NASA JOHNSON SPACE CENTER FACILITIES
EDITED ORAL HISTORY TRANSCRIPT

RONALD L. NEWMAN
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is October 21, 2009. This interview with Ronny Newman is being conducted at the NASA Johnson Space Center [JSC] for the JSC Facilities Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. Thanks again for taking some time to meet with us this morning.

NEWMAN: My pleasure.

ROSS-NAZZAL: We certainly appreciate it. Would you start by telling us about your career at NASA?

NEWMAN: I'll start a little before that. I'm a native Houstonian, one of the few I know around here. I went to all the regular grade schools in Houston. Didn't feel like leaving for college, so I stayed here and went to Rice University. After coming out of Rice, I was interested in working for NASA. It wasn't a childhood goal. I watched the Alan [B.] Shepard flight and the early Mercury, Gemini, and Apollo flights. I was always fascinated by it. It always seemed so distant from me, as far as I never thought that I would be part of it, until looking for a job coming out of college. I thought that a good source of jobs was NASA. It was a fascinating thing to work for.

I did apply for NASA proper in the electronics area. I talked to some people in Building 44. At the time, this was in 1977; it wasn't a hiring time because [this was] post-Apollo and before Shuttle hiring really started building up, so NASA didn't have any openings available. My placement office got a notice of a need for a spacesuit engineer for ILC [International Latex Corporation]. ILC Dover is the name of the company. I applied, interviewed, was hired, all within a week and started the next Monday. I was hired to work in Building 7. During my interview, I walked into the high bay area where they have the chambers, and my interviewer told me, "That's an astronaut over there. He wanted to test the spacesuit." It was just all overwhelming and very cool.

A week later I was working here. It was all in a haze. I wasn't here in time for Apollo, but I was here with a lot of people who were, the suit techs like Joe [Joseph W.] Schmitt—I know he's in your interview database—Alan [M.] Rochford, they were the NASA techs; also the ILC techs like Ronnie [Ronald C.] Woods. When you see the Neil [A.] Armstrong walking out of the suit room into the van on the way to the pad, Joe Schmitt is right behind him, but Ronnie Woods is already in the van. Working with the people that were part of history is always fascinating.

At the time, they were still developing the Shuttle suit, so I was here to witness a lot of the development of the Space Shuttle suit. The company doing it was in Dover, Delaware, and that was my home plant; the company I worked for was ILC. ILC built the suit itself. Hamilton Standard built the life support system backpack. We were subcontractors to Hamilton Standard; they're now Hamilton Sundstrand. Both of those items were being developed. The spacesuit functionality, how well you could operate it, all the evaluations happened here because this is where the astronauts were.

I started in 1977. In 1978, the first class of Shuttle astronauts was hired, the group of 35. One of my jobs was being the sizing expert on the spacesuit. The group of 35 would come through, and we'd measure them all and see what kind of suit they would take. They made spacesuits in different sizes, and based on whichever size was made first, a certain number of astronauts would be selected to come through, do evaluations, put the suit on, and see how well it worked.

To summarize the rest of my career, I was a spacesuit engineer and eventually became a manager of the field group supporting the spacesuits. I worked for ILC for 12 years. I got an opportunity to join NASA. After the [Space Shuttle] *Challenger* accident [STS 51-L], they were hiring flight safety engineers, and I joined NASA as a civil servant and as a flight mechanical systems safety expert on the spacesuits and on spacewalks.

I was in safety for three years, the last year of which I spent on detail to the mission director's office for the first Hubble [Space Telescope] servicing mission, STS-61. A special mission director appointed by [NASA] Headquarters [Washington, DC] came down [to] take a special overview and look at all the work that was going into that mission, because it was such a publicity risk if we didn't fix the telescope. They appointed a special office down here. It was a Headquarters person running a JSC mission; there's a little bit of tension there. They needed a safety person, and I was going to be the Hubble mission safety lead, especially for EVA [Extravehicular Activity], spacewalks.

Because I was in that slot and they asked for a safety person for this mission, they detailed me for a year. Randy [H.] Brinkley was that mission director. Once that mission was conducted successfully, then he was given the control of the Space Station Program. I moved with him to the Space Station Program. I was there for a few years, and then they decided to

reorganize slightly, and my functions were moved over to MOD [Mission Operations Directorate].

When I was in the Space Station Program, I oversaw the development of the Neutral Buoyancy Lab. I was one of the people on the operational readiness inspection team. I became fascinated with that facility. When I got the chance to come to MOD, I started working at the Neutral Buoyancy Lab. Was there for about six years, then was put on a source board for a year and a half. I'm now in Building 9, and Building 9 is a sister facility to the NBL. My division chief knew that they needed help here, and coming off the source board I came here. This is my second year here.

ROSS-NAZZAL: Wow, quite a diverse career.

NEWMAN: Everywhere I've been has something fascinating about it. It's hard to avoid at NASA.

ROSS-NAZZAL: If you could, tell us about Building 7 and what its purpose is and how it was used to support the Space Shuttle Program.

