NASA STS RECORDATION ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

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INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is April 15, 2012. This interview with Bill Roberts is being conducted for the NASA STS Recordation Oral History Project in Cocoa Beach, Florida. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright.

Thanks again for taking time out of your schedule to meet with us today.

Roberts: You're welcome.

Ross-Nazzal: We certainly appreciate it. Last time we spoke was about, I don't know, about a year and a half ago?

Roberts: Yes, I think so. It think it was like August of 2010, if I remember right.

Ross-Nazzal: I believe so, yeah, because the program was still flying.

Roberts: Yes.

Ross-Nazzal: And you were talking to us about two documents that you had been working on with your team of former subsystem managers.

Roberts: Yes. The two documents, one being the Orbiter Fleet Safing Document, which was a document that was written to establish the criteria on how to safe a vehicle. Not necessarily how to; I shouldn't say that. It was the criteria that established what were the hazardous commodities in the vehicle and then what should be the mitigation steps to either eliminate or minimize those hazards after the vehicle's safe, to achieve that goal of getting the vehicle safed for public viewing. The Orbiter Fleet Safing Document, which we refer to as the OFSD, then was completed.

Then the group, the former subsystem managers and myself, started on writing the End State Subsystem Safing Requirements Document, which is the ESSRD, and that took the criteria documented in the OSFD and turned those into requirements by subsystem on addressing those hazardous commodities that were identified in the OSFD. So those requirements noted in the ESSRD established what had to be done to eliminate those hazards or, like I said, either minimize those hazards.

Then another thing in the ESSRD, we put in the ferry flight requirements for a safed vehicle, because normally when we were flying in the operational mode, all of our ferry flight requirements were documented in our ferry flight drawings and tech orders and such. It was agreed to, before we got into the transitional retirement timeframe, that we were not going to release any new drawings during this period of time, for a variety of reasons. One was part of transitioning out of the program was to eliminate a lot of the processes that were in place during operations, and one of those processes was engineering release and configuration management and all this kind of thing.

So since we were not going to have the ability to update and modify the ferry flight drawings because the release system wasn't going to be in place, we took all those ferry flight requirements previously documented in the ferry flight drawings and documented them into the SSRD that were applicable to a safed vehicle, because there's a lot of ferry flight requirements in the drawings that are only applicable when you have a fully operational vehicle. So the difference was a fully operational vehicle doesn't have hypers, doesn't have pyros, doesn't have these kind—a fully operational vehicle does have those things and a safed vehicle does not, and so that's how we kind of filtered out the requirements associated with hypers, pyros, fluids, these kind of things, left them out of the SSRD and brought all the other requirements into the SSRD that were applicable out of the ferry flight drawings.

So that all got documented and reviewed. We had multiple reviews, not only through our group, but also the Space Shuttle Program folks that were in the operational area of the program. After that series of reviews in, I believe it was the following October after I met with you in August, we brought them to the PRCB and had those two documents, the Fleet Safing Document and the SSRD, baselined and they becomes NSTS documents, and I forget their numbers. I can get those numbers for you later. So they are official NASA documents now.

So with that, after they got baselined, the ESSRD requirements were then taken by the KSC ground ops folks and Work Authorization Documentation was generated to safe the vehicles. Those WADs, Work Authorization Documents, were put through the system and reviewed and approved. By the time 103 flew the last flight, which was, what, February last year?

Ross-Nazzal: I believe so.

Roberts: Early winter of last year. All of the safing documentation was already released and ready to go, so that when 103 landed from that flight, they had a period of time—I believe it was thirty days or forty-five days—post wheel stop to do their normal down-mission processing, and then from that point on they got into the ESSRD safing requirements and those WADs that directed that work.

So the ESSRD is a document that is not vehicle-specific, but the WADs associated that were written for 103 were vehicle-specific, and so each vehicle, 103, 104, and 105, all had vehicle-specific Work Authorized Documentation specific to the vehicle, generated from the ESSRD requirements.

Ross-Nazzal: Why is that?

Roberts: Because in writing that ESSRD document, it would have been much more difficult writing a vehicle-specific document that is a baseline NASA document rather than having the ground ops guys write their WADS vehicle-specific. There's slight differences because certain vehicles have certain design changes and all this kind of stuff that some requirements that were in the SSRD may be applicable to 103, but may not be applicable to 104. So we allowed them that latitude to change their work documents and make note that this requirement doesn't apply to 104 but it did apply to 103. Those specific items, I really can't remember what they are, but there were slight changes in their documentation.

