NASA JOHNSON SPACE CENTER
FACILITIES ORAL HISTORY PROJECT

LEWIS JERRY SWAIN
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is October 2, 2009. This interview with Jerry Swain is being conducted at JSC for the JSC Facilities Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. Mr. Swain begins today by talking about Room 1150 in Building 5 South.

SWAIN: From a building history point of view, what used to be room 1150 20 years ago was a very high bay area used for Apollo training. I usually cover this visually during my tours as I show the facilities. It was just a big hangar area that contained the Skylab exhibit and some of the trainers that are over in Space Center Houston now. NASA gave those up a number of years ago, and they went to Space Center Houston as Space Center Houston developed and became a tourist attraction.

So years ago, 1150 was just a big high bay area. You can see that by the hangar doors on the west end of the building. NASA extended the building out about another 20 feet or so to the south 15 years ago. Then they put in what we call the mezzanine, which is the structure that's actually over 1150, and that's where the Space Station simulators sit. Underneath them, which is the new room 1150 that you note in your paper, is a computer area. There's a couple of offices in there as well, maintenance and computers, that's Space Station related. If you look at it from a building construction edifice point of view, then yes, 1150 was there—I don't know what the room number was back in those days, but it was just a high bay area back in the Apollo and the

Skylab days, where training took place. Then as those programs ended, again 25 years ago, tourists were allowed to roam all over JSC, and you could actually go in the trainers, and the tourists could go through them, just like they do at Space Center Houston now.

Except the Skylab simulator here was vertical. You went up stairs. If you go over to Space Center Houston now, they've got it laid down horizontally.

ROSS-NAZZAL: You can actually walk in through it.

SWAIN: Yes, they've just flipped it 90 degrees, over in Space Center Houston. If you're looking at a building age point of view, then I guess 1150 is still valid. If you focus on Space Shuttle, 1150 doesn't do anything with Space Shuttle. I make that distinction when I give tours, because we do the tours on this side of the building, then we go over to 5 South, and I talk about how we transitioned from a Space Shuttle training environment to a Space Station training environment. I give a little bit of the history of the building just like I did a second ago.

ROSS-NAZZAL: Do you want to talk about the history of the building, what it was built for, and then how it changed to support the Shuttle Program?

SWAIN: Right. I'll try to go through. You [asked] about a history of the building. Your questions here follow along exactly the way we give a tour almost. We start down near that lobby where we came in. We have a hall of fame, and we show a lot of the pictures of the whole manned spaceflight. This facility really wasn't used for training until the second Gemini flight.

We've got a model with the Gemini and the simulators. We have all the pictures on the wall of everybody, the Mercury guys and beyond.

It's a fairly old building. It's been reconfigured many times, as you can imagine, as we've gone through the different programs. The building was for Gemini, and then it supported every program forward, just like I mentioned with the Skylab next door and what's called 5 South now but at that time it was just Building 5. It was one building; there wasn't a north and south distinction back in those days. Again, we've changed as the different programs have evolved. The astronauts, since they've been here at the Johnson Space Center, have offices in Building 4 when it was just Building 4. Now they're in Building 4 South. So with Building 5 being in close proximity, it's been advantageous to them. We've had it for all training activities. Like I said, we've conducted training since the second Gemini flight forward. We have gone through a lot of equipment changes as technology advances, as you can imagine too.

The facility wasn't new to the Shuttle Program because it evolved, like I said. Now starting to focus on the Shuttle, the high bay which you're lumping into room 117D, that's the high bay area, has two simulators there now. Link built the motion-based simulator, and the logo is still on it. This was in the late '70s. We're still using the same simulators we did then. We've retrofitted them many times. We've gone from the mechanical flight instruments that was prevalent in airplanes, and now we have the glass cockpit, which is a term most folks are familiar with, the little TV screens that depict the same kind of flight instruments.

We've gone through those sort of transitions, but we still kept the core motion base and fixed base simulators. The motion base is for the aerodynamic phases of flight, when the students—the astronauts—primarily want to experience motion sensations. The fixed base is for on-orbit training when you'd be in a zero-G environment. Of course you don't need those

motion cues then. The motion base is just forward-looking, when the astronauts are strapped in their seats doing ascents and entries. It's a simulator similar to what you might find if you went to a major airline, except ours can tilt back almost 90 degrees where the astronauts are lying on their back. Then we launch it and shake it and put some audio launch sounds into their headsets so it's noisy.

That's the simulator we use with the astronauts looking forward out the front window, for ascents and entries. If they're going to do something on orbit, then we go to the fixed base, and we have the flight deck that we have in the motion base but we also have the middeck, which is where the galley is and the space potty, the WCS [Waste Collection] System.

Now all the electronics, the technology that goes along with the computer upgrades and things like that, we try to upgrade as best we can. The contractors do that within budget and as technology comes along, like the glass cockpit I mentioned or updating the computer system. A number of years ago one of the rooms, 117A, was filled with computer equipment, big IBM [International Business Machine] computers. As technology has evolved that room has got a lot more bare, and it's almost a bowling alley there now, because technology is such that we can do the same kind of simulations almost with a desktop-size computer that we had to use big IBM type machines [for] in the past. The technology has helped us there in reconfiguring the building.

Some minor things—as managers and contractors have rearranged people and functions. In the past year we had a big effort, which is ongoing today, where we're reconfiguring Building 5 South so a lot of the technicians that worked there were forced to come over here to 5 North. We've had to double up on the office space and those sort of things. Those sort of configurations happen all the time around here where people get moved around, and offices

change, and a wall will get knocked out or something like that or an office will be made. Those sort of transitions and things happen.

You have a question here about any kind of complications [from program to program]. I don't think there was any major complication that I was ever aware of. [There] seemed to be enough of a window between programs. In other words, there was enough of a window from the end of the Skylab Program before Shuttle really cranked up that there wasn't a lot of overlap. As we moved from Shuttle to Station, we had that whole building 5 South available to us. There wasn't any great infringement on Shuttle space in 5 North.

I'm seeing more now where Cx [Constellation Program] is coming in, and we're planning on Cx to be in the high bay too where Cx comes in and Shuttle goes out. We've got an area set aside already. The high bay is divided into three general areas, this is the 117D area. The westernmost area is void right now of any Shuttle simulators. The T-38 simulator is there right now, but the T-38 is actually a small piece. The void area has already been allocated for Cx. We'll bring Cx in and populate that area as Shuttle winds down. Then as the Shuttle simulators get disassembled and moved off to some museum, then we'll migrate to the east and add more Cx simulators.

To actually say your question here, "is there any transition," I've never heard of anything like that kind of complication from any sort of transition. Officially the building began supporting the Space Shuttle Program from the beginning of the Shuttle Program. It was late '70s they started building Shuttle simulators here. They were doing some training down in the Cape [Canaveral, Florida], but it came here soon because like I said the astronauts live here and try to stay away from travel problems going all the way to the Cape for training.

