

SHUTTLE CARRIER AIRCRAFT ORAL HISTORY PROJECT ORAL HISTORY TRANSCRIPT

JEFFREY L. MOULTRIE
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is April 12, 2012. This interview with Jeff Moultrie is being conducted for the Shuttle Carrier Aircraft [SCA] Oral History Project at the Kennedy Space Center [KSC]. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright.

Thanks again for taking time out of your day this busy week to meet with us.

MOULTRIE: Sure.

ROSS-NAZZAL: We certainly appreciate it. I'd like to start by asking if you can give us a brief overview of your NASA career.

MOULTRIE: I came to NASA 11 years ago, and I started with the Langley Research Center in Hampton, Virginia, and I was hired as a research pilot there and I flew primary on the 757. They had known about me from Boeing and they hired me from that, and I was also an airline guy also at the same time. So they hired me basically for the 757, and I ended up flying that and T-38s there as well and a whole host of small airplanes.

Then eight years ago I came to Aircraft Operation Division in Houston [Texas, NASA Johnson Space Center] in 2004, and I started flying the Shuttle carrier shortly thereafter with the crew that were flying the airplane at the time, and I've been on that airplane ever since. At Johnson Space Center I fly the Shuttle carrier, the T-38, and the C-9 Vomit Comet.

ROSS-NAZZAL: Luckily you're on the pilot seat for those flights.

Let's talk about some of the historic events that you've been involved with on the SCA, one of which involved the flight of the Phantom Ray. Would you tell us about your involvement in that?

MOULTRIE: I guess it was historic in the fact that the Shuttle carriers have never flown anything else except Shuttles, and so that's been the only time that we've flown a test article for a commercial concern. It was a Boeing project we did a few years ago. There's a lot of engineering work that led up to that, especially the attachment point for the Phantom Ray on the Shuttle carrier. The dimensions of the Phantom Ray are way different than the Shuttles, so the big thing was getting the attachment fittings for the Shuttle carrier and also the fact that there was no wind tunnel data for that project. We required, or at least we wanted to do a test flight to see what kind of vortices were being produced by the attachment fitting.

We ended up doing one test flight there in St. Louis [Missouri]. I think it was either the next day or the day after, we ended up taking the vehicle to Edwards [Air Force Base, California]. So it was probably a lot more work on the engineering side than it was on the flight crew side. We probably had the easy part. Jill [D.] Brigham at AOD [Aircraft Operations Division] had done a lot of the work, the interface with Boeing, and got us to the point where we could do the test project.

ROSS-NAZZAL: Tell us about that flight. Was it just one leg from St. Louis to California?

MOULTRIE: We ended up doing just one leg. We were debating. We ended up making a decision in flight at a point to go ahead and continue based on our fuel burn. That was another reason for doing the test flight, was to look at our fuel burns on takeoff and at cruise to estimate what our fuel consumption was going to be for the duration. We ended up putting enough fuel in to get there. I think that particular day we had a wind issue, a crosswind component issue that sort of that worked itself out. We made an on-the-spot decision somewhere over, I think, Phoenix [Arizona] to press on, so we got the vehicle there the same flight, one flight.

ROSS-NAZZAL: Did you fly with your normal crew of two pilots and two flight engineers?

MOULTRIE: I think we did. One of the pilots that I flew with, Triple [Jack A.] Nickel, is now retired, and I think it was Henry [T. Taylor] and [Gary W. Ash], on that flight with me, if I'm not mistaken.

ROSS-NAZZAL: Did you take any of the Boeing folks? I know when you take an orbiter that has hypergols on it, you can't take anybody else. Did you take some Boeing people with you?

MOULTRIE: No. You know, the Shuttle carrier is not a stock airplane, obviously, and so anytime we have a test article or a Shuttle, it's considered an experimental aircraft, and so our rules at Johnson prevent us from taking anybody during a ferry, although we're making one slight exception for this next leg. We're doing a flyover. For [Space Shuttle] *Discovery* we've got one gentleman from the FAA [Federal Aviation Administration] that's going to be riding with us. That's sort of unprecedented, so it's a different thing for us.

ROSS-NAZZAL: Did you have a Pathfinder involved in the Phantom Ray?

MOULTRIE: Yes, we did. We had a Pathfinder C-9. It's, in fact, the same Pathfinder we're going to have on the [April] 17th, I think the same pilots. But we ended up having a chase ship, an F-18 chase ship that did all the filming of the Phantom Ray up to arrival into Edwards that I think he probably followed us for maybe 150 miles or something like that, the last 150 miles.

ROSS-NAZZAL: This summer there was another event involving the SCA that I thought was interesting, and that was the first time that you flew in formation with the SCAs. Would you talk about that decision to do that?