NEWMAN: I'm a little ignorant of all the organizations that are in the building right now, but it's traditionally the home of the Crew Systems Division. There's an office area, and there's the high bay industrial area. Actually, Building 7 I think is the high bay and 7A is the office. May need to verify that.

Crew Systems is responsible for developing the spacesuit, including both the suit itself and the life support system. They're responsible for crew equipment, just simple things like tools they're going to need for spacewalks. I think they work on the tools also inside the spacecraft, the Shuttle or the Space Station. They're responsible for the life support system on board the Shuttle. They are, I believe, responsible for the toilet on board the Shuttle. So anything environmental involving the Shuttle, the environmental control system, both the Shuttle and the spacesuit, they're involved.

The high bay area, when I first started, included actually a 20-foot vacuum chamber, which was used for some isolation tests before my time. They would put people for a month at a time or three months at a time to just practice living away from anybody else for all that time to see how people reacted to Space Station-like conditions. They also had an eight-foot chamber. Any time I use the word chamber, it implies vacuum chamber, where you take all the air out. There are parts of the spacesuit that only work in a vacuum. The cooling system requires a vacuum because the cooling water, when it sees vacuum, it wants to immediately evaporate, but if you restrain it physically, it won't be able to evaporate, it'll just get cold. It'll form ice. It's that ice that actually cools the spacesuit inside.

A vacuum is essential to make the spacesuit work, and so they want to make sure that it will work in a vacuum before they launch the systems. The eight-foot chamber was used for testing just the backpack. They also had an 11-foot chamber. Each of these chambers is basically a cylinder. When I say an eight-foot chamber, that means it's an eight-foot-diameter cylinder. There's room for a person to get into it, but not move around. There's a larger 11-foot-diameter chamber where they would have a treadmill so the person in a full spacesuit could get on the treadmill and work up a heat load. Walking on a treadmill is a lot of work in a spacesuit,

and so they wanted to make sure that the cooling system is strong enough to handle the heat load of a person working at the workload they expect on the Moon or in the Shuttle or outside the Shuttle. Vacuum chambers were used to test the parts of the spacesuit that only work in space.

While I was there, they installed the ECLSS Test Article. ECLSS is environmental control and life support system. It's a Shuttle system, but I think they just changed it later to Environmental Test Article [ETA] to simplify things. The test article included a Shuttle airlock; on the real Shuttle astronauts put their spacesuits on inside the airlock. After they put the suits on, then they'd drop the pressure in the chamber. They went through the entire procedure that they would do in space; they went through those procedures here on Earth to train the astronaut and also let the astronaut really feel what it's going to be like inside his or her suit before they go out on a spacewalk. It's an important part of their training that once for each astronaut in their suit, they would go through that process to feel what it's like and to hear the sounds, smell the smells, and to know what to expect once they get into space. As they put their suit on, drop the pressure in the chamber around them, their suit would then keep its pressure. It would stay at 4.3 pounds per square inch of pure oxygen before they would go outside. They would experience all that in a vacuum chamber in Building 7 after they got in the ETA.

They would do similar things inside the 11-foot chamber, but they weren't inside an airlock mockup. The airlock in the Shuttle has switches that you have to be able to reach, and you need to know where they are, which switches to flip when, and what umbilical connections to make. All that training happened after the ETA was delivered. I understand there's now a different kind of chamber, the SSTA or SSATA [Space Shuttle Airlock Test Article] or something like that, but that was after my time so I'm not going to do that.

ROSS-NAZZAL: Would you describe for us one of the tests that you might conduct on a spacesuit, the MMU [Manned Maneuvering Unit], or the primary life support system? Who was involved? How long a test might take?

NEWMAN: The ones I'm most familiar with would be in the 11-foot chamber and in the ETA. The 11-foot chamber, for example, one of the design criteria would be that a spacesuit has to support a certain workload from the astronaut for eight hours at a time. The normal length of a spacewalk is six hours. There's an emergency tank, two tanks in the backpack, which will supply emergency oxygen in case the fan breaks. The spacesuit recirculates your gas, your breathing air. It replenishes your breathing air. Well, actually in a spacesuit it's pure oxygen. It supplies pure oxygen, but you breathe out carbon dioxide. The spacesuit has to filter out that carbon dioxide to keep it from building up, because if your CO2 level builds too high, then you get headaches, you get sick, and eventually you will die. It's painful first. You're trying to avoid any kind of buildup, so it extracts the carbon dioxide from the breathing air and replenishes with pure oxygen.

It keeps you cool. There's a certain amount of cooling water that circulates through plastic tubes that run around your body. The tubes cool you off. You can adjust the amount of or the mix of the water, warm water versus cold water, you can adjust that temperature to your liking. In fact, you have to do that. I'm going in several directions here. When you're in orbit, you're in the sunlight, your suit temperature can be 250 degrees Fahrenheit. When you're in the shade, your suit temperature can be -250 degrees Fahrenheit. It's physics so you know sunrise is coming up pretty soon, just before sunrise comes up you tend to turn your cooling high, get maximum cooling, because it takes a little while for the cooling to take effect because it's got to

cool your entire body basically. There's heat there that it's got to take care of. When you're in the Sun, the Sun very quickly makes your suit warm, so you have to anticipate that a little bit ahead of time. You get cold first, and then you get hot. Like I said, because it's physics, you know it's going to happen, you know sunrise is coming up in five minutes or three minutes. You know precisely when that's going to happen.

