SHUTTLE CARRIER AIRCRAFT ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

ROBERTO GALINANES AND DON SWEM
INTERVIEWED BY REBECCA WRIGHT
KENNEDY SPACE CENTER, FLORIDA – 17 APRIL 2012

WRIGHT: Today is April 17th, 2012. This interview is being conducted with Roberto Galinanes and Don Swem in the Vehicle Assembly Building [VAB] at the Kennedy Space Center for the Shuttle Carrier Aircraft Oral History Project. Our subject today is the mate/demate device [MDD]. The interviewer is Rebecca Wright. Thank you both for taking time this morning, for coming out to sit and talk with me. We're going to do this as a combination with both of your skills, and I appreciate your efforts with that. Roberto, if you would share with us a brief history of your career here at Kennedy.

GALINANES: Well, I started in 1984 as an electrical engineer for the crane section. Ever since [then] I have been in the crane section. This July I'm going to be 28 years with the United Space [Alliance]. I started with Lockheed then it changed to United Space [Alliance]. The thing that I most like, we cover so much, we cover the demate, we cover the pad, we cover the VAB assembly, we cover the HMF [Hypergol Maintenance Facility]. That's what I like. That's why I never requested any transfer or anything like that, because I enjoy it.

WRIGHT: Don?

SWEM: I started at Vandenberg [Air Force Base, California] back in 1980 with Martin Marietta building SLC [Space Launch Complex]-6. I got transferred out here after *Challenger* [STS-51L

accident] in 1987, and I worked in the design organization doing modifications and improvements on the facility. Approximately, I guess, 12 years ago I transferred to the cranes and door department, basically just to have a change and be more field-oriented. I thought that would help my design career, being more into the field aspects. We cover a lot of cranes. I would say approximately 25, 30 cranes out here, bridge cranes that we maintain. Then all the doors our group handles and repairs. I'm not talking rollup doors. I'm talking extremely large doors. In the VAB there's 28 doors alone, vertical doors, and seven horizontal doors, these massive doors. We had a lot of things. We're constantly putting out fires. I did go back to design engineering and realize that I didn't like sitting at a desk all day in front of a computer. I missed being out in the field.

GALINANES: We're teaching something. At least we're teaching over here to be more oriented in different points. Over there in design he was only one task oriented. Over here we got him trained to multitask.

WRIGHT: Well, Roberto, tell me about the cranes, and how important they are to the overall facility.

GALINANES: The cranes are pretty much the unit that we use to assemble the SRBs [Solid Rocket Boosters], the ET [External Tank] and the Shuttle. We put the payload in the OPF [Orbiter Processing Facility] for the horizontal payload, and we use the 90-ton to put the vertical payloads in the pad. They're pretty much essential. If we don't have it, they cannot be assembled. That's the bottom line on that one.

WRIGHT: What are some of the important attributes [of crane operators]? Or what do you expect the people who work in the crane department? What kind of skills are you looking for?

GALINANES: We're looking at people that are capable of not getting nervous when they're picking up an orbiter. They can talk and [demonstrate their] skill when they're talking on the radios, especially since the crane operator has to be the electrician, and they have to be mechanical too. So they have to have their own skill too. They have to be skilled in their own craft, separate from being a crane operator. The people that work with us, they're really nice people.

SWEM: When you're picking up flight hardware or an SRB and you have a crane problem, and the crane goes out, you have to go out there and fix that very quickly. You need people in this group that can make decisions. Not everyone can make decisions. They freeze up. They become afraid of the consequences. You need people in the group to go out there and be able to come up and make [decisions]. You do take calculations into consideration. There's risk factors, but you have to make a decision and move forward. That's a big difference. A lot of responsibility.

WRIGHT: And the responsibility of such expensive hardware. There's no time for oops.

GALINANES: At least we haven't dropped anything.

SWEM: No, we have a good record.

GALINANES: Yes, maybe damaged a couple of things. But not dropped anything.

SWEM: If you drop an SRB, that's it. Everything's over. So you cannot do that.

WRIGHT: Let's talk about the use of the crane with the mate/demate device. Can you share what those steps are?

GALINANES: Yes. The MDD is a special structure that was designed for the Shuttle to onload or offload, they call it, the Shuttle from the SCA [Shuttle Carrier Aircraft], the 747. At the beginning, since all the Shuttles were pretty much landing in Edwards [Air Force Base, California], they had to onload it there in the Edwards MDD—or Dryden [Flight Research Center, Edwards, California] they call it. And they have to offload it here, every time they landed over there. I think they did it 54 times over there. They land over there, and we had to offload it here 54 times. Plus we had to onload a couple of the orbiters here when they did the upgrades on the orbiter to California.

It consists of three hoists, one in the forward and two in the aft. They call it starboard and port. They attach the sling, and they got four attachment points on the sling that hook up to the orbiter. That's pretty much it. You just attach the orbiter, pick it up from the 747. We back off the 747, and we set it down on the floor. Sometimes they open the landing gears, and sometimes they put on top of the OTS, it's [called the] orbiter transporter [system]. They set it down and take it over to the OPF or wherever it's going.

WRIGHT: You make it sound very easy.

GALINANES: Oh, it's easy. Plus you got other equipment. You got these SAPs. They call it service access platform that are being used to attach those points. They are being lowered. They're big humongous platforms. They have two attachments, and they have tubes in those attachments so it will be a wind restraint. They don't move a lot. They're just big safety chains that they would add on as a safety factor, because they have a single failure point. If wire rope fails, it will drop down on top of the orbiter. So we came out, and they designed some big safety chains. The links are maybe four inches.

SWEM: They're very heavy. You can really pinch your fingers in them. It's just not a good system. One problem I saw when I first saw the winches up there were that the two brakes were downstream from the drum. So there was no real drum brake on it, which is not the best design, but we lived with that design. That's why they have the safety chain as a backup, because we didn't have a drum brake. On the coupler side, the coupler was very old. From downstream on the gearbox side, we had the two brakes. I didn't really like that system at all, but we dealt with it.