MOULTRIE: Well, I had sort of tried to have that flight for a couple years, and what happens these days in government service is you have to justify everything, so because we're all formation-qualified in T-38s, we're all capable of doing it, but the thing is it's not something that's needed in the Shuttle carrier, so you have to come up with a set of conditions that justify the flight. The problem also was that I have two crew members that I use at [NASA] Dryden [Flight Research Center, California], and so I had to use another instructor on the airplane.

The way it worked out is Bill [William F.] Brockett, the instructor, happened to be available at the time, and we had a maintenance test flight to do on one airplane and we were doing a training flight on the other, so we could get both things accomplished in the same piece of airspace without costing the taxpayer any more money. That's sort of the genesis of how that came about. I had to wait a while to get the right set of conditions to pull this thing off. The

gentleman flying the F-18 was also doing proficiency flights, so everything came together at one time and were able to get it done. So it was a neat day.

ROSS-NAZZAL: Tell us about flying in formation with two 747s. As you said, you do that in a T-38, but I've never really heard about 747s flying in formation. What did you guys do? What path did you take?

MOULTRIE: Let's see. I'm trying to think which direction we were. We were in the desert about 20 miles or so from Edwards, and we basically had the lead, in this case, was flown by Bill Brockett, and we had him and myself and Arthur [C.] Beall, "Ace" Beall. I don't know if you know him. You probably talked to him.

ROSS-NAZZAL: We're going to talk to him on Monday.

MOULTRIE: He used to have my job, but now we've hired him back. Anyway, Ace and I were in the wing aircraft, so we traded off a little bit. I flew some of the formation, he did some of it, and we basically just had the lead aircraft orbit in a holding pattern at a constant altitude while we got some shots. So it was a unique thing.

ROSS-NAZZAL: Was it a challenge to fly in formation or to get those videos?

MOULTRIE: I don't know. For the video people, I don't think they had too much problems. They're professional guys at Dryden. They do this stuff all the time, this air-to-air stuff. But,

yes, we took it easy. We had quite a bit of separation, wing-tip separation, in formation, but it wasn't difficult, really.

ROSS-NAZZAL: You had mentioned in an email earlier that you had flown the 747 commercially for quite a few years.

MOULTRIE: Right.

ROSS-NAZZAL: When you came onboard to fly the SCA, was it a major challenge or difference that you noticed?

MOULTRIE: The SCA is not that difficult to fly, compared to the commercial counterpart. There's some restrictions on the SCA that are not placed on the Boeing 747, so it's learning the differences of the airplane. We fly the airplane at 250 knots indicated airspeed, which is way slower than you'd fly a Boeing 747, and that's because the vehicle configuration and the tip fins that we have that have a speed restriction. The airplane's flown at 250 knots, and we limit our bank with the orbiter to 20 degrees of bank. The airplane climbs extremely slow, so you have to really fly the airplane to a tighter specification than you would a Boeing 747 just to get the airplane to climb. You're really very degraded in climb performance with an orbiter on top. You don't have a lot of backup energy, so you have to use every bit of energy and fly the airplane to an exact speed to keep the airplane climbing.

ROSS-NAZZAL: We learned from Larry today that this is a 100 Series.

MOULTRIE: Right.

ROSS-NAZZAL: Had you flown a 100 Series before you got here?

MOULTRIE: Right. Yes, I'd flown 100s and 200s and 400s, so, yes. The 100s and 200s, from a pilot's perspective and from a rating perspective are the same. On my license I have B-747, B-747, and that allows you to fly the 100s and 200s and actually the 300s. That's another story. That's a foreign airplane. Then the 400 is a completely different airplane. So there's really, for the 747, there's really like two licenses or ratings that you get, one of them to fly up through 100 through 300, and then a separate rating for the 400. So from the pilot's perspective, there's just not a lot of difference between what maybe would be a 100 and a 200. There's some only minor differences.

ROSS-NAZZAL: I understand that that plane out there is a fly-by-cable plane. Can you tell us about that?

MOULTRIE: I think that's a misnomer a little bit, because there's aircraft coming out now, for example, that have been out for a while, the Triple-7 [Boeing 777] and the Airbus 380, possibly some other airbus, I think the Airbus 319, and they're, quote, "fly-by-wire." NASA developed fly-by-wire many years ago at Dryden, but this airplane is really no different than a lot of the fleet out there. When you say fly by cable, all it means is from the control column you have a cable that runs to a hydraulic actuator and hydraulically moves the control surface. So we're not

anything in the Stone Ages here. It's a normal configuration as far as hydraulics for many airplanes that you'll fly on.

ROSS-NAZZAL: How is the flight crew for the SCA different from flying a commercial flight crew? For instance, there's a pilot, a co-pilot, and two flight engineers.

MOULTRIE: Right.

ROSS-NAZZAL: But there's typically only one flight engineer on your 747.