So, as you know, 103 is fully safed and ready to go, 104 and 105 are going through their safing right now, and 105 should finish up with all of its safing in July and 104 should finish up

with all of that vehicle's safing, I believe, in August. Then that's it with all those requirements, never to be used again, because there won't be another one of these vehicles to be safed.

Ross-Nazzal: Yeah, yeah. What was your role as they were processing *Discovery* and then started working on *Endeavour* and *Atlantis*?

Roberts: Well, as the work got started on on *Discovery*, the ground ops folks had suggestions at times to change the requirement, meaning do something a little different. Maybe instead of removing an LRU, a Liner Replacement Unit, they may want to disassemble it partially and remove only the parts that were affected by the hazardous commodity and that kind of thing. And when those discussions took place, and we had weekly meetings with ground ops, and whenever there was an issue associated with changing the SSRD, we obviously had to discuss it and value or try to value their input, and if we agreed to it, the problem with changing that document, the SSRD, every time there was a change to it, we have to go back to PRCB, which is a large process, and get those changes baselined into the document. So we tried to minimize the changes to the ESSRD as much as possible, and we tried to keep any deviations or any modifications to safing requirements limited to the WADs that were being generated down here and gave the ground ops folks options of either they could take a waiver against that requirement or an exception or something like that, rather than change the parent document, the requirements document.

So we had a lot of discussions with them early on during the 103 safing period and it resulted in multiple changes. Since the baseline version was released of the ESSRD, I think we

have two revs out of that document, which resulted in, I don't know, each rev probably had ten or fifteen requirement changes.

Ross-Nazzal: There had also been a decision to have the SLS take some of the equipment out of the orbiters.

Roberts: Yes.

Ross-Nazzal: Did that have an impact on what you guys were doing?

Roberts: Well, my team, my group that I was working with, obviously we were heavily involved and were the lead in establishing the safing requirements. We're also involved in the design issues of the vehicle associated with weight and CG, structural altercations, that kind of stuff. SLS requested to remove significant hardware out of the aft fuselage and the mid and these kinds of things.

We were asked by our customers, USA and NASA, anytime there's any kind of significant configuration change to the vehicle, such as the SLS removal requests, we were asked to evaluate the issues associated with removing those, see if it would impact ferry flight, weight, and CG. Obviously most of the stuff wouldn't impact any kind of outer mold line, but most definitely if it was significant enough, we'd have to look at load path capability impacts and this type of stuff, only associated with a ferry flight. Obviously, our loads in an ascent or a descent in an operational mode are much greater than in a ferry flight, but we had to evaluate what a ferry flight load impact would be, meaning if they removed a structural beam to gain access to a main

propulsion system valve, did they have to put it back in or could they leave it out and this type of stuff, so those kind of things.

Ross-Nazzal: I understand, too, that some of the museums wanted items from inside the orbiter, like they could take the galley if they wanted or the potty.

Roberts: Yes.

Ross-Nazzal: So that also impacted the team?

Roberts: We were all involved in this, our Boeing group along with our USA customers and NASA customers. Like I said, we had weekly meetings. We were in discussions with some of the display sites. We had a display site acquisition list. There was a list of hardware that was evaluated. We all knew that we had to take out the potty, because it had to be cleaned and serviced and all that. Then did it have to go back in the vehicle or not? Not really. There was no hard requirement to put it back in because it wasn't going to be used. But if the display site wanted it back in, then we all had to agree on it and track that configuration that was back in. The weight would be an impact to ferry flight and all that, so all of that had to be recalculated back in.

Like 103 has an airlock in it and a galley and lockers and lots of flight crew equipment hardware in the crew module, as a result of requests by the Smithsonian folks, whereas 105 and 104 will not, because 105 and 104, their final display configuration is the type of configuration that they won't have visitors in the crew module, so there's no need to have that hardware back

in there. So there's three distinct display request lists of hardware that we're working, and, like I said, the main reason, the main thrust why we are involved in working that is because our Boeing mass properties folks are the responsible engineering group that's responsible for the weight and CG calculations for ferry flight.

So everything comes off the vehicle for safing was noted. We knew what the weight was. We knew the X, Y, Z location on the vehicle was, so that all fell into the final calculations. Things that got put back on the vehicle was also put into those final calculations.