GALINANES: Remember, it was built in 1960. It's almost [52] years old. So the weather here is not like in Dryden. It's dry. Over here it's moist. We have the ocean right there. So we get a lot of rust. So that MDD has been refurbished a few times and repainted because of that condition.

WRIGHT: What was its first use?

GALINANES: I think it was STS-1 because they landed in Edwards, and they had to offload it over here when they came back over here. They did it also for the *Enterprise* too, I think.

SWEM: All of them were built in California and flown out here.

GALINANES: One of the other components of the MDD is the X-Y. They call it the X-Y movement. The sling is attached to the hoist. Also they have tubes to help with the wind restraint. They have some screw jacks that can move that sling. You can move it in this direction, in the X and the Y, and you can move it forward or aft. That's to fine-tune all the little movement that you have to do to be able to attach those to the orbiter. So that's how they do that. Also they have the hydroset at the end of the hook. The hydroset, you can do really minute movement on the load by using the hydroset. So you can move maybe what?

SWEM: Thousandths of an inch.

GALINANES: Thousandths of an inch with the hydroset. They have long strings that they attach to the handles so they can pump it up or pump it down, whatever direction they need to.

WRIGHT: How many people does it take?

GALINANES: I think it's approximately about 70 people. Between the operational people, the crew people, the crane crew people, and safety, and all the other people that you have there. Heavy equipment. Approximately 70 people.

SWEM: Like Roberto was saying, there's basically three major systems, X-Y positioning system on a telescope. These tubes were telescoping tubes, and we've had a lot of problems with them because sometimes they would hang up when you lower and raise them. They would stick, and all of a sudden release and pile-drive down and shake the whole structure, which scared the heck out of us. So I came up with a device that'd go inside the tube. The problem was you couldn't lubricate. You can lubricate the outside of a telescoping tube but you couldn't lubricate the insides. So I had this greasing tool that would pump grease inside the tubes. We would lower it down. That worked for a while, and then we had more problems with it. So we duct-taped a bunch of spray cans together with lubricant sprays, and then screwed down a piece of plastic with a threaded rod to push down on the little sprayers, and then lowered it down with a rope, down inside the tubes, to spray the inside of the tubes. Little ingenious things we did to keep that from pile-driving and scaring everybody. It would shake the structure, one of our little quirks about that.

WRIGHT: You had secrets about how to make it work.

SWEM: Inside little things.

WRIGHT: You have to come up with ways to make something work, because you don't have that opportunity to redesign. Is that correct?

SWEM: You have to live with [things]. It's very difficult to redesign a lot of things, because there are a lot of drawings you have to revise, and you have to go through a huge process to revise things. There's a lot of paperwork.

GALINANES: At the beginning we were launching a lot, not compared to now at the end. We did three at least a year. We were doing about five or six a year. So it was a constant movement. Then we are involved through the whole process of doing the orbiter, from the SRB, ET, and then the Shuttle. As soon as it goes out of here the only thing you have to take care is the payload—if it goes that way. If not, it was already installed in the OPF so we didn't have to worry. It was constantly pop, one after the other one.

SWEM: So you don't have time to do improvements all the time, because of the schedule. Everything was so schedule-driven. We're not talking eight-hour days. We're talking around the clock 24-hour shifts.

GALINANES: For mating.

SWEM: It was unreal.

WRIGHT: Are there other tools or ingenious resource fixes that you can think of that you guys put together during the timeframe other than the [telescoping tube]?

SWEM: On the MDD? Or on other stuff here?

WRIGHT: MDD first, and then you can do some other stuff.

GALINANES: The MDD is pretty much maintenance stuff that we had to [be] ingenious on, because of the telescoping tube principally and the bad weather. The other things they have been pretty good, other crane stuff.

SWEM: I brought my design skills where I could do a sketch real quick and get a shop to make a part that we need to go out there and implement. That was the nice part. I saw instant results. I liked that.

GALINANES: That's why we're going to keep it. We told him, "Hey, you're coming back—you're not staying there."

WRIGHT: So what other types of fixes did you do? Can you think of some more that you worked on?

SWEM: When I was in design I did the brake modifications. Originally we [had] a three 55-ton hoists that does the lifting. The original brakes on it were these archaic solenoid-activated

wedges that would spring-load and shoot down every time there was an emergency stop that you had to make. They would shoot these wedges into the flanges and wedge the drum from moving. It was just very difficult to dislodge this thing once it was activated. When I was in design they gave me that project, and I came up with a giant disk brake, similar to a car disk brake. You had a disk, and you had a caliper. I worked on that design to install a caliper brake system as our emergency brake system on the MDD. That was a successful modification that later I got to service after I got to work with it.

GALINANES: That and the new pancake brakes.

SWEM: We had other brakes that were like the motor brakes. They were two independent drum brakes. They were made of carbon steel and would constantly slip and not meet the torque specs on them. I came up with stainless steel disk brakes similar to a car, two of them in line with each other, and implemented that design on the brakes. Eliminated the corrosion problems since they were made of stainless steel.

WRIGHT: You have to forgive me for being so ignorant about it all, but sometimes it helps because then I can ask those questions. The brakes were used how in the MDD? Where were you applying? As they come up?

SWEM: All winching systems or hoisting systems have to have at least two brakes on them. The reason why we added them is to stop the hoist when you stop operating. Then you had an emergency brake which would lock everything up. The emergency brake is designed if you lost

power the spring-load in the caliper would clamp down on the disk. The way it is is you hydraulically pull back the brakes, so if you have a loss of power, the valves would release, and the spring-loaded mechanical systems would clamp on the brake. Very fail safe. All hoisting systems have to have a minimum of two independent brakes for safety.

GALINANES: That emergency brake that he's talking about, it's activated mainly by the overspeed. We have an overspeed in the system that is calibrated to a certain rpm [rates per minute]. If it goes over that rpm, then it shut off the power, and drop[ped] out the solenoid on that caliper. Then it's set up in the wheel.

WRIGHT: Did you ever have to use it?

GALINANES: No, but it got activated by nuisance trips. So we decided to go ahead and change the wedge system to the disk brake system, because it was easier to dislodge them completely. It was a good design; it was nice.