MOULTRIE: Right. Well, we still had the same configuration, the cockpit, that you would, obviously. So you take a commercial 747 crew and they'd be right at home in this cockpit. They wouldn't really see much difference at all. We still have only the one engineer station. But what we found is this airplane, when we operated with an orbiter, it's considered an experimental vehicle, so it's quite different. There's vibrations and there's noises on this airplane that you're not going to have in a 747. So we really rely on the engineers. In fact, it would be considered, I would think, an engineer airplane, meaning the engineers really run more of the show than the pilots because they're really in tune with the systems, and specifically on this airplane, due to the odd configuration that we operate it in, they know about the structure in the back of the airplane, the way it was modified, what kind of vibration we're supposed to have in the back. The guys, basically, on a flight will swap out and share the duties, but the other guy's usually doing something, whether that be checking the configuration, looking at things on the vehicle.

Also they really help with, like right now, preparing the SCA for mating and keeping up on systems and looking at potential problems. We have a 40-year-old airplane, so we have the same problems that an airliner does at this age. It's a constant thing to baby the airplane, to keep everything up to speed. So it's a big job. It's really a bigger job, I think, on them than it is on the pilots. We have it easy. They do all the work and we get to fly.

ROSS-NAZZAL: Henry will like to hear that.

How many pilots have been assigned to work the SCA since you've been here?

MOULTRIE: Traditionally and now, we have six crew members. A deal was cut many years ago for Dryden to fill two crew member slots. Ever since I've been on the program, we've always had two Dryden pilots. In fact, when I came on, Gordon Fullerton was—if you know Gordo, he was still flying, still flying the SCA, and he used to be my sim [simulation] partner up until the time that Gordo left. We had Gordo and Bill Brockett, and Bill's still with me, and when Gordo retired, we replaced him with Frank [W.] Batteas. So Bill Brockett and Frank Batteas are the two guys at Dryden. But that has been a historic thing. They've been allowed two pilot slots, and they're just like us, except they have brown suits.

In fact, the only other instructor pilot in the program is Bill Brockett in the program, so it's myself and Bill Brockett. They give us a lot of potential for utilization, so when you have an instructor that needs to fulfill a role, you can use those guys. You can use Bill Brockett. We've in the past always had a JSC crew member on the airplane, and what we will do is, for example, have one of the engineers, like Henry or Larry might be on the airplane, and then you might have an all-Dryden crew that's doing proficiency flying. I might not be there or a Johnson crew

member might not be there. It doesn't really matter. They're the same. They have almost the same skill set.

ROSS-NAZZAL: You're the SCA chief pilot. Would you tell us what that entails?

MOULTRIE: It's just being there when they needed somebody. Dave [David L.] Mumme was the chief pilot on the airplane before, and I was flying the airplane at the time, and I was the youngest guy. They needed somebody to do the paperwork, so that's what happened. [laughs] No, it's just basically at AOD, a lot of pilots are given that responsibility on one airplane or another, and it just so happens I have the Shuttle carrier because that's what I fly. But you'll have another guy, like my other pilot, Bill [William E.] Rieke, he's a chief pilot on the WB-57s. So everybody sort of shares the jobs around there, and I just happened to have a background that Dave [David H.] Finney was looking for at the time. That's about it.

We have a dwindling pilot staff at Johnson. When I came on, there were on the order of 20, maybe, to 25 guys, and now I think we're down to, I don't even know, maybe 14 or 13, something like that, and they're retiring more and more every day, I mean all the time. We've got a pilot retiring at the end of April.

I'm only responsible. I'm not any different than any other pilot. I simply make the schedule for the training. I make sure that everybody stays trained. I make sure everybody is current. I schedule the simulators for us. I keep abreast of maintenance problems on the airplane. But it's no different than Bill would do, really, for his airplane. It's just a managerial-type role. That's it.

ROSS-NAZZAL: Do you select who gets to fly on what ferry flights?

MOULTRIE: Yes, I have some input to it. We generally try to be fair with everybody. We don't try to have one guy hog the seat, so we generally rotate everybody on the ferries. We're coming up on a situation now where we're in a different environment because the Shuttle Program is over and we're just delivering the vehicles. Because it's a Johnson program, we're doing the last flights. That's just because it's a Johnson program, nothing against our colleagues in Dryden. It's like they fly SOFIA [Stratospheric Observatory for Infrared Astronomy], that's their program, and they'll take the last flights for SOFIA someday. It's a little different than we normally operate, I would say, even though they are participating. Everybody's participating in the ferry in one way or the other.

ROSS-NAZZAL: But they're not going to fly the airplanes?

MOULTRIE: They are, yes.

ROSS-NAZZAL: Oh, they are. Okay.

MOULTRIE: Yes. We've got several legs coming up. We've got several legs where we're going to move the vehicle back to Edwards. We've probably got—we don't know how many legs coming up in September, at least three legs to get to California, and then we're going to stage out of Edwards going to Los Angeles [California]. So, yes, they're participating in ferries.

ROSS-NAZZAL: Tell me, what are the tasks of a pilot before you get to do a ferry flight?