Let's see. "How has it actually been supported, the Space Shuttle Program, Building 5?" We've supported it all along. It has been a prime simulator, the prime simulator almost. A lot of that is in that flyer that I gave you too. It's saying the same kind of thing I am, with a little quicker way of doing it I'm sure. We've been here in support of the Space Shuttle Program.

We talked a little bit about how it's been modified. The Shuttle simulators haven't really been modified except with technological advances and vehicle upgrades. The instructor rooms along here—again, just being an office type of environment, have been modified from a technology point of view as things got more refined and the equipment got smaller. Then we put carpet on the floor and amenities and things like that. They've been modified as the Shuttle Program has evolved.

When the Department of Defense [DoD] came, we had double doors and curtains and all the things that the Department of Defense would come along with. The building itself was modified to accommodate Department of Defense activities. When the Department of Defense left, then a lot of those things were taken out, and we're not quite as tight as we used to be.

The building here has been always set aside as a nonvisitor area when the regular visitors were allowed on site. It's still a controlled access area, even for employees. You have to have a need to be in here; you can't just wander in more or less like you can in some other buildings. Even in the old days, when the tourists roamed around JSC, they weren't allowed in this building without being in here for a tour or whatever it might be. We've gone through a little bit of an evolution going into the DoD and working with the DoD for a number of years, and then when the DoD left then we came back and reconfigured some things in that regard.

Now you say here's an example of the mission control and the FCR [Flight Control Room], the Apollo MOCR [Mission Operations Control Room] landmark. We've had different

folks come through suggesting we set aside a portion of the building, and we've always tried to tell them that because the whole building is pretty much utilized we anticipate it to be continued to be completely utilized. We've fought the idea, the philosophy, or the suggestion that maybe we would set aside something as some sort of historical area, like they have done in the Mission Control Center. We won that battle because we just don't have the space to set something like that aside. We're more than willing to let the Smithsonian or some other museum take the simulator away one day, but to set aside a portion of the building or something like that we've always fought that and said no, we don't want to do that. We need the building in its entirety. Even today, just with people coming and going and such we find ourselves wrestling on many occasions on just who can be placed where and where can we put a piece of equipment.

In fact, one of the efforts that's come up in the last couple weeks is finding a place for some more employees and developing an office environment for them. To try to set aside some kind of an area like you use in your example here on the sheet, I don't think we've ever contemplated that.

You say, "Is it reconfigured for each Space Shuttle mission?" Yes and no. It's not reconfigured structurally in any kind of horrendous fashion, but every mission is unique. The simulators are reconfigured for the next mission. If I were an astronaut, and I was two or three flights away from my mission, and I came over here to train, I would have to know that the simulator was configured for the prime crew, the next guys that were going to go up, because we do have different payloads on board and different flight profiles, and crew desires sometimes.

So some of the configuration, if it's payload-unique or maybe vehicle-unique, they do get reconfigured. We don't do a lot of major structural reconfiguring, obviously, because the simulators are bolted in place. But yes, the panels and some of those things do get reconfigured.

Obviously the software loads, the actual software loads that drive the simulators, the computer loads, those all are very flight-unique. They're always geared toward the next flight, the prime crew. If I were a downstream crewmember, then I'd have to just wait until it was my turn. Then I'd get my flight profile load.

You see that in the flight data file books that are produced here at the Johnson Space Center, the checklists that the crew uses. They have tons of those it seems at times. They're all flight-unique as well. The flight data organization brings those books over here for the crews to use, and they have to reconfigure all those for every training session to make sure the books are right there for the crews to use. In that regard yes, we do configure mission-specific.

ROSS-NAZZAL: Can you explain more about the payloads?

SWAIN: Well, not so much now because we're so Station-related. In the old days where every Shuttle had a different kind of payload on board, a different satellite they were going to launch or whatever, it was somewhat of a nightmare because every flight was unique. You'd go in the simulator, and the panels would be laid out for one particular group of payloads, and the books would be up there for that payload. The technicians would have to scramble between sessions and take those out and put the next one in for the next mission, a different mission. Sometimes that was like a daily or weekly type of a configuration. They'd have to work between two training sessions and take out STS-X and put in STS-Y, and then later go and put in STS-W or STS-Z, and they'd have to do those sort of things as an example.

Nowadays, because we're just pretty much going to the Space Station all the time, it's not quite that much. Plus we've got to the point where a lot of those unique things are on laptop

computers that the crew has, so they can just type in and call up a lot of the data they need on laptop computers. They don't need a whole hardware panel to be ripped out and a new one put in in its place or anything like that. Like I said, in the past where every Shuttle had a different kind of payload, it was really an effort a lot of times from a maintenance point of view to keep it configured properly.

ROSS-NAZZAL: You also mentioned crew desires.

SWAIN: Well, yes, a lot of the crews for whatever reason, I can't get into their heads, but they would say, "I want this book over here, or I want this, or I want that." We have a big wall of lockers in the middeck that are actually like the ones on board the Space Station to some degree. Sometimes certain things, like the in-flight maintenance tools, the tools that the crew would use to repair something, are in a certain locker. Then I've gone there, and that locker has been moved down over in the lower right hand corner where it used to be up in the upper left hand corner. You do some research and they say, "Well, this crew, they like it down here."

It's not like a major vehicle modification type of a change, it's just those little crew desires type things. The crew says, "I want my locker that has my clean socks in it to be out of the way because I don't wear socks," or something. So you can put it way over here in a corner. Versus, "I change my socks all the time, so I want it right here where I can get to it." You have those sort of things. The crew has their little particulars like that sometimes, and the lockers get moved around. That usually doesn't affect us, like I said. We don't change the position of the seats or the control stick or something like that. Obviously that's going to be standard across the board.

ROSS-NAZZAL: In terms of the vehicle uniqueness, can you describe that for us in terms of the fleet, how it changed from *Columbia* to *Endeavour*, especially for you?

SWAIN: I guess the way they built them in California there was some nuanced differences. We would have to say okay, this particular flight is going to fly *Atlantis*. *Atlantis*, it's configured a certain way. Those changes weren't great, but they did have some. So our folks would have to accommodate that at the time. There doesn't seem to be a whole lot of that going around now, since we're just down to the few. But I know *Columbia*, because it was eventually designated as the Spacelab Shuttle with the Spacelab module in the back, there was some uniqueness about it. The software loads, because of the center of gravities and the weights and balances and things like that, differences in the vehicles come into play. Again, back when there were many different types of missions.

When the Hubble flew, it was a little different because they had a whole different launch profile than the missions going to the Space Station. So there was a lot of training that wasn't needed for Hubble, but of course it is done on the Space Station, because the Hubble didn't rendezvous with the Space Station. Their launch inclination was completely different than what we use for the Space Station. So those sort of things factor in: the launch profiles and the software loads, probably more so than the configuration of the vehicle. Of course, now that we're done with Hubble, just about everything is going to be Space Station from now on. It'll probably settle in pretty tight now, there won't be a whole lot of configuration changes.