So the cooling system has to work in the spacesuit, and the air system has to work in the spacesuit, and both of those things have to last for at least six hours. There's always margin they build in the design, because astronauts want to do more things than they originally had scheduled or because something takes longer than originally scheduled. There's some margin. You can go a little bit longer than six hours for a spacewalk. In fact, most Space Station spacewalks lately, they've sort of changed it to a seven-hour normal time span as the suit got a little bit better and as they know better how to handle the recharging of the suit. They stretched the normal working time for that.

You want to make sure that every suit that flies has been through an 11-foot chamber run where they test for however many hours the test profile calls for—nominally six hours, but they'll probably test it for seven just to give you some design margin—to make sure that the cooling system works for that long, make sure the fan works for that long, make sure that there are no leaks that would deplete your oxygen sooner than the six hours. It's impossible to make a suit that doesn't leak. There's an allowable very small leak rate.

You have suit bearings. If you're just in a cloth tube that's pressurized, it's very hard to bend, very hard to operate, so they sew in special joints in the cloth so that you can bend your fingers, that you can bend your elbow. Your shoulder works in a certain direction, and in fact it works in several directions—you can turn and move your arm up behind you, in front of you—so

your shoulder has to go in several directions. So they helped shoulder mobility; they installed a ball bearing around your shoulder so that it spins. One of the difficulties in designing a bearing that's supposed to hold the air tight is that you have a seal that rubs up against a ring. You have a 30-inch perimeter, circumference around the bearing, and every point on that seal has to be touching in order to hold the gas inside. It's hard to design. Any time you move something, to try to keep perfect contact, it's impossible, so there's always going to be some little amount of leak. The allowable amount of leak is small enough so that all your gas will last for the eight hours it takes you to do your spacewalk. All that gets tested when you're doing an 11-foot chamber run.

To test the heat control, the thermal controls, you have to do physical work. In the 11-foot chamber they have a treadmill for the astronaut to do physical work. You can build up a lot of heat using your arms, but your arms get tired very quickly when you're under heavy loads, so it's your legs that build up most of the heat. They have a treadmill to do that kind of workload.

So an astronaut would be inside the 11-foot chamber. There would be, I think, typically two emergency technicians. They're considered chamber technicians. I don't remember the names of the contractors who provided the chamber support people. I'm sure Lockheed was involved at one time, but I don't remember some of the other contractors. With the main chamber being as close to total vacuum as we can get it in the facility, there's an anterior chamber that would be at a middle altitude, equivalent to 18,000 feet, where it's partially depressurized. A technician would be there on a breathing air mask, so that if there was an emergency he would be the first person to be able to go inside. They would repressurize the chamber, and because he was partially there, the chamber didn't have to come up to full atmospheric pressure for him to be able to go in and render help to the crew member if there was

an emergency. I don't remember if there's one or two of those technicians in that intermediate pressure, but there's at least one.

There would be suit techs on station. The suit techs would go in and suit the crew member up: put the suit on, close everything up, make sure there was no leaks. They would leave, but they would stand nearby in case of emergency, so that once the pressure of the chamber reached normal atmosphere pressure for us, they would be able to go in and render any aid to get the crew member out of the suit quickly if they needed to.

Test conductors would be in the control room calling the procedures and giving orders on how things were run. The typical control room would have—this is not my area of responsibility, but this is just from my memory—maybe eight people inside the control room. There would be other rooms where you could monitor what was going on. The doctor would be in one of the back rooms. I as a suit engineer would be in one of the back rooms also. The medical and the safety people would be on communication loop, but not necessarily in the same room, just for space limitations, and to try to keep a certain amount of order. There's a lot of side conversations in the room you don't want, so keep the number of people small so the normal amount of noise is small.

There would be people operating the vacuum pumps. I'm sure there were technicians on duty to make sure those were operating properly and that they kept operating when they needed to. Also in the control room, there'd be a person whose job it is to hit the button to repressurize the chamber, if they needed to, for an emergency.

ROSS-NAZZAL: That's quite a lot of people.

NEWMAN: Yes, and there's all our bosses over in the offices.

ROSS-NAZZAL: So you think about maybe 20 or 25 people involved in a test for the 11-foot chamber?

NEWMAN: Yes.

ROSS-NAZZAL: What about for the ETA?

NEWMAN: The ETA, it would be very similar. Again, I don't remember how many techs were in the intermediate altitude pressure. Pretty much the same, other than the fact that you don't have a treadmill operating. You still have all of the same safety concerns, so pretty much the same amount of people for that too.