MOULTRIE: Well, the big thing is we're all big boys responsible for our own currency. We have a lot of other jobs, and so you try to fit in the training. I try to fly the airplane once every three weeks and I try to make the airplane available to all the crew members during that time. It's their responsibility in a way, with me, to try to keep current. When you come to ferry, you want to be as current as you can. We have, actually, regulations regarding that currency. So that's the first thing.

Then once the crews are determined, who's going to be on the crew; this next one is myself and Bill Rieke and then Henry Taylor and Larry LaRose. We get together as a crew and then we produce something called a Flight Readiness Review [FRR], and that's what we're going to be briefing here on the 16th. But it's just a basic plan, ops [operations] plan, of what we're going to do. We're going to start at this airport and here's what we're going to do. We're going to do a flyover at this altitude. Here's the points we're going to overfly. Here's the fuel requirements. Here's what the temperature is estimated to be on that day. Here's how much roaming length we're going to use. That type of thing, and we just lay out the plan, the ops plan, and that could change, of course, based on weather. The pilots and all the crew are familiar with what we're going to do on the day that we do it, so it's no surprises.

For the commanders or for the guy doing the leg, it's their responsibility to plan for that leg and then brief the other crew members. On the New York leg, Bill Rieke's the commander, so he's briefing me and he's doing all the planning. He's talking to the mayor's office. He's talking to the FAA people and has coordinated this whole event in New York. That's not my leg, so Bill's doing all that. So that's what we've put together because we're doing the flyovers,

and it's better if the guy flying it does the planning, rather than being told what to do on the leg. We found that works better for us.

ROSS-NAZZAL: So what have you had to do to prepare for this final ferry of *Discovery*?

MOULTRIE: For this one, we started a long time ago. I think Don [Donald L.] McCormack and the other team had started probably a year and a half ago with initial meetings to move these things. But the pilot group and the flight crews have gotten involved in the last few months. A lot of meetings involved—I've gone several times to Washington, DC to brief the FAA, and then last week I took two T-38s to overfly the same route that we're going to be doing when we interface with the FAA on this particular flight.

The area we're going to be flying around is protected. It's prohibited air space in and around the White House, so we had to get everybody together on ATC [Air Traffic Control], on the frequencies, on our procedures, and what we're going to do. They're going to temporarily shut the air space down in DC for us. That's a big concern, of course, for the airlines that don't want to have their schedules messed with. So we want to do this in a timely manner. We want to have everybody onboard to what we're doing. It's been quite an effort on everybody's part, especially the Don McCormack side of the house, but for us, too, getting everything ready to go and briefing the whole NASA chain from Janet [L.] Kavandi on down. I'm sure our Center Director's very aware of what's going on too.

It's been quite an effort to do all this, and, of course, everybody has some piece to it. The [National Air and Space Museum] Udvar-Hazy [Center] has their desires and their wishes and their ceremonies, so we're trying to put it all together to meet everybody's desires for this day.

ROSS-NAZZAL: Would you normally have to do a lot of those steps? Obviously you wouldn't have to coordinate with the FAA, but would you do some of those same steps?

MOULTRIE: We've done some of it. Like I did the flyover of Johnson Space Center a couple years ago and we did—I can't remember. I think we did White Sands [Test Facility, New Mexico] on that particular trip. We did a White Sands flyover. We staged out of Fort Worth [Texas] and we did JSC and then we did [Houston] Intercontinental Airport and then we landed up at Barksdale [Air Force Base, Louisiana]. So there are some coordination efforts for that, but a lot, lot less to do really on a normal ferry, even a normal flyover, because the air space that we're going into in the Washington, DC area is so unique, as in the air space in New York City, the most congested air space in the world. So that's a lot of coordination, and Bill has done a lot of work on this, coordinating them, the New York City flyover. So he's really put a lot of effort into this, and I've put quite a bit of effort into the DC leg as well.

ROSS-NAZZAL: It sounds like it. You mentioned you try and fly once every three weeks. Do you fly out to L.A. [Los Angeles] and then pick up the people?

MOULTRIE: We do sometimes. For the most part, I fly T-38s out there. Sometimes I go the day of. I'll leave real early in the morning if I think I'm going to have the weather. Occasionally, I'll commercial out there. But a lot of times I'll stay a couple of days. I'll go out and do the training session and then maybe have to stay to assist in an engine run or something with the

maintenance staff. So I'm generally out there maybe a couple of days a month or something like that, or a couple of days every three weeks, dependent upon—we try to work the schedule.

The problem is at AOD everybody flies multiple programs. If you say, "Okay, I'm going to have a training day on the 26th," you'll find four people that can't be there. So you go, "Okay, how about the 27th?" Okay. You've got three people that can't be there. So you'll have to make adjustments constantly to try to get most of the people that you can find to fly on the crew. On any given sortie, any given training flight, there's probably somebody that doesn't make it, and that's okay, because our requirements are 45-day requirements. So 3 weeks is 21 days, so they can miss a cycle and still be current.