WRIGHT: Sounds like it was very valuable—not just for the hardware but of course for people. Or vice versa, not just for people but for the hardware.

GALINANES: Yes, we have to create it for the overall system. We have to create a special tool. It was like a fork to get in there. Sometimes you even had to bump the hoist to be able to dislodge the wedges in there, it was so hard. It was steel against steel, so it was really hard.

SWEM: Yes, it was a pretty lame design.

WRIGHT: Worked for 1960, huh?

GALINANES: Yes. It worked fine until we finally came up with that solution. It was a good solution.

WRIGHT: Do you remember when you integrated those brake systems in?

SWEM: It was in the mid ’90s, I think. Yes, ’95 let’s say.

GALINANES: They did the modification in Dryden but they didn’t do the other brake modification over there, because over there they didn’t have the problem with the rust. So that was taken care of. We only did half of it.

WRIGHT: If a modification was made at Dryden, was it also made here?

SWEM: I think it’s more like the other way around. Here first and then [there].

GALINANES: Yes because we do the maintaining. But it was operated by the ops people [at Dryden]. Over here we do the maintenance [and] operate the system too.

WRIGHT: So you knew the system inside and out because you had used it. Tell me about the weather and the corrosion.

GALINANES: He can tell you a lot. He worked a lot of it.

SWEM: I'll tell you what. In California you have the desert and no salt. The MDD out there is pristine. The one out here, it is a constant battle with rust and corrosion. Not only does it affect the structure and the steels, but it affects the electronics, the breakers, the electrical system, even our wiring gets corroded. It gets brittle. Constant battle. Just very difficult. That's one of our most difficult facilities to maintain, because it's a frame structure out in the weather. We have hurricanes and things like that.

GALINANES: Water, rain.

SWEM: Water constantly gets penetrated. We have birds, thousands of birds.

GALINANES: Alligators.

SWEM: Buzzards.

WRIGHT: They think it's a roost?

GALINANES: Snakes, spider.

SWEM: That sit on that. They go on it pretty much. Their droppings are corrosive. It's just a very difficult facility. Be honest with you, as much attachment as I have with it, the last one goes off--.

WRIGHT: It'll be good.

SWEM: I'll be happy.

WRIGHT: Do you have a regular maintenance schedule?

GALINANES: Yes.

WRIGHT: Do you tear it down?

GALINANES: No, we have an operational and maintenance procedure. The operation [and maintenance instruction] mainly tells you how to operate the system and all the whistles that the system has. We have a maintenance procedure that we do quarterly, semiannual, and annual PMs [definition?]. Then we do a load test every year. I think since *Challenger* they came out with, they call it the file six requirement. It's a database that they created after *Challenger* that any critical system that [has] a requirement would be put into that database. So it have to be signed every 365 days. It had to be done that way. So the load test, when we pick up that weight, the total weight of the hoist, the 100% load test, we test each brake individually. We test

the emergency brake, verify that it holds, and also holds at 150%. So you don't choke the load if it's activated.

Regular maintenance on the wire ropes, on all the electrical components, and everything. So we keep a constant maintenance all the time. No matter if we use it or not. Then before every use we do a good preop, because the system is not used that constantly like the cranes over here that we use more. The preop there takes about maybe two, three days to get that done. So before we did *Discovery* we took pretty much a whole week because we haven't used that one for a long long time. The weather has been nice, so it has been operating often. Everything worked fine in this onload that we did for *Discovery*.

WRIGHT: So I guess on a couple sides you were busy, because as we were walking in you mentioned that *Discovery* had been kept in the VAB.

GALINANES: That's right.

WRIGHT: So do you mind walking me through the last couple weeks or however long it was that you actually started moving *Discovery* toward [ferry flight]?

GALINANES: *Discovery* was moved out of OPF-2 because it was completed. So they moved it to High Bay 4. NASA did that, because they don't have another bay, because the other bay was rented to commercial people. They put it there, and they said, "Hey, now we can show it to people." So they got tour buses coming into the VAB, and they could walk through for the tour

people so they can see *Discovery* in High Bay 4. That was something nice extra that the tour people got to see. They were pretty close, maybe 25 feet from the orbiter.

WRIGHT: That's nice, that is close. So you babysat with her for a while.

GALINANES: Yes.

WRIGHT: Then you mentioned about a week before you went out to the --

GALINANES: To the MDD.

WRIGHT: And checked it all out.

GALINANES: We did the preop on the hoist, on the SAP, and the X-Y system. So we did pretty extensive [tests]. We didn't want them to have any hiccups. We know that there was a lot of people watching us and looking at it.

WRIGHT: I guess on this onload you had a few more observers, I guess, than normal because of its destination.

GALINANES: Yes, and TV, it has been recorded and everything. Everything was recorded.

SWEM: Our OMI [Operations and Maintenance Instruction] systems, we have monthly maintenance that we do, and we have semiannuals every six months that we do, and then we have our annuals. The annuals are more extensive, deeper maintenance that we do than the others. Then our 100% load test where they bring these great big weight cages. They have these great big 10,000-pound plates that they shove in like a deck of cards. For each hoist connection we pick up these great big weight cages. It's quite impressive. Do our testing.

WRIGHT: What's used for weight?

SWEM: Steel plates. I would say like two-inch-by--.

GALINANES: They call it like a test cage. They slap those [in] and put them on top of it.

SWEM: Slide them in like cards. Two-inch. I would say they're like six-by-ten maybe sheets of heavy heavy plates that they slide into a square frame, steel structural frame. Then we attach to that, pick it up. Three of them for each hoist. There's three hoists. People forget. There's two on the aft component of the sling setup because that's where all your engines are. Basically your heaviest, like 60% I would say of the weight, is in the aft portion because of the three main engines and the OMS [Orbital Maneuvering System] engines and the fuel cells. The front portion of the Shuttle that we pick up is just one hoist. That's much lighter because there's not as much components in there.

WRIGHT: Do you always test for the maximum load?