ROSS-NAZZAL: Would simulations run the same way? Were there simulations done in the chambers and the ETA?

NEWMAN: It was rare for the chamber runs to be connected to mission control, for example. Other than every ETA run would have a little bit of malfunction practice. They'd say, "Pretend your fan just stopped operating. Your suit pressure is still okay. What do you do? Now pretend you've got a suit leak. Your pressure is dropping at such a rate. What do you do?" So they would do malfunction training. But as far as simulations? You can't induce a leak on purpose for safety reasons. They would just tell you, "Pretend right now."

The spacesuit would have a checklist on the arm. For a certain emergency, you'd flip to that page and go down those steps to do to first of all isolate the problem and then solve the problem. They're wearing physical cards on their wrist because you can't depend on communications because that might be your problem. You may lose com, so you have your physical emergency response checklist right there in front of you. So they would practice. Over the com loop they would tell you, "Okay, now you've lost com, what do you do?" You flip to the right card and go through the steps and turn your radio off and then back on and see if that fixed it.

ROSS-NAZZAL: Were you ever a test subject yourself in the chambers?

NEWMAN: Not in chambers. I have the slightly embarrassing problem of my right-sized upper torso was a medium, but the neck area was too small for my head to go through it. I would have been a chamber subject, but I couldn't fit in my suit because my head was bigger than my body.

ROSS-NAZZAL: Tell us if you would about getting ready and testing for STS-5. That was supposed to be the first Space Shuttle walk and then there were problems with the suit. Can you tell us about all that?

NEWMAN: It was supposed to be the first spacewalk. For every Space Shuttle mission, there are at least two people assigned to do spacewalks, even if there's no spacewalk scheduled for that mission. Every mission has to have the ability to go out and close the payload bay doors, or there are other contingencies. For example, after the external tank separates from the Shuttle,

where it was connected—they had to have a connection there and the liquid oxygen and liquid hydrogen flowing through the connection—you can't have it covered with tile. After the ET separates, that opening there has a door which will automatically close and seal. One of the big concerns was if the latches don't work, if the door doesn't spring closed properly, reentering could be fatal because you need the tile protection right there.

So that door had backup mechanisms to help make sure it would close, but everybody was wondering, "Well, sometime we may have debris in it, or maybe some other reason that it just doesn't close. We have to get astronauts out there to fix it." They had some ideas on how to get the astronaut to that spot on the Shuttle, but the robotic arm on the Shuttle couldn't reach that far to get the astronaut over there. One idea everybody had in their back pocket was you take a laundry bag, just something with some mass but soft. You tie it to a tether, throw it around the Shuttle, let it wrap around the Shuttle, catch it as it comes around in the payload bay, and then you tie both ends that way. Then you can have a little cord that you can pull yourself over and hopefully get close to the external tank door.

There were other emergencies that had known fixes. If the payload bay door latches don't work and close securely, there are mechanical overrides that you can perform. The astronaut would then go out in the payload bay, and they'd have their own special wrenches and other tools that they would ratchet down the doors and close them.

In fact, after reading Jim [James W.] McBarron's interview recently—knowing that I was going to do this, I looked at some of the ones that you already had—his interview reminded me that if it weren't for concerns about closing the payload bay doors, we probably may not have had EVA capabilities on the first Shuttle flights. A lot of people, including Chris [Christopher C.] Kraft, were skeptical of the safety. They didn't want to make spacewalks an everyday thing

because of the safety concerns, but because of concerns on what might go wrong, every Space Shuttle flight has always had at least two spacesuits on board. Two astronauts were always trained to use those suits, and also because the suits had to be sized for those particular people, you named those people ahead of time, you trained them in what they needed to perform. Sometimes it was just emergency repairs, but other times they actually scheduled spacewalks. Whether they had any scheduled or not, there were two suits on board.

For STS-5, the two crew members were Joe [Joseph P.] Allen and Bill [William B.] Lenoir. I don't have all the details of the malfunction of the suit. I know one suit had a problem where it just wouldn't start. There was a fan speed sensor that didn't work. The sensor would sense either a fan operating at too slow a speed, which means it wouldn't give you enough circulation to clear out the CO2 from your breathing gas, so it's unsafe to operate. It wouldn't let you operate; it would shut off. If your fan was going too fast, it might be an indication of an electrical problem, and so it would shut off. The fan speed had to be a certain rate for the system to keep operating. That sensor itself didn't work, so it wasn't sending the right signal to keep the system operating, so that suit didn't work. I think it was Joe's suit that didn't start at all.

Bill Lenoir's pressure regulator was slightly maladjusted. I don't remember if it was vibration— somehow it maintained the suit pressure too low. I don't remember the numbers, but it wouldn't let the suit pressurize fully, so it was unsafe for him to go out. Plus, we always want to send people out two at a time just for the buddy system. If there's an emergency, you want somebody out there to help you, so we never sent anybody out just one person at a time.