ROSS-NAZZAL: Where do you fly the plane out in L.A.?

MOULTRIE: We generally fly in and around the Mojave Desert area in Palmdale, which is just a few minutes' flight, five minutes' flight from Edwards. It's a nice training facility out there. It's where the vehicles really came from out there. That's a Boeing facility and it's mostly test flying that goes on, so it's a nice place to go and get our training done without interfering too much with Edwards, or certainly the L.A. area. We don't want to go anywhere near there, but it's a good place to do training.

ROSS-NAZZAL: When you go to the simulator, you can, of course, simulate having an orbiter on your back, but you don't have that possibility or luxury when you're flying the vehicle. How do you simulate that, or does it matter? Is it more important to practice landing in emergencies and things like that?

MOULTRIE: At NASA, we don't have any rules. The airlines are governed by the unions, and their rules have always been—and I used to be an airlines guy—you can only do one emergency at a time, meaning you can't have multiple emergencies. In effect, I don't know what might happen in real life, but in the simulator it only happens one at a time. So you have one problem, you fix it. You have another problem, you fix it. Not at NASA. We have no such rules. So we have multiple emergencies in the simulator. So we might have an engine shut down already and then a fire on another one, and so we're doing multiple emergencies in the simulator.

We do our training in Denver [Colorado] at the United [Airlines] facility. Now NASA bought their own simulator. It's not ours. It's Dryden Flight Research Center's simulator. So we use that. It's a beautiful simulator. It's a really nice simulator that came from United and it's been modified specifically. We have the data package, the software, to simulate a mated SCA, so it's pretty accurate. This data package was written I don't know how many years ago, 25 years ago, so it's not a new thing, but the data package pretty closely simulates a mated SCA. We go twice a year, and then we fly the airplane, like I said, every three weeks so that we stay pretty current doing that.

ROSS-NAZZAL: Tell me about the two planes. A lot of the planes, even though they may be the exact same model series, they have quirks. They're different in some way. Are the two planes different in any way from your perspective?

MOULTRIE: 905 and 911?

ROSS-NAZZAL: Yes.

MOULTRIE: Well, 911 has seen its last flight, and I flew the last flight over to Palmdale, and the airplane's resting over there now. But, no, there's very few differences. The basic airframe is a 747 Series airplane, where the 100s or 200s are very much similar. This airplane, its flight characteristics are almost identical to 911's. It has a few cockpit differences and overhead panel differences, but other than that, you don't see it.

ROSS-NAZZAL: So nothing when you've flown it, you'd say, "Oh, of course it's 911"?

MOULTRIE: Well, if you have a favorite, you might for some particular personal reason like one or the other, but you're not going to see that big a difference in their flying characteristics.

ROSS-NAZZAL: How many ferry flights did you fly from Edwards to KSC?

MOULTRIE: I've done, I think, four, and then Phantom Ray.

ROSS-NAZZAL: What was your first ferry?

MOULTRIE: I was with Dave Finney, and he was my boss at the time. We had some weather on this particular ferry mission and we ended up that particular leg, my first leg, was out of Omaha, Nebraska. It was Omaha to Fort Campbell, Kentucky. So it was a unique experience for me. I

remember that experience very well. One reason is Dave has passed away, and so I think of him when I think of that particular flight.

But it was a unique experience that day. From a pilot's perspective, coming from this airplane prior, the big difference, the big thing that shocks you, even though you've seen it in the simulator, is really the takeoff roll. You don't really realize it takes a long time to get this airplane off the runway. You could almost think you can read one chapter of a book while you're waiting on the airplane to accelerate. It's a long time. It would be sort of unnerving, I think, to an airline pilot, even a 747 pilot, who jumped in this airplane and experienced this set of conditions, because the runway length is so long that you become a little bit unnerved about the distance remaining before you actually rotate the airplane. Even though you've seen it in the simulator, when you actually do it, you're hoping your acceleration schedule is good. You're hoping the airplane's accelerating on schedule to meet the number of parameters that you're shooting for. It's a big mass to get stopped. If you were to have to stop this thing at the end and if everything's not done right, you're going to go off.

ROSS-NAZZAL: About how long does it take you to lift off the ground from that runway?

MOULTRIE: It's usually on the order of 10,000, but I think we've computed this next ferry's going to be on the order of, depending on the temperature that day, 9,500 to 10,000 feet. So that's generally about the point at the end of the runway for a lot of runways. So we like to have 15,000-foot runways and long runways to fly the SCA, and our selection criteria is determined or helped by DDMS [Department of Defense Manned Space Flight] people, which are the Air Force counterpart at Johnson Space Center, and they help us to select the runways based on the

length, the fact if they're military or not, the security around the airport and the perimeter that we will have available to us, security perimeter around the airplane. And the fact we sometimes carried inert gases, which is a thing of the past now, so that's a security concern as well. That portion of figuring it out is done by somebody else; it's done by the DDMS people. So that takes away a lot of work on us.