Ross-Nazzal: How many people are working on your team and how many people at Boeing are working this?

Roberts: We have approximately, between Huntington Beach, Houston, and Florida we have about eighteen folks. Of the eighteen folks, there's about eight that are full-time on TNR, and the other ten are part-time, meaning they're working other projects like CCDev and this kind of thing. Our weight and CG analyst, his name is Bob Hundle [phonetic], he's working CCDev. He works all of our calculations on these ferry flights.

So there's other things that get involved. I don't know if you want to get into this now, but with 103 going to the Smithsonian this week, it's pretty much done, packaged up, and the only thing that's really remaining is getting it up there. Well, we have a ferry flight review tomorrow at eleven a.m. that is the final stamp on all of the elements, the NASA orbiter, the NASA, KSC ground ops, the Boeing Company, and that's about it. We all have to sign on the dotted line that that vehicle's ready to be ferried and all that, and that will be the final official

documentation on 103, except for I think there's a DD-1149 that has to be signed when we hand it over up there in Washington.

105 is going to the California Science Center, and we as an integrated group, NASA, USA, and Boeing, are obviously involved in several tasks that are authorized by NASA that's associated with safing and ferry flight preplanning, a display configuration, a lot of the same things we did on 103. That's been going on in parallel while we finish 103 and will continue on through August timeframe.

At the same time, Boeing has a separate MOA that the Boeing Company is working directly with the California Science Center, supporting them in certain display configurations. We have our loads analysts involved in—they have two separate display configurations planned for OB-105. One is horizontal. California Science Center is building a horizontal display facility, which is a, quote, unquote, "temporary" facility that will be used for two to three years while they build a new extension on their building there at Exposition Park, which will be a vertical display facility. Their plan is to basically build a launch pad environment there—

Ross-Nazzal: Nice.

Roberts: —and place 105 vertically on an ET and with SRBs and a tower next to it and access arm and all that. That's the end result, but before we even get there, when 105 gets ferried out to LAX, it's landing at LAX and then it's going to be removed from the SCA. It's not going to be put on its landing gear. It's going to be put on the Rockwell or Boeing-built overland transporter that we had back in the seventies, that we used when we delivered the vehicles from Palmdale up to Edwards Air Force Base.

That transporter's been parked out in the desert for forty-five years, next to the mate-de-mate facility there at Dryden. So California Science Center got their hands on that, and they disassembled it and brought it to one of their contractors in Santa Fe Springs. The company's named Sarens Riggings. Sarens is S-a-r-e-n-s Riggings, and they're a major construction company that moves things, and they're an international business company. So Sarens got this transporter, and they delivered it to their yard in Santa Fe Springs, and they, the California Science Center, along with Sarens, requested us to get involved to do an evaluation of that overland transporter, which was, like I said, a Rockwell-built GSC model or article.

The evaluation was to inspect welds, inspect the general overall condition of it, inspect the bolts, all this kind of thing, and they plan to use the overland transporter in a different way than it was originally used back in the late seventies and eighties. Obviously, they plan to put 105 on the overland transporter, which has, just the SCA, two ball attaches for the aft attach and then the forward yolk assembly and all of that, but instead of using the wheels that were built for the overland transporter, because of the route from LAX to Exposition Park there where the California Science Center is, they will have to straddle concrete center medians in the route. So you couldn't do that with the original wheels.

So they have these large devices called SPMTs, which are self-propelled motorized transports, I believe, is the spelling out of that acronym. What they are is a large vehicle with twenty-four wheels, twelve on one side and twelve on the other per vehicle. So you have four times twenty-four, whatever that is.

Ross-Nazzal: That's a lot.

Roberts: That's close to a hundred wheels. Then each device, each SPMT has a diesel engine on it, and what they do is they wire them all together to a central control module, and then there's a person that has a wireless remote control and he steers this thing and walks along with it. So basically you've got these four SPMTs with the overland transporter bolted to it and then the orbiter on top of that, and and they're going to be wide.

Well, actually, they're going to have two configurations. They're going to have a narrow configuration that gets them out of LAX, through certain gates, and then crossing a narrow bridge, which they're going to be on Manchester crossing the 405 Freeway right by LAX. Once they get past that, then they're going to stop the vehicle, jack it up, and move these SPMTs outboard so that now you can drive right over the center median of Manchester and make a left and go up Crenshaw and then make a right on Martin Luther Drive and go down to. So that's the reason why they want to do that. That route—I want to call it a tow route, but it's not a tow route; it's a drive route—is thirteen miles. So it's going to be a long day that day. The maximum velocity they're going to be going is one mile an hour. More often than not, they're going to be a lot less than that, and they're going to have to zigzag around trees and this kind of things.