So both of the suits weren't operating properly. There was thought of just leaving the one suit that almost worked, put that just in the airlock, and just to experience, to say we actually did open the door and did our spacewalk. They eventually decided that wasn't the right thing to

do. STS-5 was supposed to be the first spacewalk, but was not, which made STS-6 the next target of opportunity.

STS-6 crew members had been assigned already. It just happened to be Story Musgrave, who happened to be the suit representative for the Astronaut Corps, so he was somebody that we knew and had worked with a lot. It was kind of like one of our own got lucky and got his break to do the first spacewalk. It was Story Musgrave and Don [Donald H.] Peterson. They ended up doing the first EVA for Space Shuttle Program. I remember one of his talks that Story gave to us later. He talked about funny things happen in life, and sometimes the tide takes you out, sometimes the tide brings you back in. It's his way of saying that circumstances fell to him. He would have been a good choice, period, of being the first spacewalker, because every astronaut has a technical assignment, and Story's technical assignment was the development of the Shuttle suit. He knew it probably better than any other astronaut. It was one of those lucky things that the person who knows most about it was the first person that got to use it.

ROSS-NAZZAL: Were there any missions while you were working at Building 7 that you were ever called upon—say there was a mishap or malfunction in space—to work on in the chambers or the ETA?

NEWMAN: I don't think so. There were suit problems that happened, and we would get together sometimes in our labs to try to recreate the problem and to better understand it. It was suit-specific. I don't remember a chamber run. There may have been some I don't remember.

ROSS-NAZZAL: Are there any missions that you supported when you were working in that building that really stand out in your memory that just boy, that was great?

NEWMAN: Yes. STS-5, STS-6 was obviously very big to us. I was the lead engineer for the flight suits, the suit portion, for ILC. Bringing the suits back from the first spacewalk was important. We wanted to make sure they were taken care of, and they were carefully transported, carefully packed so that we could study them to see what happened to them by being in space. I was assigned to go out to Edwards [Air Force Base, California] for the landing to oversee the packaging of the suit to bring it back. While I was in my hotel room, I got the phone call that we weren't going outside; we didn't do that spacewalk. So I got a free trip to California, but I still had to bring the suits back.

Let's see. I'm going to talk about STS-4 right now. STS-4 included the first time anybody put the suit on in the Shuttle. It was not planned to go outside, they just wanted to make sure that you could do the procedures. There was always a question. Because of the way the suit is built, there's a waist ring that is a big circumferential ring in the middle of your body where these two rings have to come together and latch completely, front and back, all the way around, in order to make the seal. After a person climbs into the upper torso, which is holding the backpack, then you've got your pants on already, but you got to attach the pants to the upper part of the suit. It's a ring with around 12 latches, it might be eight latches, all the way around. Each of those latches has to close.

They had to test them in zero-g missions to make sure the astronauts were able to close it without gravity, and close it by themselves ideally, even though the other astronaut was there to help if they needed to. They always trained to try to be able to do it by yourself. It was

important that we know that once you're actually in space that a person can put it on. Ken [Thomas K.] Mattingly was the commander of STS-4, so it was his assignment to get in the suit and put it on.

When you're in space, you grow taller than you are on the Earth, just because when we're here our weight compresses our spine. There's a certain amount of zero-g growth that you get just immediately when you get to space. You grow a fraction of an inch just because your tendons and ligaments are relaxed, and they're no longer compressed by gravity, so they'll stretch a little bit when you get to space. Also, your spine is compressed by your weight here on the ground, so some of the fluid goes out of your vertebrae. When you get back into space, fluid seeps back into the vertebrae and you start growing. In the morning while you're still lying down you're a little bit taller than you are at the end of the day. You get up, but very quickly the gravity will then make you your normal size when you get out of bed. In space, you're longer.

There was a design feature early on in the Space Shuttle suit where there's a bracket where you could just push a button and the suit would get one inch longer. That bracket was heavy, expensive, hard to make. In spaceflight, every pound you add is going to be lots more pounds of fuel. There's a big cost to adding any kind of weight. Because of the money, the design complexity, and the weight, they decided to get rid of that feature. I guess it was decided that people would still be able to close the suit without a problem.

As a spacesuit engineer, I knew that astronauts like to have a tight-fitting suit because it gives them more mobility. So if you have a tight suit and you're growing an inch, are you going to be able to close it? I did a little bit of research on my own using the NASA data from Skylab. One of the astronauts who was in charge of that experiment, they measured how much you grew in space over a period of time. After a couple days, you grow as much as you're going to grow,

but you do grow. If you have a tight-fitting suit on the ground and you get up in space and you're bigger, it kept worrying me that you weren't going to be able to close the suit.

I recommended to my NASA technical monitors that we really needed to accommodate that somehow. I brought the data to them and convinced them that actually we do need to allow for that. We no longer have this capability. The way we fix that is we fit the suit to them properly on the Earth, then just before launch we add anywhere between an inch and two inches, to the length of the suit, to be able to make sure they can close it. We ended up deciding at the time to add one inch to everybody's suit length to allow for the spinal growth.