"Any specific Space Shuttle mission that stand out in your memory?" That's hard for me to say. I've been here since '81, and I worked in some fashion, or at least been associated,

affiliated, or in the know of every one since STS-1. All of them have some uniqueness to them. We had the first night launch. That was played up for a while. That was STS-8. In fact, that was one of the ones I worked. Of course, the *Challenger* and *Columbia* [accidents] always stand out in your mind over the years.

ROSS-NAZZAL: Were you working STS-1?

SWAIN: No. I interviewed for this job before STS-1 flew. Then the way it was portrayed to me, [President Ronald] Reagan during his inaugural address scared some people about all the cost-cutting he was going to do. So they called me up and said, "Well, just hold your jets, don't come here just yet, we're going to wait and see what Reagan really does." I was on hold for a number of months before I came here. By the time they hired me, we had already flown STS-1. But I did get here in time to participate in [STS]-2.

I left after *Challenger* and went off and started working Space Station and a lot of the Return to Flight tasks initially, as well, from *Challenger*. Then I stayed pretty much with Space Station until '95 or so. Then I got back in the Shuttle business. The Return to Flight after *Challenger* of course was a high point. From there forward, I didn't work a whole lot of Shuttle missions until like I said '95. So I don't have a lot of insight into those flights that flew from the Return to Flight after *Challenger* up to '95 or so.

ROSS-NAZZAL: Anything unique in any of those missions in terms of things that you had to do here in terms of training, or maybe something happened on flight that you were called on real-time?

SWAIN: Yes, I was going to touch base with that here on the real-time support. The DoD was a big thing. NASA has always been open. Their charter is to be open to the public, more or less. I bring this up a lot of times during my tours. I say that it's your space program as taxpayers. So when DoD came in here, that was a disruption. I came from a military background, so it wasn't a big deal to me to live in that world. But a lot of people, the kids and others coming right out of college never had any kind of military experience. It was a real shock to them to fall in and have to work in a DoD environment. The DoD was something that was in front of you a lot of times. To a lot of folks it was different. We don't have it now, the DoD has quit using the Shuttle. We're back pretty much an open environment.

There's been many different instances when we do real-time support. For every Shuttle flight we set aside, and it's usually the fixed base, as a flight asset that can be called up in a moment's notice [and] an instructor team. Usually the team that worked with the crew is called in, and they do the real-time support. There's been numerous occasions over the years. I can't specifically recall one, where something has happened on orbit where the crew needs to come up with an impromptu type of activity. Mission Control, the flight controllers, the engineers, and everybody talks about it.

Then we'll come here and actually run the test case in the simulator. Come with a crew [and] instructor team. They'll go through the whole exercise, because all of our computers we use here are the same computers they use on board the vehicle. So the only thing we're lacking in our simulation world versus what they're going to see on orbit is the zero gravity type of environment. So the way the software would interact or not interact or something like that would be seen here. So we've had instances where we've tested out different things.

Any kind of a hardware thing, like they've had situations where they actually had to fabricate some kind of device, they'll usually go to one of the other facilities for that. They'll go over to Building 9 maybe and actually build some kind of a tool. They've done that on different occasions. They'll do that usually in some other lab, to see if a torque wrench is going to be strong enough to do something or whatever it might be. Over here, we have had instances where we've come and run test cases in our simulation just to see how the vehicle is going to react, and if it really can be done that way, if the systems will support a particular configuration or whatever they come up with. We've done that in the past. I'm sorry I can't recall any one specifically. We always set aside a simulator for that purpose.

We continue using the set-aside simulator during training, but it's always known and advertised that if a generic crew is here doing some routine training, and all of a sudden there's a mission up and they have to be booted out because we're going to run this test case, that falls in the purview of our capabilities to do and have happen. We do set aside a simulator for that purpose. For that reason, we protect the building from any kind of software load development or upgrade. We say, "No, you can't do that till after the mission lands because we don't want to do anything that might disrupt anything we may have to test." Plus we don't want to take a lot of time. We have certain time constraints. We have to be able to react and come and run those test cases. So we don't want to have to reload the whole simulator or reconfigure it in some fashion if we need it right off the bat.

ROSS-NAZZAL: How long would it take you, if you had to prepare for a new mission, to get these simulators ready?

SWAIN: You're talking about one of these real-time support type of things, or are you talking about just in general?

ROSS-NAZZAL: Real-time support, and then also when you switch out.

SWAIN: Well, real-time support has a two-hour constraint. There's a two-hour constraint for some things, and there's a four-hour for something a little bit different, but that's for the real-time support. We know that we have to be able to come over here and do whatever we need to do to have the machine ready for a real-time test within two hours. That means calling in technicians from home, if it's on a weekend or anything. There's people on call for those sort of things. Like I said, usually the instructor team that worked with that particular crew are the ones that know that when the flight is up that they're on call on a moment's notice, well, two-hour notice. We bring them in. Either they make themselves available, or they make sure that somebody else is available.

To prepare for a mission, that's just an evolution thing. They'll start working up the books across the street in Building 35 where the flight data file, the checklists, are produced. They've already started that process. So those books for the next flight will start showing up here, like I mentioned earlier. It's just an evolutionary thing. There's never really a feeling like we're done with this and now we have to go out and reinvent the wheel type of thing.

The vehicle itself, like I said, doesn't change a lot. The seats don't get moved around and such. The stick is still there. The instruments are still there and things like that. There's no kind of flight configuration that has to take place in that regard for us. The books and the software loads are in development for future flights. We get routine statuses on those. We've got several

in the queue at any one time. STS-X will end, and they'll do a software dump. They'll dump that software load, and they'll do a software [load] for STS-Y. Then they'll use that for a four- or six-hour training block. Then those guys will leave, and the technicians will go out and reload the simulator for STS-W. Our schedule has that factored into it, like a 30-minute load change. We have those depicted on our schedule. I can show you that, where there's just little blocks of time between training periods where they actually reload the simulator. That's just an ongoing thing.

Then in the background, the United Space Alliance, they're producing these software loads, and like I said they're in a queue, and they'll come to us and they'll say, "Okay, STS-362 load is going to get dropped this weekend," and we'll start testing it. Then they'll go through that. STS-362 is way downstream, but by the time we get there, it's been perfected, and it's ready to be used whenever we need to. Did that answer your question?

ROSS-NAZZAL: Oh yes.

SWAIN: Okay. Let's see. We talked about the real-time support. We have been called upon to work malfunctions while the crew is in orbit. Yes, yes, we talked about that. I hope I covered all that. We do that for the Space Station as well. There's always that option there for the Space Station simulator to test something if they needed to.

I'm sure in the archives somewhere—PAO [Public Affairs Office] probably loves those kind of things. There's been situations where the crew had to fabricate something —I remember times when the crew was up there and a particular procedure was going to be tried because some

kind of a workaround was required. They've come over here and tested it out before they actually told the crew to go do it in the real vehicle. I know that's happened before.

Let's see. "Describe a typical Space Shuttle simulation, test, mission. When your facility is running a simulation, how many people work in the facility." Yes, this would be a good one. The crews come here usually in a shirtsleeve environment just like we are in most cases. Although we do suited sims [simulations], and the JSC suit techs [technicians] will dress them up in the big orange suits, and they'll do what we call a suited sim.