Ross-Nazzal: Are you going to be in charge of the remote control, or are you leaving that to someone else?

Roberts: Oh, no, no, no, no, no. [laughs]

Ross-Nazzal: It sounds like a big—

Roberts: I have been on the route with them and looked at what they have to do, and there's a lot of work. I mean, there's a lot of light poles and traffic lights and these kind of things. The way their traffic engineers have described it, they're going to have an army of people out in front of the vehicle that are going to be dropping these light poles and traffic lights down, because they're mechanically attached, and then as the orbiter goes by, they're going to have another army behind them bringing them back up. And obviously they're going to have to cut down some trees along the route and this kind of thing. They've identified every tree that has to be trimmed or cut down.

Ross-Nazzal: Yeah. And manage the crowds, because I'm guessing there's going to be tons of crowds. People are going to come out.

Roberts: Yes, it's going to be crazy. I mean, L.A. had two things recently that was on the news that impacted traffic and large crowds. One was Mulholland Bridge over the 405 up by UCLA, they were doing a partial demolition of it, and they had to close the 405 Freeway for a weekend.

Ross-Nazzal: Yes, I remember hearing about that.

Roberts: So the news was all, "Don't go near there," and all that kind of thing. Then just a few weeks ago they had this big rock that they were moving from Riverside to the La Brea Tar Pits area, the Museum of Natural History or something like that. That one there, they had multiple nights where they would go three or four miles and stop for the—they wouldn't do any moving

during the day. It's all in the dark of the night, whereas this move here, they're going to start at two o'clock in the morning at LAX, and they said it's going to be a couple, two to three hours to get off the property of LAX and then go on from there. It'll be another thirteen, fourteen hours.

Ross-Nazzal: They're doing this on the weekends, I'm guessing, not on a Monday morning?

Roberts: Yeah, that's the plan. So the vehicle is supposed to get out there in late September, and the move date hasn't been released yet, but it'll be probably seven to ten days after the vehicle arrives at LAX.

Ross-Nazzal: And you'll be helping them with the—

Roberts: That's one of the authorized tasks that we're working directly with California Science Center, is to make sure on that move day that our GSC, which is sandwiched in between an orbiter and those SPMTs, is not only configured right, but will operate right and all that. So we're going to have our engineers out there that day and work alongside with them.

In preparation for their horizontal display facility, we're working with their civil engineers and their architects and helping them understand, first of all, what the weight of the orbiter and the transporter together will be, because when they get it in the horizontal facility, they're going to drive it into this large Quonset hut facility that kind of looks like that facility out at the SLF, not as big as that one. They're going to drive it in and then jack it up and remove those SPMTs, and then they're going to jack it down and put it on permanent jack stands on the concrete floor, and they're going to leave the overland transporter on the orbiter. They're not

going to lower the landing gear or anything. They're just going to leave it like that for two, two and a half years, until that other facility is designed and built.

So with that, they understand that there's never been an orbiter left on the attach points for more than sixty days and this kind of stuff, so we've been involved in doing an engineering assessment on given the weight of the orbiter, given the materials of the transporter, the ball joints, blah, blah, blah, is it okay to leave it on there for two, two and a half years, this kind of stuff.

Also we've been involved with where would you want to jack onto the transporter for that length of time and how much attenuation would you get if there's an earthquake event coming through the concrete floor, through the jack stands into the transporter on the orbiter. So we're working with them to understand what the design-to-seismic requirements are that any given structure in the L.A. area designs to and whatever those requirements are with the orbiter, be able to withstand the accelerations going through the [unclear].

[interruption]

Roberts: So we're trying to work with them. We're not "trying." We are working with them to make sure that whatever their design-to-seismic requirements for a structure in the L.A. area, that the accelerations going through the transporter into the orbiter and the aft fuselage and the forward yoke assembly will be fine and it won't break. Our guys have already taken a look at it, and it's looking favorable. We looked at a number that we're sure they don't design to, because when you consider the accelerations and the vibrations loads and aero loads on those three attach

points during a launch environment, that's a hell of a lot more than you will get out of an earthquake. So that's our initial assessment. I wouldn't put that on the record, though.