ROSS-NAZZAL: Did you ever have any really exciting or challenging takeoffs or landings that you can recall?

MOULTRIE: No. They're pretty standard now. We try to not make anything exciting. We don't like exciting stuff. We've simulated most of the stuff in our simulator. We can put different airports in, so we can actually simulate even the runway lengths and things like that and the conditions that we're going to be flying in. There's not an unlimited number of airports that we can go to, so we can get the list from DDMS, like what's the latest, what's the status of the runway, what's available to us, and we look at all this stuff ahead of time to see, hey, where could we divert if we had a problem. We can't just duck into the first pavement, maybe like an airliner could. We can't do that. So we know along the route where we can go with a problem.

ROSS-NAZZAL: You mentioned that trip to Fort Campbell, Kentucky. A lot of people have mentioned that because that's the most northern point you guys have gone in the SCA. I guess there was weather that day.

MOULTRIE: Yeah, I think so. Yeah, that was my first experience. I don't know how many times they've gone into—if they've hit Omaha [Nebraska] before. You'd have to ask Henry on that. He knows more the history on what they've done. But, yes, it's not normal we go that far north, that's for sure.

ROSS-NAZZAL: Did you spend a lot of time with the public then since you were sitting on the ground for quite a while?

MOULTRIE: The problem is that NASA has to pre-plan this type of thing, because they generally don't show the vehicle off as much as I think they should, because the vehicles have a logistics plan. So they have to get back here, and the USA [United Space Alliance] people have to start working on the Shuttles to get them prepared for the next launch. So what happens is they want you to have the vehicle there yesterday, so there's really not a lot of time. You might talk to some people, but, remember, the airplane is in a secure area when we're in a transit intermediate stop. You might see someone at the fixed-base operator or something like that, we might see people lined up, but they're generally away from the airplane. That's my humble opinion, we should have shown off the vehicle a little more. I think the public might have known more about the Space Program had we done that.

ROSS-NAZZAL: You mentioned something that made me think of another question. There are Flight Readiness Reviews when the program was flying for Shuttle. Were you guys part of that checkbox that had to be ready to go if there was a Shuttle ready to launch, that you had to say, "We're ready to ferry a vehicle"?

MOULTRIE: Yes. We usually do the last portion of the Flight Readiness Review. That usually comes down to us, and then we tell the plan based on what the weather we see and what our plan is for the day and if we're willing to go or not. So the final decision rests with the crew always, because it doesn't matter what anybody wants, if we don't have the weather to do it, we're not going to do it. So it all comes down to the flight crew in the end.

I think that this set of flights we're going to be doing are going to be—I shouldn't say quite different—but somewhat different, because Don McCormack, who's normally our ferry manager, although he's done most of the coordination on this, done a year and a half of coordination on this thing, I don't think he has the final say in this particular affair. I think it's a lady I have not met yet. Dorothy [S.] Rasco is tasked with signing off the last box. So I'm briefing her, I think Saturday, when she's here, on what pilots do and what we're thinking. That's kind of the difference here, I think.

We've had a lot of input from [NASA] Headquarters [Washington, DC]. We've had input from the FAA. We've had input from a lot of people, and I don't know that there's one place where the buck stops. "Look at him," you know, that type of thing.

ROSS-NAZZAL: Will you have any responsibilities after you take *Discovery* up to Dulles [International Airport] once the plane has landed? Do you have to meet with the media?

MOULTRIE: I think we are doing a media flight, and I can't remember—there's Lori [B.] Garver [NASA Deputy Administrator]. There's three or four people I think they want us to shake hands with. I don't think they really have anything planned for the most part until the 19th. The 19th is

when they do their show-and-tell of [Space Shuttle] *Enterprise* and *Discovery*, and they're going to have USA guys tow them nose to nose, and then they're going to have the senators or something there. I don't know what they're going to do. People that want a picture.

ROSS-NAZZAL: Typically when you would land for one leg of a Shuttle flight, did you have any responsibilities at the end of the day, or could you leave and then the aircraft crew—

MOULTRIE: At an intermediate stop, do you mean?

ROSS-NAZZAL: At an intermediate stop or your final stop.

MOULTRIE: Once we do the final delivery, once we get back here, it's taken over by the maintenance folks and the USA folks, and now it's theirs. They own it now. We're done with it. We usually take the Pathfinder back to Houston within a couple of hours. But on intermediate stops we're very aware of everything that's going on. We could have maintenance issues on the airplane. We could have a brake problem. We could have something that needs to be changed, some part. We're aware of that, and we have a briefing. Don McCormack usually has a pre-ferry daily briefing, and that includes the weather, the status of the vehicle, and a lot of other things. A lot of other people chime in based on runway availability and changes and things like that. So on an intermediate stop, we're always thinking about it. We're at the hotel, but we're always planning for the next day based on what the weather's doing. But, once we get the vehicle here, they own it. It's USA's baby.