GALINANES: Yes. 100%. If we do a modification in the brake system, in the path of that brake, we will have to do 125% load test, just to verify the integrity of the component and [that] everything worked fine. Then we continue doing the 100% load test on that one.

WRIGHT: So for *Discovery*'s route last week, she left early Thursday, I think, morning. Wednesday morning?

GALINANES: No. Saturday morning. They took it out at 4:30 in the morning. We left the doors open the night before in High Bay 4. The weather was good, maybe cloudy but they didn't care if it rained. The orbiter people came in, and heavy equipment came in. Put the threshover plates [in]. I think at 4:30 they were pulling it back. By the time the crane crew got here, it was already parked underneath the—they took in the wheels. So they tow it all the way back to the OPF. So from there on by 7:00, yes, they were ready to go.

WRIGHT: So you just reported down to the SLF [Shuttle Landing Facility], is that what it's called?

GALINANES: To the MDD, yes.

WRIGHT: Can you tell me about that morning? I understand you had weather again that caused a little issue.

GALINANES: Yes, we were there and everything was good. We got the system working fine. Even though it was windy we started doing the process. So we went ahead and lowered the sling, and then we attached the forward attachment point first. The orbiter is a little bit in an inclined position. The nose dips more than the aft. So you have to attach the forward attachment first because if you lower the sling completely it will hit the on spot in the back side. So the sling [has] to be crooked just like the orbiter. Then what you do after you finish attaching the forward attachment point, you pick up the orbiter from the front side only, about four feet to make it level. Then you can lower the aft connection points so you don't hit the on spot and come down. Then before you do that—you lower it to that position, then you have to lower the big platforms, the SAP platforms, to help the technician to access the attachment point in the aft.

SWEM: Just one thing I'd like to point out is that the lifting connections and the mounting connections are two different systems. Lifting connections are pretty much barrel receptacles on the sides of the orbiter where the sling swings down and inserts into the sides, and they screw them in, and secure them to lift it. On the underside is where you make your other connections to the 747. What I found interesting was that it's very much similar to the way the orbiter is attached to the external tank.

GALINANES: Yes, exactly the same.

SWEM: It's exactly the same. So it's designed the same way. Basically the 747 has become like an external tank. Same proven setup. The aft portion of the two connections on the underside are good and front the nose loads.

GALINANES: They call those what? The monoballs? Yes they're called the monoball, I think, the ones in the aft.

SWEM: The forward one is basically just to hold the nose down on the orbiter. It doesn't have any forward and aft loads. So just basically hold it down on the top. But I always found it interesting, it was similar to an external tank. It was, I thought, very ingenious that they did that.

WRIGHT: Who gives the go-ahead when the orbiter is parked in there? Who actually says we're ready to go?

GALINANES: We get the move director. That's mainly people from the OPF. They're the ones that tow the vehicle out and park it and say hey we're ready to go. That's where mainly we receive the orbiter from. We just follow the procedure, and we just operate the hoist according with the procedure. Then pretty much it's follow the procedure from there on, unless we have an issue—one of the brakes damaged or one of the motors [fail]. We have a couple of incidents that have happened. We had to replace a motor one time. We had to change a brake one time with the orbiter hanging in there. So it has been a couple of things that make it interesting.

SWEM: You get yourself in situations where you have to do unorthodox things because the risk factor of a storm coming, and you have to lower down the SAP platforms. We open up the panel, and we take an insulated screwdriver and a glove and push in the contact or the coil felt on. Just hold that in manually to lower that SAP down so they can keep moving with the

process. So you do things, these inside stories, where you have to make decisions and take a somewhat calculated risk.

GALINANES: Another thing that the SAP have designed in it was the stuff to hold the sling in case the weather gets really bad. How do you call those? The big barrels.

SWEM: Oh, the 50-knot wind tensioners or something like that.

GALINANES: It's a wind restraint that attach[es] from the SAP platform to the sling. So that will restrain completely. Since the SAP has tubes, the telescoping tubing, and the sling has telescoping tubing, that will attach both systems together to make it hardly movable. It will be pretty good. It will restrain up to 50 knots, no?

SWEM: Up to 50 knots, yes.

GALINANES: They're good up to 50 knots. It got so bad with corrosion that we have to pretty much eliminate that. The spring inside, we opened it one time.

SWEM: Rusted into a solid chunk of rust. They've been refurbished once, but we hardly use them at all.

GALINANES: I think we used it one time. One time that we did that we had to restrain it for bad weather that was coming in, but after that we have never used it before.

WRIGHT: Has there been occurrence of when you've been out either getting ready to offload it or onload it that weather has come in and that you've had to stop operations?

GALINANES: Well, this Saturday. Yes this Saturday we hook[ed] up everything. We lifted the front, and we were lowering down. We attached the aft, and then we had to stop there. We were supposed to pick it up so we can get the 747 underneath. We [could not] do it because of wind restraint. The wind was coming from the southeast at 26 to 28 knots. The tolerance is 16. If the wind comes from the east I think 16. You can put more wind straight from the front because it doesn't move the orbiter. So we had to stop. Safety shut us down. We had to get wood cribbage, how do you call those?

SWEM: Cribbing.

GALINANES: We had to put the cribbing in the front wheel about four feet high and lower the front a little bit. So we set the front wheel in there and lock[ed] it up, and [left] the orbiter hanging in there halfway until the next day. So he took over the next day, and they were able to finish it.

SWEM: Yes it went very smooth Sunday. We completed everything pretty much ahead of schedule. Worked out well.

WRIGHT: So safety issues like on Saturday, was there more of a concern for the orbiter or more concern for the people working?

GALINANES: For both. For both, because you got a load that is doing this. [Demonstrates]

WRIGHT: Moving back and forth.

GALINANES: Yes, back and forth. Even though it's going to a machine, you don't want to damage anyhow.

SWEM: Well, you know what, they've had data basically on side loads from wind. People forget that when you have that huge tail rudder and the side of the orbiter, you have a wind of let's say 10, 15 knots, you have about 4,000 or 5,000 pounds of force from that wind. It's basically a sail like on a sailboat. A lot of loads.