Ross-Nazzal: Okay. Are you helping with the vertical configuration as well?

Roberts: We are. Right now it's not into the detail level. We're doing conceptual ideas. In fact, the California Science Center, obviously they have to design that display configuration to meet the seismic requirements in L.A. and all that. That's much more challenging, and they've come up with some ideas for us to look at, and these ideas require a lot of steel beams and heavy metal. It looks feasible, but we are just now getting involved in that discussion, but that discussion's going to be a long discussion, because they just want us to understand what they are proposing and make sure that whatever they are proposing is inside the envelope of what the orbiter's capable of. I'm sure there's no weight-saving requirements when it comes to designing this facility like we have when we fly this vehicle, so I'm sure we'll be able to work it out.

Ross-Nazzal: Last time we talked, you were also working with the Smithsonian on *Enterprise*, and one of the things you had mentioned was there was some concern about corrosion on the vehicle. You were doing some analysis on that.

Roberts: Yes, we did all that.

Ross-Nazzal: Would you talk about that?

Roberts: Yes. We finished all that up and we put out some specific areas of concern to the ground ops folks and the NASA quality engineers. We sent up some Boeing guys from here, went up there. Our lead structural analyst, his name is Bill Novak [phonetic], he went out to do a detailed inspection and wrote up his requests on how to clean that out and this kind of thing. That all took place.

It finished up, it actually resulted in three trips, one to do the detailed inspection, another one to go back and do some of the cleanup in the forward fuselage. The lower forward fuselage was the area of largest amount of damage, corrosion, and that's because when *Enterprise* was first delivered up there, it was parked outside for close to three years and not covered, so it got snowed on and rained on and all that. When the vehicle's parked, the nose is down a little bit, and so when all that snow and water, either the snow melted or the rain, it all collected in the lower fuselage underneath the crew module.

Enterprise was built differently than *Discovery*, *Atlantis*, and *Endeavor*. The insulation blankets that are in between the crew module and the lower forward fuselage were gold blankets, gold surface blankets, aluminum foil, gold foil blankets. When the gold comes in contact with the aluminum skin, especially with water on it, you get this galvanic reaction, and that's what really accelerated the corrosion in certain areas. The lower forward fuselage is also a lot of ribs and webs and this kind of thing down there, and basically the water collected there for many years and it puddled and it corroded in this area.

But Bill Novak and our loads and stress engineers did an evaluation, we did some tests, and we blessed *Enterprise* that it's fine to ferry. We did put a caveat in there that it will ferry from point A to point B and not go on a tour of the United States, just because it's a good thing to do, go to point A, point B and that's it.

Ross-Nazzal: A short trip.

Roberts: A short trip, right. So, yes, we did all of that, that 101 work. There was a lot of other work on 101. There were some configuration issues associated with 101. When the Smithsonian had it up there, they changed some bolts that weren't flight bolts. We actually did some tests, the program did some tests on 101 during the program, like the wing leading edge impact test. We popped off some of the panels there and shot some foam at it and then put them back on. There were some cracks in one of the panels that got repaired.

There was a window. We did the vent system around the windows in the crew module. We did our vent checks, and one of the vent systems, I think it was window six, was blocked by some debris in there, and so they had to drill a hole in the window frame so that the vent system would work. They did all this work last January, February, and cycled the gear, checked the air pressure, and it's ready to go.

That's another interesting operation when 101 gets up to New York. It's scheduled to ferry, I believe—let's see. 103 gets to Washington on Tuesday, gets taken off. I think 101's scheduled ferry flight from Washington to New York is a week from tomorrow on Monday, and it arrives at JFK and it'll be parked underneath the ice—what is that? It's an ice-spraying hangar. It's a big hangar up there that the airlines go into and they spray this ice-melting solution.

Ross-Nazzal: De-ice.

Roberts: De-icing. But obviously they're not going to need it in May. So because it's very large and it's designed to have regular airline jets just go right underneath, and it's got a cover over the top of it, they're going to park the SCA and 101 underneath this de-icing hangar. It's not really a hangar. It's more like an easy-up, if you will. They're going to leave it there for a month because they have to remove the wind suppression system that's been put into the apron out at Dulles to assist in 103's de-mate from the SCA and then 101's mate to the SCA. There's only one set of that wind suppression system, which is a series of poles and cables that surround the whole SCA orbiter area. So that all has to be disassembled at Dulles, put in the trucks, and motored up to New York, and then put into the concrete up there at JFK airport.

