They didn't realize it. They thought that everything had to be bright and shiny, polished. Well, there's no way to get stuff that way, except the old hand-rubbing and polishing and what have you. So we had to slick finish everything, and then it was anodized to preserve that bright, shiny finish. And if you look at some of the latter tool carriers that was on the rovers, they dulled it instead of finishing it bright. They found out, I guess, that the heat and the reflection and what have you was bad, so they were dulled. In fact, they used a light abraded finish over it that turned it just to kind of a gray, a dull gray. It was still anodized after that, but they didn't want that bright, shiny, slick finish on them. We made all of those things. They were all made by hand.

WRIGHT: Can you tell us what some of these are?

ROWELL: Oh, if I could remember, I probably could. Of course, the little spade there. That's on the one side. I can't see very much of them, but we had a rake, and I don't see it on here at the time. Some of these handles that are there, they were shortened up. Some of them looks like just a piece of tubing, but what that is, is extension handles that they snap together. And this shovel, the end of it there has a lock mechanism on it so that it can turn it like a hoe to where they could dig with it. They could flip a little button and make it into a hoe where they could dig with it.

The rake was like a basket rake. It was almost like a basket. They would scrape up their rocks with the rake, and all the dust would fall out of it and then they would just pick their rocks up.

This one thing over here is a camera that's on—I made a trip to the Cape before the thing flew. Last minute, we got a call from the Cape. They were practicing in the clean room with this thing. [Edgar D.] Mitchell was the astronaut, I believe it was, that he had went to put the thing back on the arm there and something was interfering. It was hitting or whatever. So we got a call at the last minute, and one of Creasy's engineers and myself went to the Cape to make the adjustment on that, and what I wound up adjusting it with was my pocketknife. He held the vacuum hose for me.

We had a piece of Teflon that was like a little slide or a cushion there, and when they went to put it down in there, the QA people were doing this to start with, and they didn't know really how it was supposed to work anyway, and they were being real easy with it, and they happened to hit this area there. We tried the thing, tried it and tried it, and it was working fine for us. So finally, one of them came in and we asked him about it and he told us, so I just took my pocketknife and shaved a little bit off of it. Larry stood around between the inspector and myself, all the time I was shaving with it, and we got it to work.

We had to stay there then that night, until the astronauts came back through the clean room. We had to sit there and watch them put that camera back in there. Mitchell said, "Aw," he said, "this is probably the way I'll do that," and he's left handed and he grabbed that thing and [demonstrates] just shoved it down on there, I flinched. I thought, "My god, he's going to tear it up." But we went all the way to the Cape just to do that one little thing, though, because it wouldn't work to suit the QA people. We wound up modifying it to where it would work.

WRIGHT: How did you learn that things went well on the missions with your projects and your tools and whatever came out of your shop, and/or didn't go well? How did you get the feedback?

ROWELL: Most of the time it would be, if we had what I would call the good engineers, the engineers that we loved to work with and that we felt [were] doing what we thought they should do, what the technicians should, would be they would come back and if they were pleased with your job, you'd hear it from the engineers. Now, we had some that wouldn't, but most of them would come back and they would tell you.

Now, like some of the latter jobs, one in particular I can remember was, since the Shuttle has been flying, was that even the astronauts came through and told us what a good job we were doing. Because we were trying—here, again, one of these rush-rush jobs to get something finished from the test because they had had some problems with something. We'd been working that night. We'd worked I don't know how many hours, and next morning, one of the bosses came through and he was going to proceed to chew me out about something. I don't remember now what it was, and I was in no mood to listen to [anything] that morning and all, and I told him then—and the astronaut had just been through and told us they thought we'd done a good job. He said, "I like what you're doing, and it's going to work. I know it's going to work." Then this guy was coming through and was trying to tell me something's wrong. It just hit me wrong. Of course, I won't say what I told him, but anyway.

WRIGHT: When you got the plans originally, or the specs and requirements, when you looked at them, if you didn't feel like this was going to work, were you able to make inputs or suggest changes? Were they receptive to your input?

ROWELL: There again, some of the engineers would; some wouldn't. The best engineers that I found throughout the time at the Space Center that I've worked with [are] the ones that had some shop training behind them or they had gone to school on the co-op program, where we ran the engineers, the students and all, as they were going to school, ran them through the shop area. They worked right with us or whatever. They saw everything as we saw it, or chased it through the whole system. They'd work a week in our shop, work a week in the machine shop, in the electronics a week, metal finishing for a week. They saw everything through. Then, of course, some of the older ones that we had that were good ones; they were good from the very beginning.

But the better ones, I would say, were the young guys that had gone through that co-op program. That was one of the best programs, as far as I'm concerned, for developing engineers that you could have.