ROSS-NAZZAL: Have there ever been any in-flight emergencies when you're flying the SCA where something had to be fixed?

MOULTRIE: I haven't. In the past, they have. Henry's probably told you stories. They've had a fire out of Edwards before. I can't remember. Henry could tell you who was flying. I think maybe Gordo was flying the airplane. They ended up coming back around, shutting that motor down, and having no other problems. But it was a real fire. Sometimes you'll get indications occasionally, but I think they ended up having a real fire.

ROSS-NAZZAL: Who handles the maintenance if you do have an issue, say you've landed and you need to replace a tire or something like that?

MOULTRIE: We have a maintenance staff, CSC [Computer Sciences Corporation] guys. Rick [Richard A.] Brewer is the Chief of Maintenance, and so we work everything through him, and then he, in turn, hands the task over to his people, and they do a nice job. I think Rick has been there for a few years now, but in the past they had some guys—in fact, we have one of them with us this time, Arvid [C.] Knutson. He was a long history on the airplane. He was one of the original CSC guys, one of the original old head maintenance guys. He still works for CSC and he works on the SOFIA Program at Palmdale. But we've asked him to come on the ferry to help out. So he's one of the old heads you might talk to, Arvid Knutson.

ROSS-NAZZAL: We didn't see him today. There was somebody else in the plane when we took our tour.

ROSS-NAZZAL: You mentioned Dryden, and those were a couple questions that I had for you. The plane is housed in Dryden, but the pilots and the flight engineers, with the exception of the two pilots, are based out of JSC, but it's got a JSC tail number. Talk about that relationship between Dryden and JSC, what's Dryden's role, JSC's role.

MOULTRIE: Well, I don't know the original—the deal was cut many years ago on this plan, and I think after that point they've followed tradition or maybe the original agreement by having two Dryden crew members. I don't know at which point Headquarters made this agreement. At Johnson, we're a space center, and Dryden does all flight tests. So they have a beautiful ramp space down there to keep the vehicles, that's one consideration, and also it's a dry desert climate. They were anticipating that the program would last probably as long as it did, or longer, and that dry desert climate is much better for keeping the airplane from having corrosion issues. So it's a corrosion issue, I think, and it was ramp space and an agreement at some point in time, and because the airplane was there, I think they want to participate, and so they have been. They have the whole time. It's well before my time. I couldn't even tell you who made that agreement. I don't know. I'll bet my boss doesn't even know.

ROSS-NAZZAL: Is there any sort of possessiveness in terms of the vehicle? Is there anything like that?

MOULTRIE: Well, I don't know about that. In recent years, Dryden is also operating the 747, the SOFIA Program, so we have allowed them, or my boss has allowed them, to use the airplane to train their SOFIA guys. So Frank Batteas and Bill Brockett are also SOFIA pilots.

MOULTRIE: That was Dick [Richard N.] Clark [on the phone]. Do you know him?

ROSS-NAZZAL: No, his name doesn't ring a bell.

MOULTRIE: He's our Division Chief. In fact, he's going to be down here. We're doing the flyover, so we have three [T-]38s involved, and one of them's going to be down here, and he's flying it. He's doing the photo chase with—you might know Sherri [Sheryl D.] Locke. I don't know if you know her. She's our doctor's wife, actually, but she worked at JSC before they got married. But, anyway, Sherri Locke's going to be the photographer on that. He's flying the T-38 and we're doing a photo chase here too. It's quite a coordination effort, because we've got him here and then we've got two airplanes staged up in the DC area. The timing as to work out. The reason we have to have two airplanes is because the T-38 does not hold enough gas to stay aloft for an hour and a half.

ROSS-NAZZAL: Really?

MOULTRIE: If the one thing I could really get across to the public, even the controllers is that the public doesn't know, air traffic controllers don't know, that we're flying really old airplanes that never had any fuel capability, that we've successfully operated these airplanes for decades that

any other commercial pilot would just be appalled at. Because when we take off, we're already out of gas, and so you really have to keep abreast in a T-38 of your fuel status, and you've got to be a pretty good planner just to fly 38s for many years, because you're always planning. "I'm out of gas." You know where you're going, what the conditions are, where your alternates are, because you don't have time to mess around. That's why the controllers, even after decades, they don't even realize that. When you take a descent in an airplane, the lower you go, the more fuel you burn. You know that?

ROSS-NAZZAL: No, I don't.

MOULTRIE: So they'll give us descents at the same point in space that they'll give an airliner, a 737, that has four hours of gas, but they don't realize they're pressing us. We're getting more and more out of gas for them doing this. So we're constantly bargaining with controllers, and I don't know if they get it, honestly. I don't know if they really get why we're doing this, why we need to stay up, because I don't think anybody realizes, the public, that we have an airplane that on average we get a 1.3-hour flight.