WRIGHT: With a tail that big, you're right. So you were finished on Sunday, correct?

SWEM: Yes.

WRIGHT: How long does it normally take if you don't have weather conditions or a brake having to be replaced?

GALINANES: Usually takes between 14 to 16 hours pretty much from the beginning to end. It all depends. This was beautiful weather even though it was windy Saturday. We didn't have any mosquitoes. You didn't have nothing that bothers you, because sometimes it gets so bad with mosquitoes on there it's unbelievable. You have to put one of those screen jackets so the mosquito wouldn't bother you. It's unbelievable the amount of mosquitoes.

SWEM: One of my fondest memories of the MDD is I had to operate—it was a 24-hour shift. Had to come in at 7:00 and work 7:00 in the morning. It was drizzling rain. It was in the middle of August and hot, drizzling rain. I was glazed over like a doughnut with Deep Woods OFF. The winds were coming and going, but I remember the floodlights. We have five stadiumlike floodlights, and it was at night in this drizzling rain. They were swarming around the floodlights, the mosquitoes, and they created like a vortex around these floodlights. I was staring saying, "Oh my God this is unbelievable." That was a rough shift, going through that night and all day.

WRIGHT: I don't know what the use of mosquitoes is, but they're horrible, they're just horrible. Tell me is there a difference, a risk factor in operations procedure when you're doing a night operation?

GALINANES: Well, you have pretty good lighting in there. I don't see any difference. But [it] all depends on the people you got working there. You have to be conscious of what you're doing and getting pinched or whatever, doing hoisting or whatever. That's the main thing, just safetywise.

SWEM: I remember one time I was watching, just observing. It was a day I was looking in. I noticed when they were raising up one of the cords that was attached to the side of the orbiter that came down, and they had tied it off and forgot about it. This electrical cord is what operates the wheel landing gear. See, what happens is when you remove the 747 and you're lowering the orbiter down close to the ground, the landing gears are up. They forgot to untie this thing. I noticed this cord was there. I called an all stop, and we went out and untied this cord that activates the landing gear. It's neat to watch because you're watching the bottom of this orbiter. They press the button when it's about I guess 15 feet or 20 feet off the ground. All of a sudden you hear this sound, and all three landing gears drop instantaneously. Then they can proceed to lower it. That's one thing. You have to observe. Take responsibility and look at things and see what's happening.

GALINANES: Even though it's not your system, you have to be aware of it. You have to be aware of everything. Anybody can leave something tied off to anything or forget about it, and that's why you have to be there watching all the time.

WRIGHT: Because you all have to work so closely together.

GALINANES: That's the main thing. You have to work together as a team.

WRIGHT: You started out by telling me that it's so important that people that work within your team understand they have to be able to make those decisions.

GALINANES: We have that in the operational procedure. You have to be conscious of what you're doing in the cab on the hoist. You have to be watching the amp meter. They have a selsyn indicator. They have to be watching that to make sure that they're going the right direction, because sometimes you have an issue that can go back and forth. The E stop. I have to be always watching the load and listening to the radio. So he's the backup for the communication system. So if he sees that the cab people talk to the ground controller and he doesn't hear them talking, he calls a stop right there. He can E stop that. He can shut down the power of the whole hoist. So they have to work as a team. That's the main deal there, work as a team, and make sure that they're doing it safely.

SWEM: One of the more challenging parts of the job as a system engineer [is] that we have to follow a paper system. We are dictated by paper a lot of times. If we have a problem in the field, you have to run back here to your office, to your computer, and initiate a problem report. So you're balancing doing this as fast as you can and dealing with any computer problems.

GALINANES: Doing troubleshooting.

SWEM: And then contacting your NASA folks to get their approvals on what you're doing. You don't do anything without getting NASA approval and contacting your NASA folks. I have to say that our support team with the cranes people, the NASA folks, have just been awesome working with us and being very pliable and understanding our paper problems and things like

that that we have to initiate the PRs [Problem Reports]. Sometimes we don't have time to fully write it out. We get a telephone concurrence.

GALINANES: Approval.

SWEM: We verbally talk. Communication with the NASA people. You establish a good trust between each other, and they know your reputation. Can save you so much time in trying to dot all the Is and things like that in your paper and to keep the process moving. Because you're on a schedule, and you have weather elements and things like that you have to consider. That was real important, and I've been very pleased with our group of NASA people that we work with.

GALINANES: That's true.

WRIGHT: During the mate and the demate where is your crew located, physically?

GALINANES: They're operating the hoist pretty much. They have two E stop observers, one for each, the port and the starboard half hoist. They have an operator on the cab. Plus we got ground controllers too, to watch the operation. Those are the same people when they're doing the SAP movement. They leave one of the E stop and the hoist system with the operator in the cab. The other people go and do the lowering and raising of the service access platform. So they're always doing something, moving from one system to the other one depending on the move director instructions—whatever he needs.

WRIGHT: So they're up and down.

GALINANES: Up and down, moving the things just to get it aligned properly. Whatever the move director tell us to do, we're there to support him pretty much until we're done.

WRIGHT: Are there more challenges with the mate compared to a demate, or is it just about the same?

SWEM: I'd say mate.

GALINANES: Yes the mate, because if you have the orbiter on wheels like they did over here then you have to pick it up. You have to retract the landing gears. Anything can happen. One time we spent—I don't know, maybe half a day, because the hydraulic unit, something happened to it. It was a little switch that they forgot to put.

SWEM: Little details.

GALINANES: They couldn't get it to work. So stuff like that happens. Maybe one of our crane men started acting on us, start tripping or whatever. Everything changes. So everything is a challenge. But you get more familiarized and without fear to go in there every time you do it more and more and more. It's just hey you take it like it is.

SWEM: You get better through repetition. Plus we learn little quirky things about our system, about the MDD, through time. When I first started that was my first system that I had to work. You learn through time. Like okay, it's doing this. This is not operating. Oh yes it's that solenoid on the brake. So you run over there and you know there's a red solenoid, [it] has a history of going out. They burn out after a while, and you know exactly where to go. So you learn through time.