So the de-mate of 101 from SCA is scheduled for mid May, and then that vehicle will be de-mated in mid May, like I said, and then I believe they're putting it on its landing gear and they're rolling it over to an area adjacent to the Hudson River, and then they're going to lift it off of the concrete and put it onto a barge on the Hudson River, a small barge. Then go under some bridges and this kind of thing, then park it in a marina area. I'm not quite sure where that is. I've seen it on the map. I haven't really been involved with the New York folks like I've been involved with the California folks.

But then they're going to transfer it from one barge to another barge, which has a huge single crane on it, and that barge is going to be the barge that goes up to the *Intrepid* aircraft carrier, and they're going to use that single crane to lift 101 up off that barge and put it on the aircraft carrier deck.

Ross-Nazzal: Amazing.

Roberts: And that's all next month.

Ross-Nazzal: Yeah.

Roberts: I was talking to some of the folks out there today, some of the NASA folks, and they feel the same way I do. The folks up in New York really haven't asked for any help whatsoever, and they've never done this kind of operation before. We were surprised they weren't down here today watching the 103 mate operation since our ground ops folks are not doing that work up in New York. The New York folks are doing that work. So it's going to be a mess. [laughter] But we're going to be up there. We'll be up there during that operation, not with a wrench or a lift or anything like that. We're up there for any engineering support that they may need and request. So that's the 103, 101 story, and, like I said, the 105 story is September, October.

Then 104, like I said earlier, will continue to be safed through the summer into August, and then its plan is to roll out and go to the Visitors Center October, November timeframe. We are just recently receiving direction to work with Delaware North, who runs the Visitors Center here, to help them out with their structural analysis on their proposed display. They want to elevate 104 up and attach to the aft attach points and the forward attach points and then have it in a rolled configuration, like a 45-degree roll, with the payload bay doors open. That would look great, but the payload bay doors open, they're designed for zero-G, so that's going to be a little bit challenging.

Ross-Nazzal: Yeah. Are they going to have those supports then? Is that something they're going to get from NASA?

Roberts: I haven't seen any detailed drawings because we're just now getting the direction to give them support, but the drawing I've seen, it looks just like columns coming out of the concrete floor that go right into the aft attach and up to the yoke. So you've got three columns coming up and the orbiter sitting on top like this. So we'll see. Obviously, they don't have earthquakes here, but that display configuration would be impossible in southern California. [laughter]

Ross-Nazzal: How are they displaying *Enterprise*?

Roberts: Just parking it on its landing gear on the carrier deck, and then they're going to build a—I think it's almost like inflate a structure around it, a soft structure, one of those high-pressurized structures. I've seen some graphics on it.

Ross-Nazzal: And *Discovery* is just going to look just like *Enterprise*. They're just wheeling her into the hangar?

Roberts: Yes. That's the easiest one out of all of them, really.

Ross-Nazzal: Okay. I think that's pretty much it. Do you have any questions for Bill? I just wanted to kind of get caught up.

Wright: You were talking about California this morning when we ran in to you, giving more details on the trees. Apparently that's a quite a bit of construction in its own self, about protecting the trees and how they determined the trees on how they're going to—

Roberts: They're going to have a subcontractor out there that they hired to identify all the trees on the route and then categorize those trees in certain categories that would either allow them to cut them down or trim them or not to be touched at all and would require the vehicle to have to be maneuvered around that tree. So there's a lot. That's a big task. They're still hoping that the state of California won't require an environmental impact report on these trees. [laughter] So if they require that, I don't know if they're going to meet September, October.

Ross-Nazzal: Jeez.

Roberts: —because those reports are— [laughs]

Wright: Pretty deep. This morning out at the mate-de-mate, what was your role as an observer, or were you part of—

Roberts: I was there representing the Boeing Company with my GSE, Ground Support Equipment Engineer, Norm Ring [phonetic]. So we were there just in case some of our GSE didn't work and this kind of thing and if there were some mechanical issues and that kind of stuff.

The rest of our team, those eighteen folks, most of them are here in the Florida region and they were all on call. So I was out there and Norm was out there, and if there were certain subsystem areas that were having problems during this mate, then we were to call them in and start spinning up the engineering support for them. We did that. I mean, even when we're flying the vehicles, we had a lot of folks on call and that sort of stuff. But there were no issues, really. As you know, what was completed today was scheduled for yesterday, and the winds didn't allow it to happen yesterday, but they're back on schedule.