When Ken Mattingly put the suit on, it was a nervous time for us, because no one had ever done this before. It was a big deal for him to put the suit on. He put the suit on. He was able to close the suit. Over the com loop he said, "They were supposed to make the suit longer, but it feels just like it did on Earth." It was one of those things. It was a problem averted, it was no big deal, but I know that it could have been a problem. So actually, my most concrete contribution to the space program is to add one inch to the suit. I was glad nothing happened. It was good. Again, it's one of those things. I don't know if that counts as a Building 7 thing, but since I lived there, I'll count it.

ROSS-NAZZAL: That sounds good. You had mentioned STS-4, so I was curious. Did the building also test the pressure suits for the first four test flights? Was that included as well as the spacesuits?

NEWMAN: Yes. There was another branch of Crew Systems Division that did the launch and entry suits. Now the Mail Code XA [EVA Project Office] folks control or are responsible for all

the EVA developments, but still it's Building 7 that handles the design of the launch and entry suits too. Yes, they did. I know Jim [James O.] Schlosser was the NASA manager over that program for launch and entry suits. Yes, they did train the astronauts and did the functional tests there. There were also test facilities at the Cape [Canaveral, Florida] before launch so they could test them the morning of launch and that kind of thing, and also after the astronauts donned the suits they would test and make sure they were functioning properly.

ROSS-NAZZAL: You mentioned that STS-4 was the first time someone had put the suit on in orbit. Did you have to have all of your testing of the suit done and ready for that first flight of STS-1 in case something happened with those payload bay doors?

NEWMAN: Yes. The STS-1 suits had to be tested the same way, just make sure they were running. John [W.] Young and Bob [Robert L.] Crippen went through their chamber tests in their own suits and made sure they worked, made sure they fit right.

ROSS-NAZZAL: When did you start using astronauts to test the spacesuits? Was there a break when suit techs were testing and then you moved into astronauts?

NEWMAN: During the development period, typically a prototype suit would be made in Delaware. They would have their own set of suit technicians up there. The most grueling job is to do the endurance testing for the suit, which means every joint, the elbow, the knee, the ankles, and the gloves, they'd all have a certain number of cycles that they had to be tested to. They would designate a special suit as a certification cycling test. The test subject's job would be to

wear the suit out, keep bending those elbows until the suit breaks or until they saw signs of wear, and they would know that's when they should stop. There would be people in Delaware whose job responsibility was to be a suit subject. They would typically have other responsibilities because there were other things going on; a test is run and then it's done, then you have other things to do in the meantime before the next test comes along. They'd be technicians who had other jobs too, but they were designated subjects there.

They'd send it down here to Houston. The design was still being evaluated, but the key users would be the ones you would want the opinions of, so astronauts would test prototype suits here, too, to evaluate the comfort and mobility and how useful it was.

ROSS-NAZZAL: Was that testing done in the chambers?

NEWMAN: Only when you're also testing the life support system. There's a lot of development of both independently, both the suit itself and the backpack. A lot of the evaluations of the suit itself would happen—there are other rooms in Building 7, a suit lab where there was a special separate room where astronauts would go through the motions. For example, there was a glove box where you were testing just gloves to make sure. You put the tools and things for them to pick up inside the glove box, where they would evaluate only the gloves to make sure the fingers bend right and they fit you properly.

One of the hardest things to fit precisely is a hand, because not only is your size different from your neighbor's, but the proportion may be different. My ring finger is longer than my index finger, and that's not true for everybody. It started off every glove was custom-built. Then once we had a big enough inventory, well, sometimes an astronaut would come in, and

they'd happen to be the same size as the previous astronaut, and they'd go, "Close enough," so they would reuse some gloves that way. It was normal for people to have custom-built gloves.

Other design changes would be developed and be sent down here to Houston and the astronauts would go through. We'd schedule a number of astronauts to come into Building 7 and our suit fit room and just have them evaluate things not in the chambers.

ROSS-NAZZAL: Did you ever do any endurance testing here at JSC? Or was that all done at Delaware?

NEWMAN: I think it was all Delaware.

ROSS-NAZZAL: Can the chambers do any thermal testing, or is that done in another facility?

NEWMAN: The Building 7 chambers were only vacuum. All the thermal testing was done in Building 32, the SESL (Space Environment Simulation Lab). They have Chamber A and Chamber B. Chamber A is the four-story-tall huge door movie feature vacuum chamber. Their eight-foot chamber is the smaller one, but they're both thermally capable.

ROSS-NAZZAL: Were the chambers used for anything else for the Shuttle Program besides testing suits?

NEWMAN: I want to say yes, but not that I can remember. Sometimes they just want to expose something else to vacuum, could be just another Shuttle system maybe, not that I was involved in. Since I was a suit engineer, there were a lot of things that happened that I wasn't part of.

ROSS-NAZZAL: Did you have any involvement with the manned maneuvering unit?