GALINANES: Yes, you can start troubleshooting from your desk. Say okay, yes, I know what it is. Pretty much you can write the paperwork pretty good too, because of the experience you have. So it makes it really nice to have the experience on anything that you do.

WRIGHT: How many times do you think you've mated and demated an orbiter?

GALINANES: Well, I started in '84. They landed over there 54 times, plus the one in White Sands [Space Harbor, New Mexico]. From that maybe half of it, or a little bit more than half.

WRIGHT: Did you do the [OMDPs, Orbit Maintenance Down Periods]? Would you help load them go to back out and come back in?

GALINANES: Yes. Well, that was when they did the upgrades on the orbiter. They had to be sent back to California, Rockwell. So they had to be onloaded and sent back to Rockwell for that.

WRIGHT: How many have you been involved with, Don?

SWEM: I guess I started 11 years ago and pretty much all the ones. To count them, I can't really count them. It's just I guess about 10 or 12 maybe.

GALINANES: No, I think more than that.

SWEM: More than that? I lost track.

WRIGHT: I guess they're all the same, but yet every one is different every time you do it.

GALINANES: Well, it all depends. At the beginning they were all landing in Edwards. So you knew that you were going to use the MDD. Then later on they said, "No, we save $1 million every time we land here. So hey, why don't we start using KSC?" Then they start using KSC. But sometimes the weather here was so bad that they still had to use Edwards. So the people that go to Edwards, sometimes they were sent the same day. They said, "Hey, you have to get your stuff, get a military plane, and take you off over there."

WRIGHT: So did your crew go to Edwards?

GALINANES: No, we don't operate over there, but we support engineeringwise for that.

SWEM: Problems with the hoist and things like that, mechanical, electrical.

GALINANES: Yes, he went there one time to do a load test, no?

SWEM: No. I was out there for—they had that other structure—what was that called?

GALINANES: Oh. The frame.

SWEM: The OLF [Orbiter Lifting Frame].

GALINANES: The lifting frame that they use in White Sands.

WRIGHT: White Sands and Palmdale [California].

SWEM: It was interesting. I went out there to decommission that and take it down. I was looking at everything. Everything was just in perfect condition. I was like—[demonstrates].

WRIGHT: I'm so jealous.

SWEM: It's like it's a shame to take this facility down, because everything was working so well.

WRIGHT: So what will happen to the mate/demate here I guess after *Endeavour* leaves?

GALINANES: I don't know.

SWEM: I hope they demolition it to be honest with you.

WRIGHT: Really?

SWEM: It needs it. It's seen its day; it has absolutely seen its day.

GALINANES: Yes, it has been there for what, [52] years pretty much.

WRIGHT: Amazing.

SWEM: I'll be glad to see that—believe it or not—taken down.

GALINANES: Unless they come with something similar to the orbiter, something that they can use. I don't see any other reason for that at all.

SWEM: I think it would have been a lot better if they had enclosed it somewhat, keep the weather off it.

WRIGHT: Did it ever move? Has it just always been at the SLF?

GALINANES: Always been on the apron. On the ramp over there on the northeast part of the ramp. Pretty much at the end of the runway where the Shuttle facility office are.

SWEM: I have a little bit of a funny story. I was out there, and we changed the wire ropes. That was one of the mods [modifications] we did out there. Then they also painted the facility, top to bottom. We had a contractor come out and paint this, removed all the rust. So I was going back out there to do a follow-up on the painting. Here's this beautiful facility. At the top there must have been I would say about 35, 40 buzzards sitting up there, already messing up the facility. I was mad. I went up the stairs, all the way up to the 100-foot level to these buzzards that were sitting on the handrails. They would not move.

WRIGHT: They claimed their spot.

SWEM: I was probably four, five feet away from them waving my arms, yelling at them, and those buzzards looked at me like, "Who the heck are you?"

GALINANES: Hey, this is wildlife here.

SWEM: So basically they won that battle.

WRIGHT: Now did you mention snakes get in there as well?

GALINANES: Oh yes snakes. Like he was telling [you]. We have—it's like a little room that was at the 100-foot level. They use it for antennas and communication and something like that, but at the end they took all that stuff out. There was wasps; there was snakes. Anything gets in there, and storage in there.

SWEM: Wasps.

WRIGHT: Long way for a snake to go.

GALINANES: I know.

SWEM: There must have been 100,000 wasps in that side of that room. You look inside through the window, and you can see the nests on the ceiling. They would come out and bother you. You'd be working and these wasps would be all around you. So I was really glad when they took that down. Then also we had a brake cover, a box. We noticed inside the box there were some baby rabbits or something so I didn't want to disturb them. They were in a little area underneath it. It seemed like they wouldn't hurt anything, so I left it. Came back the next monthly maintenance. There was a big snake in place of the baby rabbits.

WRIGHT: This is elevated, right? These snakes go up this elevated platform.

SWEM: Oh yes.

WRIGHT: Unbelievable. There were a couple times in the Shuttle program that flights were halted, after *Challenger* and after *Columbia* [STS-107]. Did that timeframe allow your group to make any other modifications on your operation?

GALINANES: We did all the modifications on all the cranes, specially revised all the OMIs [Operations and Maintenance Instructions] to make sure that we covered everything that we were missing, that didn't [we] miss anything, especially on the process of the SRBs and all that stuff. It was a huge change. We used to mate an SRB [in] what, maybe four hours or something like that. After the [*Challenger*] and all that board came through, it takes maybe a day and a half or two days. So all the process of stacking and demating completely changed in there. From being in an open environment we went to totally enclosed in the platforms, covered the whole thing and put AC in there when you're doing the mating for each SRB. So everything changed completely. Then the design of the SRB changed to the two rings, instead of one. It was almost two and a half years, something like that, that we went through a bunch of stuff.

SWEM: All the cranes went through a lot of modifications. We looked at our limit switches and things like that. We had a lot of design modifications. That's when they changed the brake system we talked about earlier from the wedge to the disk brakes.