The typical training period is about four hours long, but it can go six or eight. In fact, right now we're in the middle of a two-day sim. Sim actually goes along for two days. The crew won't be here all the time. They'll go home, depicting that they would go to bed, of course. They'll go to lunch, and that would be a meal period or something like that. Depending on the training scenario syllabus, we do have varying lengths of training time. I'd say the typical training period is a four-hour block of time. It's like 8:00 to 12:00 and then 1:00 to 5:00 or whatever, however the day plays out.

Once a crew is named, they'll also get an instructor team named. That individual instructor team follows that crew through their whole training year, year and a half, two years, whatever it is. Of course, some instructors go on vacation, there's substitutions in there, but that training team pretty well stays mated up with a crew, at least for our facility here. The core team is made up of five people. Four of those people are experts on different capabilities of the vehicle.

There's a communications instructor that's an expert on all the communications on board the vehicle: uplinks, downlinks, all those sort of things. A systems instructor knows all about the different systems: the auxiliary power units and the fuel cells and all, any kind of system.

The control prop instructor knows all about the main engines, the SRBs [Solid Rocket Boosters] and all the reaction control jets. He's also an aerodynamics person for the ascents and entries, again control and propulsion. Then you have a DPS (Data Processing System), knows all about computer stuff. Then you have a team lead. The team lead choreographs the training and makes sure the training syllabus and all the training objectives are met over the duration of the whole training year, year and a half, whatever it is. Plus he oversees the training activities of any one particular training session and makes sure that items in the script are executed on time.

Now the way we do training is we have scripts. They're just like as script you might find if you had in a movie or a play. It would say something like "20 seconds after liftoff, APU [Auxiliary Power Unit] number one fails. Thirty seconds after liftoff, fuel cell dies. A minute after liftoff, main engine number three fails." It's like that.

That's what the script is. Of course, the training objectives are mirrored in the script and vice versa. The team lead has that script, and he makes sure each one of those instructors I mentioned puts their malfunctions in on time. He can also sit back and look, and if he's got a new crew and they're struggling, then he can pull a couple of those malfunctions out of the script until they come up and they're better. At the same time, if he's got a crew toward the end of their training, they're very proficient and they're up there and they're having too good a time, then he can actually inject more malfunctions in to keep them busy, to keep them on that sharp edge. So he has that ability to do that.

Then that team grows depending on the flight profile. If they're going to do a rendezvous with the Space Station on a particular day, then a rendezvous instructor would probably be part of that team. If they're going to do some robotic arm work, a robotics instructor would show up in the instructor station right across the hall here. If you had a particular payload, like when we

had the Hubble mission, we'd have a whole roomful of Hubble experts at times that would come over and participate and oversee and be part of a particular training lesson or period of time.

Again, that's the way we do training in this facility. We don't do a lot of mechanical hardware type of training. They go over to Building 9 for that, if they're actually going to go move big things around. Over here it's operations, procedural, those kind of things. In our simulators, all the circuit breakers, all the switches, all the knobs, the dials, everything like that are all functional. You go to some of the other mockup facilities, the switches are there, but they're just dummy switches a lot of times. So if an astronaut is going to have to learn how to unbolt the mission specialist seat and fold it up when they get on orbit, he might mess around with it over here a little bit, but he's probably going to get trained over in some other facility to do that. Our technicians will do it here, because that's not the training functionality that we advertise for this facility as such.

Then like I said, the training period, that four-hour block, can either be what we call standalone training, where you have an instructor station full of folks and you have a crew. It's like one-on-one training. We can take this facility and integrate it with Building 30, and we'll have a whole flight controller team over there, the flight director and his whole entourage. They'll be going through the same training activity. We can also put an astronaut in the water tank out at the NBL [Neutral Buoyancy Lab], and he can be talking to the guys here and talking to the guys in 30. The simulation that's going on right now is we're integrated with the Space Station simulator next door and the Mission Control Center. Electronically we can link this building up and have any period of time, like the one we have now, a two-day sim, or a four-hour block of time, with other facilities.

We can also link in with Marshall Space Flight Center over in [Huntsville] Alabama and have an astronaut over there, or at least the Payload Control Center over there, talking to us, going through the same training exercise. We can do the same thing with Moscow or Japan. So we can have a worldwide training exercise going on, almost, if we wanted to, where everybody's talking to everybody else and going through the same simulation, depicting an actual mission if we wanted to go that far with it. We're not an isolated building and just a one-on-one type of training here. We can integrate it, just like we are right now, with other facilities and have this big full-scale type of a training situation that looks just like a real mission.

ROSS-NAZZAL: Can you talk about the ascent/entry simulations that are done here?

SWAIN: The ascent/entry simulations, we do those in the motion base where we have the hydraulics. We have an instructor room right across the hall that's hardwired with the motion base simulator. The astronauts in this case would just be the four primary astronauts that would be up on the flight deck of the vehicle. Again, it could be usually four hours or less sometimes, depending on whatever the training syllabus calls for. It could also be integrated. Obviously we probably wouldn't be integrated with Marshall because they're more on-orbit payload-oriented. The same thing with Moscow. We do integrate with the Mission Control Center and do ascent integrated sims. Usually about the last two or three simulations a crew does before they go to the Cape to launch is a bunch of ascent integrated sims with the Mission Control Center. We can integrate them just like we would some big full-blown on-orbit type sim.

It's usually a four-hour block of time. In motion, if it's ascent and entries. Again, it'd be shirtsleeve or suited depending on whatever is called for in the training syllabus. We do ascents,

since ascents are short duration, usually during a four-hour block of time we might do four, maybe five, or three ascents, depending on which kind of ascent we're doing. A return to landing site where they go up, go out over the Atlantic, and have to come back and land at the Cape because of some sort of malfunction, those are usually around 20 to 30 minutes. If they're going to go all the way to Spain and land there, then that's usually 30 to 45 minutes, depending on the flight profile and how long they want to go.

Again, it gets back a lot of times into this team lead. If he wants to do the whole profile and have them go all the way across and land, then it's a pretty good chunk of time. If he sits there and says, "Okay, you guys have met your training objectives, we don't have to continue this on and go all the way and land in Spain, let's reset and do it again," then we can get more runs in. An ascent, like I said usually you get three to five different ascents. RTLS [Return to Launch Site] or a TAL [Transatlantic Landing] where you go over to Spain, or you just abort to orbit. Again, three to five per period, for training periods in the motion base.

Entries, you can even get more of those depending on how high you want to start. If you want to start at 50,000 feet and just do a bunch of landings, well, you can just do those all day almost. You can get a whole bunch of those in in a four-hour block. If you want to start off and do a deorbit burn way out over the Indian Ocean somewhere, go through that whole profile and then land at the Cape, well, then it's going to take you a little longer. It's going to be 30 minutes, 45 minutes or something like that.

So again, it depends where the particular crew is in their training syllabus and how proficient they are. Maybe sometimes they just want to shoot some landings. They might want to get some proficiency. Or the commander might want the pilot to get a couple landings or

something like that. That can be adjusted. Then usually they work with the team lead and adjust that on the fly during the training period. Did that answer your question there?