So you see all these airplanes all around, the controllers probably see them, they go, "Well, no one would design an airplane like that."

I go, "Yes, they would. They did."

Anyway, they're coming down for the FRR on the 16th and then I think the Pathfinder's going to come down the same morning.

ROSS-NAZZAL: I was curious. Of course, they retired 911. Any insight into that decision why they decided to retire her?

MOULTRIE: Every airplane in existence has either a time restriction on the motors or some maintenance issues or some requirement for inspections. So we had that situation where we had two airplanes and we just had a lot more maintenance to do on 911, and it was not going to be productive cost-wise to keep that airplane flying, spend a lot of money, and then let 905 go. So it was a money thing. We looked at what inspections were required, what engine work was required, and we decided 911 was the one to go.

ROSS-NAZZAL: As Chief Pilot, did you ever get to decide which SCA was going to ferry?

MOULTRIE: Well, for a long time 905 was dormant. In fact, it was, I think, on the order of almost two years. You have to talk to Henry. He'll know the exact dates. But we were down for two years for engine issues, and we solely used 911. We had an engine up in Canada that we were waiting on. See, these are old motors. You have to remember, this is old stuff. These are old Pratt & Whitney motors. In the past we've had situations where an airplane may be down for an extended period of time, and so you had no choice as to what Shuttle carrier you used, but, no, I really didn't have any input. In the old days, when this was a really moving program, they pretty much alternated the SCAs for the orbiters.

ROSS-NAZZAL: You mentioned that 905 was down for a while. Does that present a problem? There were fewer and fewer ferry flights as the program went along because there were more landings out here.

MOULTRIE: Right.

ROSS-NAZZAL: Was that a problem when you wanted to take one of these planes and do a ferry flight if it had been sitting for a while?

MOULTRIE: Yes. Any mechanical device likes to be used, and the longer an airplane sits, the more problems you're going to have with it. So there was a time period where we had to work some bugs out of 905 after sitting for a long time. That's why we try to exercise these airplanes once every three weeks, to keep them moving and keep all the parts happy.

ROSS-NAZZAL: Do you have any funny stories you can share with us about any ferry flights, that you can put on tape?

MOULTRIE: I don't know. Maybe I'll have a good one after this one, I don't know. Everything has pretty much been like clockwork. Don does a good job in his planning and stuff, and he does a good leadership role in the ferries. We have so many good inputs. We have really great weather people. We have a weather squadron that does all the launches, and Kathy [Katherine A.] Winters is our primary weather lady. She's really topnotch. We've got really a lot of topnotch people that help us make decisions, and so it's a lot easier than if we didn't have these

people. I haven't had any real mechanical issues in flight, haven't had maybe some of the stuff they've had in the past. In the last eight years, we haven't had many surprises.

I'm trying to think. We've done multiple flyovers here. That's always a point of contention with NASA. Now we're getting to an era where there's a lot of, in the country, in everything, everybody looks at everything that you do. There's becoming more and more of that, I think, at NASA, in general, and I think the decision process is more taken out of our hands and giving it to somebody else. But we're at the end of the program anyway, so I think we're going to finish up in a good form.

ROSS-NAZZAL: Are there any crew traditions before a ferry flight?

MOULTRIE: Well, the engineers have some things. They bet on where the front tire will stop and this type of thing. Not really. We generally have meals together and that kind of thing on the road, and we generally try and include as many people as we can, the maintenance staff as well, and we try to have fun too. It's not all serious. But there's no real, I wouldn't say, traditions. I just think we try to include people as much as we can, as much as they have time to do, based on what they're doing on a stop. We come out to Edwards, we always have dinner together and things like that, but try to have some camaraderie. It's becoming harder and harder, I think, as everybody has more and more work to do.

ROSS-NAZZAL: What are your thoughts as you're getting ready to ferry *Discovery* for the last time?

MOULTRIE: Well, I think I'm lucky to be at the right place at the right time, maybe, for once in life. My dad was a NASA employee before he became a college professor in Huntsville, [Alabama] and so it's got some sentimentality, a little bit sentimental with the thing, and I think everybody's a little bit sad, I think, not only maybe around here but even the crew, knowing that the last landing is the last landing. I mean, that's it.

I'm going to be taking [Space Shuttle] *Endeavor* into L.A., and I think that's really going to be the big one, because that's really it, so probably Shuttles will not move again. They're going to be at their final resting places in museums, at least for my lifetime. I think we're all fortunate here. I think everybody tries to do the best job that they can, and I think everybody's going to leave with a sense of maybe accomplishment and a sense of pride to try to do the best job that they can.

ROSS-NAZZAL: Anything else that we might have overlooked about the SCA that you think we've got to know, other than go talk to Henry?

MOULTRIE: Just ask Henry. [laughter]

ROSS-NAZZAL: That's your stock answer. Well, thank you very much for your time today.

MOULTRIE: Sure.

ROSS-NAZZAL: Appreciate it.

[End of interview]