GALINANES: Also we did the demate. We had a flow all ready to go after *Challenger*. They didn't launch that one. We had to demate everything, completely. So we took the orbiter out. I don't remember which orbiter. We took the ET out. We took the SRB, disassembled it completely until the program decided what to do for return to flight.

WRIGHT: Some of the other people that we talked to this week were the marine operations that went out and got the SRBs, and also brought you the tank. So it's interesting sitting in here listening to you talk about those pieces as well that you do. You're everywhere, aren't you?

GALINANES: Well, that's what I like of this. What I like most is troubleshooting. I love troubleshooting, finding out what's wrong with this, whatever happened. So that's why I've never been to management, because I don't like to be a paper pusher, be pushing people around. I like to enjoy what I do. So I get involved with my drawings and whatever and I enjoy that. That's my passion.

WRIGHT: Do you have a favorite story about troubleshooting?

GALINANES: Well, at the beginning, yes. We were doing a lift, one of the SRBs. I was new here. I finally started second shift by myself. We have a problem on the 250. I didn't know the system that good. I spent a lot of time troubleshooting that one. It was not in the drawing, the part that was having the failure, so I couldn't find it. It was an amplifier fuse. It was a tiny thing that was attached to the box, but it was not in the drawing at all. So I [could not] figure out what in fact is going on in here. We [held] that segment there for almost overnight, trying to figure out [a solution]. Finally next day the other engineers came in and said okay, that's it. Right there they found it. It was so simple, but you get so into it trying to see what's going on. I missed it completely. But you learn from your mistakes. People didn't like having that segment hanging there for so long. So they talked to me. I said, "Hey, I'm sorry, but it was not in the drawing, I [could not] figure it out." I was brand-new with the system. It was something sad in a sense, but it helped me improve myself.

WRIGHT: Well, but if it's not in the drawing it's hard.

GALINANES: Yes. So we fixed it and we put it in.

SWEM: I have a good story. Roberto, when I was new, and he was showing me some of the X-Y out at the MDD. We were operating it. Just to see how the screw jacks [operated]; these big screw jacks push the frames from side to side, forward to aft. We were operating. All of a sudden we heard this big loud noise. What had happened was that they did an electrical modification downstream for the power coming in. Now you have three-phase power, which basically is three lines coming in. Well, downstream they reversed one of the lines.

GALINANES: They changed the rotation.

SWEM: They changed the rotation of the motor. So we bypassed the limit switch and we what they call two-blocked the screw jack and broke one of the connections. That's what kind of things can happen that you don't see. You're operating it, and you're thinking you're going in the right direction. But downstream somebody reversed some electrical connection [that] causes the motor to run in the opposite direction you're thinking you're going.

GALINANES: They were modifying the power input into the whole MDD structure. When they put the phases back in there, they didn't put it in the right place.

SWEM: That can apply to anything. If you have something that you think is running in one direction, it's running the opposite direction, its electrical phase has been switched on.

WRIGHT: There's lots of things that can go right and lots of things that can go wrong.

SWEM: Yes, not only on your system, but downstream that affects you that you didn't know about.

GALINANES: Telling you about the story about the longer it takes. The safety involved in it is unbelievable. All these changes involve more safety stuff. They make it longer, but it was really safe the way we're doing [it]. Then I looked back. The way we were doing it before—we were kind of crazy doing it that way, when we were mating SRBs together. We have a crane that we can microinch, 40 thousandths of an inch per minute. You can't see that crane moving hardly. Just stay there. We can do that for three hours. The requirement for the new mating was—[it] started [at] 50, then changed to 200 thousandths inches per minute, and then [went] back to 50. You see that mating. It goes through those rings, the O-rings, so smooth. Before we just kind of put it together, and then okay, come down. It was something completely different.

SWEM: People don't realize how difficult this mating process of the solid rocket segment [is]. Basically they're just similar to soup cans that you stack on top of each other. You have several of them. Not only [do] you have to worry about mating. You're lifting, and they're so heavy. What 180--?

GALINANES: 180 ton.

SWEM: 180 tons. That where you pick it up on the sides distorts the canister, the steel sleeving. They have a device in there that they look at how it's distorted, the circular ring at the bottom. You have to adjust for that. It's so precise. They use lasers, the SRB folks, to correct it. They actually pull differently at the top.

GALINANES: From the fixture.

SWEM: On the fixture to affect the roundness to mate up perfectly at the bottom using lasers and all types of high-tech equipment. That's how difficult it is to align that. You figure per SRB you're doing at least what, your aft, your aft center, four, five connections on one SRB. You're doing two. Then multiply that by how many Shuttles you've launched.

GALINANES: [135].

SWEM: [135] Shuttles. So you got multiples of connections. We never had—excluding Challenger—well, we mated it up properly. It was just basically a --

GALINANES: The frozen part over there and the weather.

SWEM: The weather affecting it and so on.

WRIGHT: That weather again.

GALINANES: We never got that frozen part. It was really cold that day.

SWEM: My point out here is that we did that many critical connections and have a perfect record. I'm kind of proud of it.

GALINANES: On the crane side at least.

SWEM: On the crane side.

GALINANES: The only thing that happened one time was in the RPSF [Rotation Processing and Surge Facility]. Remember we [had] a failure in one of the load cells on the crane. We damaged the clevis on one of the SRBs. We pulled too much on it. That was one time. But one in so many, I think we have a good record.

WRIGHT: Processes, it's so important for the next person that comes through. Is your process different on the MDD? Was it different than the process the use out at Dryden? Or did you copy the process pretty closely?

GALINANES: I've never been there. So I think they use pretty much the same process.

SWEM: Same thing. Same OMI, the same.

WRIGHT: OMI is --

GALINANES: It's an operations instruction or maintenance instruction, whatever you want to call it. They call it operations and maintenance instruction, OMI.

WRIGHT: I'm going to take a second and look at my notes and see if there's something else, if you'll do the same so that we don't miss anything. Pretty much what you're saying, the mating and demating have remained the same. The processes remained the same for all those years.

GALINANES: Yes.

SWEM: Pretty much.