WRIGHT: Makes sense.

ROWELL: Yes, because they see it from our standpoint of view and we're the ones that would wind up having to do the finished product. And why not? If I can make your job be a little bit better, why not accept it, you know? But you had people, some of the hardheaded ones would

not. But not this guy. That's Bill Creasy right there [points]. You can't see much of him. I just now realized who he was.

WRIGHT: I was going to ask Jennifer if she had some questions to ask you as well.

ROSS-NAZZAL: I had a couple of questions. You mentioned you started out as an apprentice, and I'm curious, did JSC also have an apprentice program?

ROWELL: Yes.

ROSS-NAZZAL: Could you tell us a little bit about that?

ROWELL: In fact, I helped set up that. I'd forgot about that, but that was one of the chores that I did as being the union president there. I was asked to sit in on the hiring of the apprentice and setting up the apprentice program. The original apprentice program at JSC was a bit different from what I went through. Mainly it was because they wanted the apprentices to take harder courses, more engineering-type courses than courses that would develop good technicians. For instance, they were taking calculus and high-math courses and this sort of stuff. When we were sitting in on the original program for that, myself and one other, and this was an old black technical school superintendent or something, he was from one of the technical schools. They had a lot of the schools in the area to send in, some of the principals and different people set in on the original meeting of it. And he and I were the only two that questioned, "Why are you

having all of these high-level math courses, calculus?" Of course, trig [trigonometry] was all right, because you used some trig.

They said, "Well, we don't care if they go ahead and go to school then on their own and get an engineering degree." Well, see, that wasn't helping the apprentice program any. We were losing people, or the ones that would have made good technicians, they would have been like I would have been; they were not capable of taking these higher math courses and all because they hadn't had enough of the prerequisites for that. And we lost a lot of good people that would have made good technicians, for that one reason. It turned out then later on that they relaxed some of the higher math courses.

ROSS-NAZZAL: How many apprentices did you train, personally, do you recall?

ROWELL: I don't really recall, but at one time we had as many as three, I can remember, at one time, just in our shop. See, there'd be different ones. There'd be machinists, electronics, sheet metal. Welding was separate. We had a separate apprentice in welding and model and plastics. I guess that was all of it.

ROSS-NAZZAL: Before we started the tape, Billie had mentioned that Apollo-1 [fire] and the loss of a number of astronauts, before the fire, really impacted the NASA community. Can you give us a sense of how the NASA community dealt with theses losses and how it pulled together?

ROWELL: Well, I don't know. I don't know if I could answer that. I don't know how I would answer that.

WRIGHT: There must not have been very much time to mourn, because you had so much work to do.

ROWELL: There really wasn't. I was just going to say, you just come back into work the next day and everything would be rush still going on, just like when we lost the Shuttle that time, the first time. It had kind of gotten routine to see the launch. And that particular day, of all times—I guess I'd seen about all of the launches before—we had a TV that we could go across the street and watch. Normally, I'd go over there and watch liftoff, you know, then we'd come back to work. Well, I was working on something that day or something, and I remember walking down through the shop. I was heading to the machine shop for something, and somebody [came] by and they said the Shuttle blew up. That was hard to even think about. I just, you know—then I went over to see it. But I didn't see it initially. But after that, I think I saw most of them after that.

WRIGHT: It must have been a rewarding time to know that they have returned to flight, even though it did take eighteen months [after the fire].

ROWELL: Yes.

WRIGHT: I guess it must have been a joyous time to watch Apollo 7 [after the Apollo 1 fire], to know that we were moving on.

We've tried to cover as many areas that we knew about. Are there some other areas or thoughts that you would like to share with us before we close?

ROWELL: No, I don't think so. I think we've pretty well covered what you had listed down here, too.

WRIGHT: I guess on a fun note, I was going to ask you all [about] the splashdown parties and the after-success events, did you and your team members go?

ROWELL: No. She was in on more of those. By that time, she was in PAO [Public Affairs Office] more than the history part of it. She attended many of the splashdown parties. I only got in on one or two of them. We didn't get in on that. We were peons.

WRIGHT: The working folks.

Billie, we were asking Fred if there were any other areas that he could think of that we haven't covered, and didn't know if you had any other thoughts.

ROWELL: She asked about the splashdown parties. I told her, no, you were the one that got in on those; I didn't.

BILLIE ROWELL: Yes, we had quite a few. We would start soon as they landed. There were parties usually somewhere, and we would party until well into the mornings. Some mornings I

would get Sally home and wonder—Fred said he was so glad that our car always had a bridle on it; it knew how to get home. [Laughter]

But as a rule, I think the relationship we had at Space Center was very special. It's been a very important part of our lives.