ROSS-NAZZAL: Oh yes. You spoke a little bit about the DoD earlier. Did that complicate simulations for you over here?

SWAIN: From a standpoint of vehicle and training, it was done the same way. The only thing the DoD complicated was just the environment. I worked the first DoD flight [STS 51-C]. I was a control instructor. I was a control instructor for other missions at the same time. From the standpoint of what you did and what you trained the astronauts to do, from a control propulsion instructor point of view, it was pretty much the same, other than the payload was different. The vehicle and those sort of things were pretty much standard. The systems worked the same way. An auxiliary power unit is going to work no matter what's on board, you might say.

The only thing that disrupted us or was different from a DoD point of view was just the administrative things you had to do, just the DoD stuff. You had to shut the door, you had the curtains across the door, you lock stuff up in a safe, you don't leave stuff out, need to know, all those DoD type of constraints. No, there wasn't any training difference from an instructor point of view. The vehicle still operated the same way. You just couldn't talk about it. You tried to not talk about it, because you didn't know where you might bleed over into something.

If you talked about a launch inclination or a vehicle weight or something like that, that could maybe in somebody's eyes be giving away some kind of a secret or identifying what kind of a payload was on board or whatever, then you tried to stay away from those kinds of discussions. As an instructor teaching then, it wasn't that much difference from one flight to the

DoD flight. You still instructed the same way, and the systems still basically functioned the same way.

ROSS-NAZZAL: You mentioned you were an instructor. Any memorable flights that you were an instructor for?

SWAIN: Well, after the first four flights at STS-5, we started the alignment where an instructor team was matched with a crew. So I worked a little [STS]-2 and then [STS]-3 and [STS]-4. Then when [STS]-5 came along, they assigned a particular instructor team to [STS]-5. I jumped from [STS]-4 to [STS]-8. That's the way the rotation went. At that time, I think we had 6 or 8 instructor teams. You would be assigned to a flight, and then you'd follow them along, like I mentioned. Then when you got to the top and your crew flew, you went to the bottom of the ladder or the bottom of the barrel, whichever way you want to look at it. Then you worked your way back up as the other flights ahead of you flew. Then you went back down.

That's the rotation. So I worked [STS]-4. Then some other teams worked [STS]-5, [STS]-6. Then I got a piece of [STS]-7 because I was working a payload on [STS]-7. I worked [STS]-8, which was the first night launch. It was also the first black astronaut, which was Guy [Guion S.] Bluford. I worked that. Then our particular instructor team, we were the backup instructor team for [STS]-9, which was the first Spacelab with [John W.] Young and [Brewster H. Shaw]. Then from 8 I jumped to the first DoD flight.

Our instructor team got the reputation, that's probably not the right word, but we got tagged as the DoD instructor team, because we knew how to do all that DoD stuff. Again, getting back to your question, perhaps the administration of that was probably more of a

disruption than the actual training, because you did have to go through all those [procedures]. Like I say, you always had to keep all your books locked up and things like that, where the other teams didn't have to worry about that. So we got named or labeled you might say the DoD instructor team. Then I became a team lead.

I got a different rotation. I worked a couple flights, then I worked the *Challenger* [STS 51-L]. I was the team lead for the *Challenger*. That was pretty rough. Of course, after *Challenger* the whole program pretty well shut down for a couple years. At that time I left the Shuttle business, like I mentioned earlier, and went over to start doing Space Station stuff and Return to Flight evaluations that everybody was involved in at that time, trying to find the fault and correct it and make sure it doesn't happen again. That was my coming up through the ranks as an instructor and a team lead.

ROSS-NAZZAL: Did you have a specialty before you became a team lead?

SWAIN: I was a control propulsion instructor. I did that from '81 until '83 or '84. Then I worked a couple years as a team lead. Then *Challenger*. Then everybody was in neutral, you might say, there for a while.

Now you do ask here about how many people work in the facility. That's the astronauts and that's the instructor teams. Even today, the instructors don't reside in the building. They are over in Building 4. The people that actually reside in the building are all the technicians that keep the simulators up and running. There's probably hundreds of those kind of folks in nooks and crannies all around here. The two rooms right next to my office here have technicians on call. They're software technicians and hardware technicians, and then we have a command

center, a command post area that has the folks that monitor all the simulations that are going on in the three simulators.

We have the fixed base simulator, the motion base simulator, and then across the street in Building 35 we have another fixed base simulator. So those three simulators, when they're all cooking, we have our command area that has technicians sitting in front of each one of those locations monitoring the three simulations. Those are the guys that are operator type people. If the instructor has some kind of a problem, simulator dies, then they call, and the PA system comes on, and they start calling people in from these two rooms right adjacent to us here. These hardware technicians, software technicians, and all those kind of folks start coming out, fixing it, and repairing it or whatever it might be.

You have 100 people in the building that are just here doing regular work or on call to support simulations. They come into work at 5:00 or 6:00 in the morning and get it prepped. Then they're here after the evening when formal training shuts down and getting ready for the next day. The same thing is true next door in the Space Station side as well. Same philosophy. You have a whole group of technicians over there that do that kind of stuff and keep the simulators up and running at all times. There's a lot of folks, a lot of behind the curtain type stuff that goes on around here, with different categories of people.

We have people coming in here when formal astronaut training isn't going on using the simulators to build software loads, development, and things like that. There's a cadre of folks in here that work in the building doing those sort of functions. Not to be confused with the astronauts and the instructors that come in here almost in a transient mode you might say.

ROSS-NAZZAL: So do you have any idea how many people work a standalone sim versus an integrated sim?

SWAIN: It's the same no matter what for us in the building, because the simulator always starts off at that one lowest common denominator. The simulator has to be up and working. If it's an integrated sim where we have to integrate this facility outside the confines of Building 5, there's a group that sit up on the third floor that do that, as well as the instructors in a room right across the hall. There'll be instructors in there if we do an integrated sim and more. If you're doing a standalone or integrated, the technicians that actually keep the simulator up and running, that happens no matter what, it's the same.

Let's see. You say here simulation versus test or a mission. Those technicians are always here. They're going to help with a mission like we talked about, the real-time support. Tests, the same thing. If a simulator has to be running, there's got to be technicians here no matter what somebody's doing, some kind of software development or anything.

Let's see. "As the program has matured, from the first four test flights to operational status, for instance, or the increasing complexity of flights over the years, how if at all, have operations changed within the facility?" I remember when we used to have ejection seats on the first four flights. Then the ejection seats were removed. That was a little bit of a training difference because there were certain radio calls that the Mission Control Center didn't make anymore when there wasn't ejection seats. So that was different.

The Spacelab lab that actually got dropped in the payload bay, that was different. We had a Spacelab simulator here. That's where the T-38 is now. It was a big silver box, and inside it was configured to look like the Spacelab. After *Columbia* [STS-107], that was the end of that.

That was all taken out. The shell was left in place. Now we've put the T-38 simulator inside that enclosure to accommodate the T-38 simulation.