NEWMAN: Later, when I was a safety engineer, that was one of my systems. As a suit engineer, we were concerned with the interface with the MMU, make sure the suit clearances would be good so when they put the MMU on they had room, they were able to reach the controls, that kind of thing. So I was aware of it. I'm trying to remember where the testing happened for the MMU, because there's no place on Earth that would let you fly it just because it had such small jets.

As a safety engineer, it was one of my systems. I did go out to Colorado, where the Martin Marietta plant was, to do design review. But also, unfortunately, it was on my watch that they canceled the program. So the MMU was mothballed in front of my eyes.

ROSS-NAZZAL: That must have been disappointing.

NEWMAN: Yes.

ROSS-NAZZAL: Did testing of the spacesuit change at all as a result of the malfunctions on STS-5?

NEWMAN: Yes. First of all, once the required design changes were made, there was something new to test just to make sure that those new design fixes worked. They added another kind of test to the fan speed sensor, but those were more laboratory type tests as opposed to chamber tests.

ROSS-NAZZAL: Does the facility over at Building 7 ever have to reconfigure for a new mission, or is it pretty much static for every mission?

NEWMAN: Because their main purpose is to test the suits and the suits don't change, it's pretty much static. Sometimes they'll do new procedures. For example, when we first started doing Shuttle-Mir missions, we had the new docking compartment and the external air. When they moved the airlock from inside the Orbiter cabin into the payload bay, the configuration of our chamber had to change a little bit just because the controls were a little bit different and the opening of the hatch was a little bit different. But once the Orbiter configuration was known, then there's not much to change.

ROSS-NAZZAL: Did anything change over time as the Shuttle flights grew much more advanced or complex? Anything maybe with the Hubble Space Telescope?

NEWMAN: Again, because they're just testing the suit, not much changed based on that. But the things they use the suit for, for example, when we did take the suits over to Building 32 for the thermovac test, they would have different tools to evaluate. For example, on the STS-61 mission they would evaluate the touch temperature of the tools and make sure that the gloves were good

enough to protect you enough from cold temperatures. Unfortunately, one of the astronauts for that mission pushed himself so far that he ended up getting frostbite, so had to recover from that before he could fly.

ROSS-NAZZAL: Is there any other unusual equipment that was over in Building 7 that we haven't talked about, other than the chambers and the ETA?

NEWMAN: There were several things that weren't used during my tenure there. There was a drop tower there for a while, but we didn't use that. We were right next door to Building 29 when they put the WET-F [Weightless Environment Training Facility] in, the swimming pool there. I wasn't there when the centrifuge was still in Building 29, but again it wasn't my building, but I was a neighbor. There may have been some things in the various smaller labs not related to the spacesuits that I'm not aware of.

ROSS-NAZZAL: I'm guessing this didn't have any impact on your facility, but did the flying of DoD [Department of Defense] classified missions have any impact on your facility?

NEWMAN: No. We were aware of those missions, but since the suit is a publicly known item, they couldn't classify that. My part of the building was never under any special conditions for secrecy.

ROSS-NAZZAL: Can you give us a listing of some of the main contractors who provided support in Building 7 when you were working over there?

NEWMAN: I'll start with the suit. The Apollo suits were made by ILC. The Space Shuttle suits were all made by ILC. Hamilton Standard all made the life support system for the spacesuits for both Apollo and Shuttle. Those were constants. David Clark made the launch and entry suits, but I don't think they maintained a presence in Building 7. The chamber support, again it changed some, but I want to say Lockheed was one of the contractors. I'm not the authority there. I can't remember clearly enough.

ROSS-NAZZAL: Well, it's been a while. Is there anybody that you would recommend that we talk to about this facility?

NEWMAN: I can help you, yes. To me the group of people that would know the chambers best would include the test directors for those tests. I know there was a test director named Steve [N.] Martin.

ROSS-NAZZAL: The comedian? [Laughs]

NEWMAN: Actually, one of three Steve Martins I've worked with here at NASA. Before we met today, I was hoping to bring an old phone book I have. I've got at least a 1989 phone book. I'm hoping an earlier one would have some of those names and job functions listed there. When we break here, I'll go get that for you. Steve Martin was a test director. James [M.] Skipper was highly active. Again, I can't tell you for sure if these people are still with NASA or not.

I didn't work with him much, but I was aware of him, I want to say Reagan [S.] Redman. I know he went over to Building 32 later, but I think he would be knowledgeable for Building 7 chambers also. [Walter W.] Guy just retired, but he was the boss there for quite a while in Building 7.

ROSS-NAZZAL: Before we turned on the recorder this morning, you had mentioned that you did some work with the suits in the KC-135 and some other locations. Do you want to share those details with us?

NEWMAN: When I joined ILC, they were just starting to hire the force to support the Shuttle suits. The first zero-G flight I was aware of our suit supporting was the one I was on, because I didn't have much of a learning curve. One of the questions I mentioned earlier: "Can a person on his own or her own close the suit, climb into the backpack, the upper torso, and pull your pants up and latch closed, latch connected?" The first zero-g flight I was on was the one where Young and Crippen tried their suits in zero G for the first time. A typical flight is 40 parabolas. It's a 10,000-foot drop. The airplane flies up, I don't know what the total flight altitude is, but the airplane will free-fall for 10,000 feet. During that 10,000 feet, you have about 30 seconds of apparent weightlessness. Everything in the plane is falling at the same time. So if you push away from the wall, then you'll float away from the wall just almost like you're in orbit.