You mentioned the hours a while ago, when I worked at the History Office. It was nothing for me to work until eight, nine o'clock at night, and go home, take work home with me and work till two, three, or four o'clock in the morning, grab a few hours of sleep, and be back. So my hours were a lot worse than his hours were at the Space Center.

WRIGHT: If someone heard that you worked that long in History, they may be surprised. What could you possibly do in all that hours? Could you share with us?

BILLIE ROWELL: Yes, Sally and I, there was two of us in the History Office, two girls, and we pulled the workload for five professional writers. So we did the typing, and we did not have word processing. I used an IBM Selectric typewriter. We did a lot of cutting and pasting. When Jim [James M. Grimwood], or whichever one of the historians, had a draft to do and we would make a hard copy, Sally and I did an awful lot of cutting and pasting. But we did the drafts of the histories of the space program.

WRIGHT: You called them fact sheets? Is that what they were called at the time?

BILLIE ROWELL: No, we did the hardcopy of the histories.

WRIGHT: Of the history itself?

BILLIE ROWELL: Well, the little fact sheets we did. Ivan and I would do those during Gemini, for when we would be in mission status. So whatever mission was going up, we had a fact sheet for that particular one. But that was just a drop in the bucket. No, our hours dealt with the historians and their writing of the histories.

WRIGHT: History was happening faster than it could be documented. Is that a correct statement from your point of view?

BILLIE ROWELL: No, not really. You capture the at-the-moment times, as far as that goes, in a chronology-type approach. Then from that chronology, they would glean the information that they would need to actually do the hardcopies of the histories. We usually had contract historians through the University of Houston [Houston, Texas]. Dr. [James A.] Tinsley was very interested in the history of the space program and all, and Jim had already started it, so he was just a marvelous historian. I used to tell him we could always tell when it was going to be a bad day because Jim was a pipe smoker, and when he was in one of these very deep thoughts, you know, some phase of the program that he was trying to get just right for the wording, he would walk through the offices and the black smoke would just roll from his pipe. He was like a steam engine. But that's what mine was, Sally and I were. And we were two redheads, two very positive people, but we worked well together.

WRIGHT: How long were you in that office doing that?

BILLIE ROWELL: Until I retired. I left the office in ’69, after we got our second child. Fred decided that it’s time I stayed home. If we were going to have children, then he felt that I needed to be home with the children. And when I went in and laid my resignation on Jim’s desk, if he wore false teeth, he would [have dropped] his teeth. He couldn’t believe that Fred was asking me to give up what I was doing.

We don’t regret it. The only thing, when I was ready to go back to work some ten or eleven years later, the technology had changed. You talk about things changing. I had gone from an IBM Selectric typewriter and now we were into word processing, and that was when the old IBM mag [magnetic] cards came. They were being used at that time.

I never did go back to the space program, because I think once you’ve been there during the era that we were there, that I was there, going back would be almost an afterthought. The excitement was over. All the news media had played down at that time, and I was so involved with the news media. All the broadcasters that would come in to cover the missions, and we had set up the news bureau to where we would be available to them to get information that they needed. We were their gofers while they were there.

WRIGHT: Was that part of your job as being part of the History Office or did you also become part of the Public Affairs?

BILLIE ROWELL: It was all PAO. The History Office was under PAO as well. That’s what I was saying, Howard was giving me the blow-by-blow on the Moon landing and so on.

ROWELL: Tell them about what R.D. said about [Walter] Cronkite.

BILLIE ROWELL: They had this little deal on Moon landing, and there was a contest about what would the astronauts say, what would be the first words they would say. I had said something about it, and our little one, at that time four, his remark was that, "Thank God we're here, but where's the helicopter?" And Walter Cronkite had picked that up and carried it on nationwide news media coverage. He was one of our favorite coverers of the space program. Very, very nice guy, very interested, very lovely. Was not the old "Get the story any way I can, regardless of what coverage," and we had a few of those.

Jules Bergman was one of those that he got his story at any cost. It didn't matter. Jules was—he was something else. But as a rule, the broadcasters were very, very good, very, very conscientious as far as what they were doing and then how much they invaded the lives of the astronauts.

WRIGHT: You worked the night of the Apollo 11 landing. Were you still working at the Center at the time?

BILLIE ROWELL: No.

WRIGHT: You had retired before that?

BILLIE ROWELL: Yes. No, I was not there. I left the Center in September of '69. Our middle child at that time was nine months, I guess.

WRIGHT: You were there for—

BILLIE ROWELL: ’62. Seven years.