Ross-Nazzal: Yeah. Good. And weather looks good to deliver *Discovery* to go out on Tuesday?

Roberts: Yeah. You can never definitely tell the future, but there will be some weather in the area, but not solid weather, so there's ways to get around it.

Ross-Nazzal: And are you concerned about—of course, NASA never wanted to fly the orbiter through weather, but this time you're delivering to a museum. Is that much of an issue?

Roberts: No, we're ferrying with the same requirements. Do not fly through rain or clouds and this kind of stuff. The forecast is for scattered clouds up there and no rain or lightning. There is rain in the area, but it's miles away, at least being forecasted. The concern is winds, again, up there.

Ross-Nazzal: Is it?

Roberts: Yeah, because when you're on the dual crane de-mating operation, your wind requirements are much lower than when you're on this mate/de-mate device. The general rule of thumb out here is 20 knots. The general rule of thumb at a remote site like Dulles using the dual cranes is 10 knots. So the forecast is for higher than 10 knots for the week up there, so we'll see. It's going to be loud, too, because the work area is right in between two runways. You saw how quiet it was out there today.

Ross-Nazzal: It's a busy airport.

Roberts: It's not going to be quiet in Washington.

Ross-Nazzal: Yeah. Are you staying for all the celebrations? We understand there's a big [unclear].

Roberts: Yeah, I'll stay there. Right now I'm scheduled to leave next weekend, so if things get delayed, I'll see if I have to delay my return to California or not, but we'll see.

Ross-Nazzal: Then you're headed up to New York?

Roberts: In May.

Ross-Nazzal: In May.

Roberts: Yeah. Then in September, everybody comes to—

Wright: Comes to you.

Roberts: Yeah. So this might be one of my last trips.

Ross-Nazzal: Yeah, yeah.

Roberts: Every time I come here in the last two or three years, I make sure to look around and enjoy it, because I don't know how much longer I'll be coming down here.

Ross-Nazzal: It sounds like you might have a connection with the visitors complex here now.

Roberts: Well, yeah, I mean, but it's not like it's a career kind of a thing. So who knows? My career might end up in the mountains of Idaho. [laughs]

Ross-Nazzal: Nice place to retire. [laughs] Well, thanks for catching us up. This is all interesting.

Roberts: You're welcome.

Ross-Nazzal: I'm glad we're able to record it.

Roberts: It will be fun to watch, most definitely over the next week, but through this fall. It's kind of neat for me because, I mean, I've been working on this project for four or five years. It's kind of like when you're on a football team, all that practice and all that preparation and the game finally is there, and it's like the game goes by like that [snaps fingers] after weeks of practice. Well, that's kind of like what this feeling is.

Ross-Nazzal: And TNR is officially over in November?

Roberts: After the handover of 104 to the Visitors Center, yeah. I'm sure there'll be some residual work that we have to do to close out our records and bookkeeping and all that kind of stuff, but not any real work, meaning technical work.

Ross-Nazzal: Yeah.

Roberts: But it's going to be interesting to watch this week and then those couple weeks out in California.

Ross-Nazzal: Yeah, I'd like to see that. I'll be part of that parade. [laughs]

Roberts: Like I said, we've been meeting with those folks regularly now, and Stephanie and her crew come out once a month and meet with the LAX officials and the city of Los Angeles, the county of Los Angeles, the mayor's office. There's a lot of people getting involved in this. Just like you'll see tomorrow how many people are going to be out there. Well, I'm sure when 105

arrives in L.A., there's going to be—I mean, there's going to be a lot of people in Washington, but I think everybody in Los Angeles and New York are going to be watching this show here when it leaves and the show in Dulles when it arrives, and they're going to learn from that and say, "We want to do more." [laughs]

I was surprised the folks at California Science Center weren't coming out to Washington this week. I actually met with them Monday, I said, "You really should, just to learn. Not necessarily to learn how to do it, but to learn on crowd control and just that kind of thing."

Ross-Nazzal: Yeah.

Roberts: But they're an office that is part of the State of California government. They have limited resources.

Ross-Nazzal: Sure. Understandable.

Roberts: All righty.

Ross-Nazzal: Thanks again.

[End of interview]