Once those first four flights flew, then we just kept on going. The facility itself didn't change because of that. I think the facility probably changed more because of the DoD, like I mentioned earlier. When DoD came in, we had to start doing things differently. We used to have a guard sitting in the lobby. We had card readers. You had PIN numbers. The facility has gone through probably maybe even more of an evolution than the vehicle itself has in some regards. We had mirrors, and cameras, and you put your card in and it would read it. Then you'd put your four PIN numbers in. We had those kind of evolutions happen around here all the time. That's probably more of an evolution than anything.

Let's see here. "Describe some unique equipment in your building." Well, I don't know. I might have answered that. Years ago this building, in the far northeast corner, had a water tank. The water tank, you can go online and see some old black-and-white photographs from the Apollo era, or maybe even before, where they actually had a big water tank, and you can go there now, and see scratches in the concrete and I-beam looking devices embedded in the concrete. It was probably a support structure or something like that. Now we use it for something entirely different. Even before they had the WET-F [Weightless Environment Training Facility], which was next door in Building 29, they had a tank here.

Then it went to the WET-F, and now the WET-F is the NBL at Sonny Carter [Training Facility]. That's been a curious thing. The NBL guys, they started off their career in the WET-F, and they think they were first from the get-go, and we always call a timeout on them and say, "No, we had it in our building before you guys did." I've actually sent them pictures. They're like, "Oh my gosh." Of course, they're younger guys, and say, "Oh my gosh, I didn't even know

that." I say, "You go back in the NASA archives, and they actually had a water tank here in this building many years ago."

Our motion base, again like I said, is probably similar to what United or Delta or uses in the way of having a big cockpit environment up on hydraulic legs that gives you the feel of motion. If we're going to do ascents, we can tilt it back almost 90 degrees. Of course, Delta and United don't have a need for that. So they don't do that, but ours can actually tilt back almost 90 degrees. What that does, is give the astronauts T minus nine, T minus two, whatever the training scenario calls for, to lie on their back.

When the motion starts, it's vibrating, and they're lying on their back, and they're having to reach things in an awkward position as you can imagine lying on your back. That's very unique. We bring that out during the tours and show them that, if we can. If we have a VIP that actually gets a chance to fly the motion base, of course that's something we always try to demonstrate. That is very unique.

The fixed base is pretty straightforward. It's got the same kind of flight deck configuration that the motion base does, except it has the aft station where you can look out through our visual systems into the payload bay. We have the capability of generating in our visual system all the stuff that's going to be in the payload bay, if we have special payloads, or either just the docking mechanism where it mates up with the Space Station. They can fly the robotic arm standing there and manipulate things. Back in the days of the payloads we had all the different payload scenes out there, depending on what type of payload we were carrying on a particular mission.

The forward visuals are very unique in that we have all the different landing sites around the world. We can go to Zaragoza, Spain. Those of us that's been to Zaragoza, Spain, can

actually look and say, "Oh yes, that's where the officers' club is right over there." You can actually see those sort of things. Of course the astronauts that have flown in different places in their military careers, they make the same comments going to different locations. Edwards [Air Force Base, California], and of course Kennedy [Space Center, Florida]. [Marine Corps Air Station] Cherry Point in North Carolina. Of course Zaragoza, Spain and a lot of the other landing sites. That's all part of the development process that the contractors have to do, is produce those visual scenes.

We have those visual system capabilities. We have the weather phenomena. We can put in cloud decks and those sort of things: day, night. If a particular crew is going to launch at night, of course all the visual scenes will be night. Or if they're going to launch late in the day and then they have to go over to Spain and land, well, we'll make sure it's nighttime by the time they get over there, depicting what it would really be like in real life. So we have a pretty good visual system showing them what we need to to build the proper training environment. That's probably not overly unique in today's technology. I'm sure if you went to the major airlines, they would have those same kind of capabilities. The day, night, and the weather phenomena they'd have to have. The tilting of course is probably very unique. Other than just the vehicle itself being obviously unique.

ROSS-NAZZAL: Can you tell us about the T-38 trainer?

SWAIN: The T-38 trainer came on board four or five years ago. The trainer itself is basically just the fore and aft cockpit of a T-38. In fact, I've heard rumors that they actually just took an old T-38 and just chopped it up. It really looks like that because a T-38 is not a very big aircraft

anyway. The simulator itself would probably fit in this room. We had it in Building 5 South until about a year ago. Then it went back to Arizona, when it went out there to some company that was going to refurbish it and give it some new capabilities. Then it came back. It's got the glass cockpit and those sort of things. We put it in the old Spacelab where the enclosure accommodates its visual system. They have a real nice visual system. They need to have a good visual system and instrument training.

Again, the box isn't much bigger than this office, with the simulator sitting inside of it with the visual system. Then outside you have a desk with an array of computer screens that the instructors sit at and talk to the students inside the trainer itself. We, the Mission Operations Directorate instructors, the instructors that train the astronauts here, do not train the T-38 simulator. The folks from Ellington [Field, Houston, Texas]—a whole different directorate—are the ones who come in here and actually train the astronauts. We don't do any of that.

Now, our technicians in this building, who keep the Shuttle simulators up and running, only go up to just basically providing electrical power to the T-38 simulator. If the T-38 simulator has some kind of a software load problem, none of our guys in this building mess with it. They have to go through their channels and their Ellington folks. I don't know who does that.

ROSS-NAZZAL: One of the questions the contractor writing this nomination wanted me to ask was has any of the hardware in the facility's ever flown in space.

SWAIN: No, and we go out of our way not to have that. Because if you have a space item, the configuration control on that stuff is a nightmare. It's just an administrative nightmare. If you

bring something into the building that's really a flight item, you have to have armed guards and bonded storage and just all kinds of bizarre things.

Now with that said, I'll back off a little bit and say that there may have been some stuff over the years. The point I'm trying to make is we don't encourage that. We don't advertise that. We don't go out of our way to accommodate that for those reasons I mentioned. A number of months ago, in the Space Station side had a payload rack called the glove box. It's the one you see in the science fiction movies where they put their hands in gloves inside this enclosed case.

Anyway, we got one over there that's really nice. They brought in a experiment that they were going to take up on board the Space Station called SPICE [Smoke Point In Coflow Experiment]. That was the acronym. What it was was they were going to experiment on the flames of different gases, like argon gas or propane or whatever the gases were, and the astronauts were required to learn how to adjust this flame. So they brought in the flame-producing device and little gas bottles, which was basically about like cigarette lighter, and a 35-millimeter camera. They put all that assembly inside the glove box. The astronaut part of the training would go in and manipulate this.

Now the scientific results from that are null and void because we're in a one-G environment. But from a training point of view, the astronauts actually got to manipulate that. Now whether all those devices, the little adjustment and all that, actually ended up going to space or whether it was just a training item I don't know. Like I say, we don't go out of our way to try to bring in flight devices and things like that here. Not to say that maybe some camera or something like that hasn't made its way in here. Am I answering your question?