WRIGHT: Tell us of the differences, of course, working at Alabama and then moving to Houston, in your duties. What were you doing down at the Redstone Arsenal?

BILLIE ROWELL: I was in an engineering group, and I guess one of the first projects I had there was putting all of the [engineering] drawings and specifications on microfilm, one of the first recordings of engineering drawings as far as missile programs go. We put it on a microfilm program.

Then when I came to Houston, I had taken a leave of absence and was not working when we first got here. Then in January of ’63, I started working with the Tech Library, Charlie [Charles M.] Grant’s area, just from the experience of cataloguing of the microfilm program that we had done at Huntsville.

… I left there, when they set up the Public Affairs Library. I was one of the first ones. Thelma Helfrich was the initial lead on that, and then I came right in with her, and she and I ran the Public Affairs Library for several years, and wound up supporting the History Office. Then ultimately wound up with Jim in the History Office, Jim Grimwood.

WRIGHT: The Public Affairs Library—was that mostly the news media?

BILLIE ROWELL: People would write in for information. Visitors would come in and want pictures. Astronauts would come through wanting information or whatever, or they would be getting information to send someone, so we were just kind of a little two-woman supply, customer-service-type thing is what it was designed as.

WRIGHT: So it was almost nonstop there in those days?

BILLIE ROWELL: Yes, but a lot of interesting people; a lot of different people that came through. I met [John F.] Kennedy the day before he was shot, so that was a very tragic time.

One of the funniest things I had is with the southern accent that I had, Prince Philip was over for a visit, and as a prelim, you always get the Secret Service or the security people that would come ahead of time to scope out the areas that the Prince would be traveling in. I was running late this one particular morning and just go flying in the office or in front of the building, and, of course, my first reaction is, "Morning y'all" type thing, and I just go sailing on down the hallway.

And in a few minutes, these little black-suited men came down and they asked what did I say. And I was so embarrassed. I had no idea what—I knew I hadn't said a cuss word or anything like that. I had no idea what I had said, and when he was trying to say what I said, then I realized what it was, and he just wanted me to say "morning y'all" again. But that was the type of my experience, was a fun, fun experience at the Space Center. A lot of fun times. A lot of fun times.

WRIGHT: Jennifer, do you have any other thoughts or questions you want to ask?

ROSS-NAZZAL: Yes. You had mentioned, before we turned on the tape, how a lot of the tragedies sort of pulled the community together. Could you talk about that a little bit on tape?

BILLIE ROWELL: A lot of the tragedies pulling our community together in that we supported—when Theodore [C. Freeman] was killed in the accident, and I remember Faith [Freeman] was at the grocery store shopping, and one of the Houston newscasters found out, by accident, where she was, went to the store where she was, and she had no idea Theodore had been killed. From that particular incident, we became a community of shielding the astronauts, maybe not pulling them together per se, but shielding, protecting them and their privacy, because we didn't want the invasion to be there, when [Virgil I.] "Gus" [Grissom] lost his spacecraft and things like that.

They lived in the community with people. They were neighbors to people. Fred and I attended church with several of the astronauts, so I think the camaraderie that we had, or the friendship that we experienced was deeper than what we see now. It's not as far apart. After Frank's [Borman] mission and his need to share his experience with us, Susan [Borman] invited a bunch of the women over to the house, and he shared with us his personal feelings of his flight, and he said that the most awesome part of the flight was being able to look out the spacecraft window and shut out what we knew as Earth with a thumb. That's the magnitude that it had on these guys.

But they were very down-to-earth people, and if you meet them one-on-one, you wouldn't know who they were, where they had been, or maybe where they were going. So they were special that way.

ROSS-NAZZAL: That's great.

WRIGHT: We had talked about the different groups and the cultures and people that came together, and one of the other things we were talking about when the tape was off earlier was the one man who pulled it all together, which was Bob [Robert R.] Gilruth. If you don't mind, if you can share your thoughts for just a second about working under someone of his leadership.

BILLIE ROWELL: I think he was specially picked. He had a gift, a very unique gift, in dealing [with people]. He was a people person. People that I knew that worked with him enjoyed going to work and being a part of whatever his leadership was for that particular time. He was unique in that he could command production in the easiest, most unsuspecting way, and yet you did not realize what were you doing, as far as that goes. To me, he was the epitome of a leader. He was not a pusher or anything like that; he just commanded the respect, not verbally, but just being the person that he was. I found him to be that way.

WRIGHT: We thank you for this morning, and you've given up your entire morning. I'll just ask again if there's anything else you can think of or any other comments you want to make.

ROWELL: No, I don't think so, myself.

WRIGHT: If not, we appreciate your time.

BILLIE ROWELL: Thank you.

[End of interview]