For those 30 seconds, it's all very well choreographed. You know exactly what you're supposed to try to do. On this next parabola, you're supposed to just climb into the upper torso. Then you'll wait. Then as the airplane pulls back up to 10,000 feet again, you're actually twice your normal weight, the two-G load. It's a lot of choreography in order to get little snippets of

weightlessness. Eventually both astronauts were able to get in the suit, able to close it. They were very relieved.

I was very sick. At about the middle point of the flight, it's called the Vomit Comet for a good reason. Getting sick is common on board. I think later they changed the rules, but when I flew they wouldn't give you the motion sickness medicine until you proved that you needed it. The first flight, I proved that I needed it for the second flight.

Our flight was 40 parabolas. You fly basically out over the Gulf of Mexico; you fly out for half a trip, then you turn around, fly back, and do the other half of your parabolas. My body waited until that level time between turning around to let me know that it was sick. I threw up. Actually, I threw up a total of five different times on the flight. Because it was my first flight, I didn't know I had the option of quitting my job or not doing my work anymore, so I stayed on station and kept on taking my notes and making my observations, not knowing I had the option of not doing it. It wasn't that big a deal, but I ended up throwing up five different times on that flight. At the end of the flight Bob Crippen comes over to me and said two things to me. Said, "Ronnie, you okay?" I said yes. He said, "Ronnie, your suit worked great." So it was a good experience.

ROSS-NAZZAL: Yes, that must have made you feel good.

NEWMAN: Yes. At various stages of procedure development, not every astronaut flew in the zero-G plane to put their suits on, but as much as we could we tried to get them to do that just for the extra training, extra experience. So astronauts would fly just to do the suit donning verifications. I ended up flying a total of eight different zero-G flights.

ROSS-NAZZAL: You had mentioned you were doing the spacesuit sizing for the ’78 class. How did that work? You had some very petite women in that class, and then you had [James D.A.] van Hoften, who was I think one of the largest Shuttle astronauts.

NEWMAN: Yes, nicknamed Ox. The smaller women were hard to fit just because the physics of a long thin balloon is a lot easier to bend than a short thick balloon. Because of the backpack, our upper torsos were constrained to a certain diameter. They couldn’t be made much smaller. Because the structural interface between the upper torso, which is made of rigid fiberglass, and the backpack, their mounting points were set in design. It was very hard to make a smaller diameter suit to fit smaller people. Small men or small women both had trouble getting fit. The smallest of the women, we were never able to get a good mobile suit to fit them very well. Even though the design goal was to fit everyone, well, there were some people that we wouldn’t have been able to fit for EVA suits.

ROSS-NAZZAL: What do you think is the significance of Building 7 in relation to the Shuttle Program?

NEWMAN: One of the Shuttle missions was building Space Station, and the only way you could build Space Station was through EVA. You can’t build modules that will automatically reliably attach themselves, so you had to go out there and actually help out with the people present. EVAs are a common thing now. Every mission has four or five EVAs now. I’m embarrassed to

say I don't know how much testing goes on in Building 7 now for the Shuttle suit prep, but I'm sure they still must use the airlock trainer every mission. They still must do that.

It was essential; it was core. The functions that happened in Building 7 would have to happen, or else the rest of Space Station wouldn't happen.

ROSS-NAZZAL: I just wanted to check with you and see if we've talked about all these different facilities that they had listed. Did we talk about the Shuttle EMU/Airlock/Life Support Test Facility? Is that something that we had talked about?

NEWMAN: To me, I don't know of anything other than the ETA that would do that, but yes, I would think that would be the same thing.

ROSS-NAZZAL: The system component vacuum test facility? Is that the various chambers?

NEWMAN: They added another vacuum chamber after my time there, a two-foot chamber. I'm not sure what they do in there. The eight-foot chamber is for just the backpack itself, so that would qualify as a small system test vacuum.

ROSS-NAZZAL: Our last question that we've been asking everybody: do you have any documents or any memos, letters, anything like that, about the facility that might be helpful?

NEWMAN: I don't think so. I'm still looking through my stuff. I'm trying to think if I ever had any pictures of Building 7. Other than pictures of just people, I don't have good representative

pictures of the facility. There was a parade going through JSC, and we had a float. So we have a picture of that, but that's not relevant to the test facility. I will keep looking, but I don't think I've got much.

ROSS-NAZZAL: Well, we thank you very much. Unless there's anything that you would like to add about Building 7 that we might not have covered, or your work with suits?

NEWMAN: I'm sure I'll think of something, but no. I can't think of anything.

ROSS-NAZZAL: Well, thank you very much.

NEWMAN: My pleasure.

[End of interview]