ROSS-NAZZAL: Well, I think she's looking to see if there was anything that has flown in space that has become part of the facilities here.

SWAIN: No, most of the stuff that gets flown in space are individual items that a person has talked a crew member into taking up there and bringing back. I have a rubber mouse at my house that flew in space. It was from [STS-8]. Dick [Richard H.] Truly was the commander, and Dan [Daniel C.] Brandenstein—he's a USA [United Space Alliance] boss now—was the pilot. We were going to have eight rats going to go on orbit as an experiment. We as instructors, were always talking about these rats. The joke became, were they going to name the rats. They said, "Well, no, we don't want to name them, because then you'd get attached to them, and we're going to do bad things to them. So we'd rather not name them." Of course, this went back and forth over the period of training over six months.

Well, one day we were going to have an ascent sim, and we were going to tilt the motion base back like I mentioned. I had a rubber mouse at the house, I got it, and I tied a little string around it. I went up there in the motion base, and I tied it off. I hid it behind the glare shield. Well, when they tilted it back, this mouse comes tumbling out. I can't remember who the mission specialist was.

But anyway, I measured off the string just long enough where it would hang right there in front of all three of them. We're down there in the instructor station, and we hear this, "Are you guys ready to go to extended pitch?" That was a safety call we always had to make to tell them we were getting ready to tilt it back. "Oh yes, we're ready." "Okay, operator." The operator is the technicians that does the work, like I mentioned to you. "Okay, extended pitch." All we hear

was, "Oh my God, oh, gee," all these kind of goofy sounds and laughter from the cockpit. Of course they called us, "Okay, what are you guys up to down there?"

Well, what they did, Dan took that rubber mouse and put it in a little plastic bag. They have to, whenever they take something on orbit like that. They took it up on the flight with them. They brought it back, and they put it on a plaque for me, and they named it. I took that home. It's hanging in my living room right now. But for just general things, people have little flags and things like that, that's flown in space, and stuff like that. I don't think we've got any really big piece of hardware that flew in space that we can come and say, "Oh, this flew in space." Obviously the Shuttle being a recyclable vehicle, we don't have a big capsule sitting out here on the grass or something that says, "This was the Apollo X capsule," or something like you see in a museum. I don't think we've got anything that really meets your question like that.

Let's see. We've got unique equipment. We talked about all the uniqueness of it, yes. DoD classified, we've really beat up on the DoD here. Measures taken to protect classified information. I think probably over my talking I might have covered that particular item. Main contractors. Well, when I got here, Link—in fact we've still got the logo out there on the simulator itself—actually built the simulators. Link evolved to Singer-Link. They were Singer-Link for a while. Then they went to CAE-Link, which was a Canadian outfit. Then I want to say there was something after CAE-Link, but I'm not sure what. Then they're Raytheon now. There might be some really old folks still around, if we could find them, that could go back, could say, "I worked for Link," or, "I worked for Singer-Link," or something like that. I'm sure around the area here in the Clear Lake, there's a lot of those kind of folks that could say, "Well, I worked for these different companies." That's on the simulator side.

When I got here the instructors were comprised of Rockwell International instructors, McDonnell Douglas instructors, Ford Aerospace instructors, NASA instructors, civil servant types. If we had an IUS payload—IUS was inertial upper stage—Boeing made that, so you'd see a Boeing employee in here every once in a while. It stayed that way until probably about '85. Then NASA decided they wanted to put everyone under one contract. That's when the STSOC [Space Transportation System Operations Contract] came along. STSOC contract came in and consolidated all those instructors.

So Ford Aerospace and Rockwell, McDonnell Douglas—all those people had to become STSOC employees or either get another job somewhere else, within their company or whatever. STSOC was all the instructors. Of course, NASA civil servant types were sprinkled in there. Then we went into a whole long litany of contracts. I think there was some other SOC type of contract in there. Basically, it was the same folks. It was just a different company type alignments. Then it went to, SPOC. It's Space [Program] Ops Contract. But what's interesting is just this year, we've changed yet again. All the contractors here in the building were USA, United Space Alliance, contractors. They went from the SPOC contract to the FDOC, which was the [Facilities Development and Operations Contract].

USA had an offshoot called USASO, which is USASO (Space Ops [Operations]), and Cimarron. So right now, half those technicians are either Cimarron employees in the technical side of it, or they're USASO if they're in the ops configuration, like all the people that do ops back there in that command post, the sim control area, they're USASO. But all the technicians here on the other side of the wall, they're Cimarron employees.

Raytheon was part of the Space Station simulation, and they handed over to USA a few years ago. So we don't get a lot of Raytheon in the building right now. They have contracts at

Building 9 and out at the NBL. The flight software load development are USASO. The ops here in the building is USASO. So there's been very much of an evolutionary progression of these different contracts that get changed as they try to build a little bit more of an efficiency into the system or cost savings and things like that. That certainly has happened over the years.

The biggest one I think was really when we went to the STSOC, and that happened about the same time *Challenger* did. Where we had that very diverse cross-representation from many many aerospace companies, and it just went all under one umbrella, the USA umbrella at the time. Then since then it seems like they would just change the contract name and employee benefits. I'm NASA, so I'm not privy to a lot of that kind of stuff. How the benefits and 401(k)s and those sort of things factor in, but I hear it from the employees a lot of times. Yes, on this side of the building, with the exception of the astronauts, there's no NASA here except me.

On the other side of the building, it's almost that way. You might be able to find a NASA instructor there, but I think it's just about been taken over by all USA or contractor type instructors and technicians. The technicians I know are all contractor, all USASO or Cimarron. We have a small cadre of Teledyne Brown employees that work Space Station because they work out of Marshall for the Space Station Program Office. They're Building 5 Space Station type of folks, even though their offices are now up here in the 5 North area.

Then sometimes there'll be a sprinkling of other specialty, like the computers. We still have IBM people that have their influence over the Space Shuttle computer because we still have the same computers here. You see those kind of folks in the building and come to meetings and what have you too.

"Who would you suggest we interview?" Well, I could send you an email of some of the guys who've retired and moved along. A lot of them are still around. We're losing a lot here in

this building because of the contract changeover I mentioned just happened this year. We had a lot of old gray-haired guys like myself going out the door. Not a lot left. Depending, of course, on how far you want to go back. If you want to go way back, you really are losing some. There's probably a pretty good core of folks still around if you could find them. One person I know that was instrumental in hiring me was Frank [Francis E.] Hughes. I've got his card here somewhere I thought. He works out the back gate by the credit union. I keep saying Textronix, but I don't think I'm pronouncing it right.

ROSS-NAZZAL: Yes, I think it's like Tietronix or something like that.