WRIGHT: Really no different on the fact that there are two SCAs? They mate the same?

GALINANES: Yes, pretty much.

SWEM: I think the only difference was the one brake issue, and then the one out at Edwards has an elevator.

WRIGHT: Oh, how nice.

GALINANES: Everything that comes from the West Coast comes with elevators. You remember the OPF, the platform in OPF-3. They come with an elevator. Over here we don't, we have to walk.

WRIGHT: Can you share with me how different it's going to be when they offload *Discovery* and onload *Enterprise*? What the operations are going to be at [Washington] Dulles [International Airport, Virginia]?

GALINANES: It's going to be contracted. We're not going to be involved in it, at least United Space Alliance. We still have heavy equipment engineers going over there, because they're going to be using mobile cranes. So they're going to have to have a fixture similar to the one that we have here, hook it up by two mobile cranes. They have to do the same process: pick it up, take the bolts out, pick it up, remove the SCA, and then land it, put it down, open the landing gears and set it down on the floor. But it's tricky. They're trying to get the cranes. I think they're 500-ton cranes. They're going to try to get it with the operator, the people that do the operation constantly every day. It's not worth it to send an operator from here that doesn't know the crane. That way they know the cranes pretty good. So that's the way they're going to be doing the offloading over there in Virginia.

SWEM: Basically a mobile boom crane.

WRIGHT: Make you nervous? That somebody's touching your orbiters? How many times you touched them, and they're yours, and somebody else is going to do that.

GALINANES: At least they're going to be shown for everybody now.

WRIGHT: That's good. Well, Roberto, do you have some other aspects or some other notes or thoughts?

GALINANES: No, I pretty much covered everything that we have here. We have pretty much covered everything.

WRIGHT: Don, do you have some other things you'd like to add or something you can think of?

SWEM: I think we covered it pretty well.

GALINANES: We feel proud of working over here. We didn't like the way it ended, because we didn't have a solution for taking astronauts to the Space Station. But hey, we have to live with it and keep on going. We'll be here until they throw us out of here.

WRIGHT: That's all of us. You've got to keep the cranes happy, right?

GALINANES: Yes. That's mainly why we stay here, for the T&R, for transition and retirement. Also NASA wants to keep the cranes ready to go. So we have another contract besides the T&R that was called code capability to do the maintenance on the VAB and some modifications they want to do for the vertical door that he's getting involved in, the whole group is getting involved.

It's pretty neat. We're doing a lot of work, even though we're doing only T&R. But we have some other stuff. It's good and keep us busy until the end.

SWEM: Yes, a lot of infrastructure rebuilding, especially in the VAB. We have all those 28 vertical doors which are 90,000 pounds each. They're basically elevators, because you have counterweight systems with them. We're modifying those lifting systems. They're basically like a lifting system.

GALINANES: And what are you doing? Installing a disk brake with a caliper.

SWEM: Installing a new caliper disk brake.

GALINANES: There he goes again.

WRIGHT: Using all that experience.

SWEM: Yes. We have an old what they call dog system that bites into the rail. They sag and inadvertently grab. We have a lot of problems with those so we're modifying the lifting system. People forget those vertical doors are elevators, because you have these huge counterweights which are 4 by 4 by 30 feet long approximately, 80,000-pound deadweight that help lift the doors up and lower them down. We're doing that big modification, United Space Alliance, as our last big job. We took on a contractor role.

WRIGHT: That's good. I'm sure the VAB has got a lot of years ahead of her.

GALINANES: Oh yes. Pretty much they repainted everything. They changed all the steel that was rusted pretty much everywhere.

SWEM: Yes, we're keeping the building in pretty good shape. We're doing a lot of work on it. You can see out in the transfer aisle all the stuff they're hauling off. Every day it fills up, and they haul off the trucks. It's amazing.

GALINANES: All the stuff that has been staged in here in the building.

SWEM: Just amazing. I mean probably hundreds of tons of just accumulation of stuff in here.

GALINANES: I talked to the guys that are doing it. You have stuff in here that has been 30 years old that they haven't used it but they store it in here. Now they have to throw it away finally.

WRIGHT: Well, if you don't have anything else to add. I'm just curious. Do you name your cranes? Do they all have names, your equipment?

GALINANES: Yes, names in the sense that we call it by the tonnage. Tonnage and crane one, crane two, or depending on the location they are. We call the MDD the MDD, mate/demate.

WRIGHT: Do you cross-train all the folks so that they can work on crane one or crane two? Or do you have specific operators?

GALINANES: Well, at the beginning we used to cover 24 hours. So we have engineers on first shift and second shift. So the second shifter will have to be more knowledgeable pretty much because he's by himself. Whenever we have to cover 24 hours he will have to stay 4 hours. The guys in the morning have to come in 4 hours early. So we cover the third shift that way. So whoever's in second, you better get moving, because something happens, it's going to be on your watch.

SWEM: I'm the last mechanical guy in the group. So I have to cover everything pretty much, all the cranes that we still have and all the doors. I think as we lost people you accept more responsibility, and you have to cover more. We're multitasked now.

GALINANES: He's the only mechanical left. I'm electrical. We got three more electrical. Pretty much we have a lot more problems with the electrical parts of the crane than the mechanical. So that's how we did it. But we're helping everywhere. Helping with the door mod. We're just here just to cover everything. It works out well.

SWEM: One thing I have to say, the 325-ton cranes are very complicated cranes. The amount of computers. We'll have the length of the bridge. Half of it with cabinets stuffed with electronics and programmable logic computers and controllers and watchdog controllers. When those things

start giving us trouble, it is unbelievable how difficult it is to troubleshoot some of the problems we have.

GALINANES: A lot of software. You have so [much] software involved in it. That's why we're getting more younger people in that part to help us with the computer stuff.

WRIGHT: Truly has a life of its own.

GALINANES: Yes, that's right. You got it right.

WRIGHT: Well, thank you both for spending the morning with me. Appreciate it.

GALINANES: Thank you for letting us [have] this opportunity.

WRIGHT: It's very interesting.

SWEM: Enjoyed the talk.

[End of interview]