SWAIN: Yes, it's something like that. Frank is still around. I'll probably see him this afternoon. Hiram Baxter, who's been here for 41 years, is leaving. Today is his last day. He's a USA employee. Probably see a lot of those guys out at the Gilruth [Center] this afternoon myself, because they come out of the woodwork sometimes for those going away parties. Frank would probably be good. He's a history buff anyway. He came to work in NASA I think right out of school. He was at the Cape for a number of years as a young kid when they did a lot of stuff down there. I'm sure he could elaborate and probably give you all kinds of insight on this facility, because like I said he hired me back in '81, and he was my boss for a number of years, and then he left, went one direction, I went another. Then we rendezvoused, and I worked for him again. I still give tours to his folks and to him. I see him all the time around here. He'd probably be the best source, I'd say. I know he's in the local area still working here. Some of the other ones may be in the local area, but they're probably on the golf course or something like that.

ROSS-NAZZAL: Enjoying their retirement.

SWAIN: Not only that, but he loves to talk to you about stuff here, so you won't have a hard time getting an audience with him. Let's see. I gave you the brochures, the pamphlet.

ROSS-NAZZAL: One thing I was thinking is do you have anything specific maybe about the simulators. Is there a manual maybe or a history?

SWAIN: Well, that's funny, because a lot of that stuff, as we've gone to the electronic age, people throw those things away now for electronic [files]. Actually what I did, I showed this to somebody. Somebody was here the other day from one of the historical societies. I think I dug this out of the garbage can maybe.

ROSS-NAZZAL: Oh, no, makes our heart break.

SWAIN: This is just some stuff. You'd have to almost go through here and see if you could see what it is. But I have it, it's like '82. The motion base crew station operating. Aft seat. See, here's the Link logo, a division of Singer. See, that's back when they were here. Where's the date? I'm missing the date here—'80. So this is probably good stuff. Yes, drawings.

ROSS-NAZZAL: Drawings would be fantastic.

SWAIN: Yes, see. That's '76.

ROSS-NAZZAL: The schematics.

SWAIN: There you go. See, that's back in the days when people actually wrote and used paper. I wow people with stuff like this. They say, "Oh my gosh, where'd you get that, oh, my!" Again I think I just inherited it somehow or another.

WRIGHT: Would you allow us at some point to borrow it to scan it?

SWAIN: I'd be more than happy to. This has even got August '78 on it. "Motion base certification document." In fact, I've done that in the past with newer stuff. They didn't want anything this old. But when they come in here for Cx, they've asked if I had any books and drawings and things. I've made comments that you're welcome to have them. They came over one day, a couple guys, and they walked off with a whole wheel barrowful of stuff, and they took it and photocopied it. Here's the instructor operator station, which is right next door.

See, we used to have these great big consoles. It was a big unit. This sucker was as tall as the ceiling almost. You'd sit here, and then you had your display. You had buttons and hardwired type buttons. Of course, now you go over there and look, and they've got this lowboy console like in the Mission Control Center. You can see it right through the glass across the hall. Just regular flat panel screens. Got carpet on the floor as well too. We didn't have that back in those days either.

What am I looking for here? I'm just looking for a date. The form was '86, so it's got to be probably newer than that. This is '88. It's stamped on '88. No, no, you're more than welcome to look at this and go through this and see. I keep a couple things up here. This is the Space Station. This is all Space Station up here. But see, this stuff is probably almost getting to the point now where you've got something like this. This is '92 with Space Station, these media books and stuff. One of these days these things are probably going to be worth something.

Yes, I've got stuff like that, if you want to task me to go dig it up. I could do it like I did for these guys that came through here a year ago. Here's a June '85. I can make these available to you anytime. Well, this is '91. This is almost new. This is a simulator ops handbook. It shows some of the actual crew displays. In '90, '91. What's this document here? "Shuttle mission simulator, instructor familiarization manual."

ROSS-NAZZAL: Oh, that would be great.

SWAIN: See? This is '85. That shows you what we used to have in there. Used to have these big super consoles, like some kind of power station or something. Yes, like that, that's what it used to look like. Of course, now we don't even have that type of furniture in there or anything. In fact, see, here's a schematic. This is '85. There's the motion base simulator and then the fixed base. Then that's the box which had Spacelab in it. That's Spacelab, as you see there, and the instructor stations across here. What we've done here right now is these two rooms got shifted down. These are the rooms that I was familiar with. This hall right here is still right there, but there's a little room right here. Then these two big instructor station rooms, they got shifted all the way down pretty much just to the hard end, and that's a little janitor's closet there.

All this population here, of all these things that are depicted in just these little squares, about half of that is gone because of technology. All these IBM and all this computer equipment is gone. This whole area out here is just tables. That's where we think Cx is going to go. This area up here isn't a console station anymore. It's gone. The T-38 is actually inside that box. So you could take this and say, "Well, this is what it looked like in '85," and then take what it looks like now and match it up. You see there's some differences.

Those don't mean too much. Of course, they give you explanations for them. But as for photographs, I had a bunch of photographs, but I'm trying to think if any of them were really worth anything. If you want to have a follow-on to today's interview, if you want me to try to make some of this available at some future date, you're seeing what I have.

WRIGHT: We'll take it anytime.

SWAIN: Bring a cart over here or something like that, and I'll be glad to let you take it away and photocopy it or whatever. …

Let me see this other [question] sheet. Room 117D really is the high bay where all the simulators are. It's actually 117E, D, and C, but I know what you're talking about. We talked about 1150 with regards to what 1150 is nowadays versus what it was back in the Apollo era when it was just a high bay area. That was off your second sheet you sent me. Then the simulator, the T-38, motion base.

Now the GNS—you mentioned the guidance and nav simulator. The GNS is just like the fixed base we have here, except it's over in Building 35. Actually, MOD was trying to get it decertified, decommissioned, torn down, this year, but I don't think it's going to happen. If the

program gets slipped out and we don't really retire the Shuttle when we thought we were going to—and all that is in the political arena—we may drag it out a little bit. But that's what the GNS is. It's basically the same thing we have here in the fixed base. So we have two of them. Why it's not called a fixed base, it's called a GNS, was it was used a lot for software load development and checkouts. Then just as the Shuttle Program was really hot and heavy, they upgraded it and turned it into a mirror image of the fixed base, so basically we have two fixed bases.

We talked about the items flown in space. Then we talked the different types of simulators. Ascent and entry, long sims, integrated sims. I think you got a feel for how we can integrate with the Mission Control Center, Marshall, and the NBL, and Space Station simulator next door. What they are, training syllabus and then the different elevations of training intensity that goes on in them.

We talked about how long they last. Sometimes the crews will come over and it'll just be the pilot, commander, and the mission specialist 2, which is the center seat, and they'll shoot landings maybe for a couple hours just for proficiency reasons or something like that. That's one end of the spectrum. The other end of the spectrum is there'll be a whole seven-man crew here for two days, like what's going on right now, and they'll be moving between simulators. They'll walk over to the Space Station simulator, spend maybe an hour over there doing some exercise, simulating that they're in the Space Station. Then they'll come back over here in the fixed base and maybe cook a meal or something, simulating they're doing something. We have a pretty broad stroke of the kind of simulations we can run and do run here in this facility. I think I covered all your sheet. Was your sheet pretty much all-encompassing?

ROSS-NAZZAL: Yes, yes. I think you've hit just on everything. I asked some clarifying questions.

SWAIN: You can follow up any time you want.

[End of interview]