

SHUTTLE CARRIER AIRCRAFT ORAL HISTORY PROJECT

EDITED ORAL HISTORY TRANSCRIPT

ARTHUR C. BEALL
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is April 16, 2012. This interview with “Ace” Beall is being conducted for the Shuttle Carrier Aircraft [SCA] Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. I thought what we’d focus on with you, and it’ll be more fun for you, is mainly historic events and some of the flights that you’ve been involved in. You’ve been involved for a much longer time than some of the other guys that we’ve talked to.

BEALL: Yes, that’s true. Henry [T. Taylor] and Larry [R. LaRose] got checked out a little after me. I got checked out in the airplane in 1983 and flew my first ferry mission in 1984, so I got in almost like the ground floor. We were flying a lot of ferry missions back then, when they were really launching a lot of orbiters, and they weren’t into a total routine of landing at KSC [Kennedy Space Center] yet. A lot of the orbiters were still landing out at Edwards [Air Force Base, California], so consequently we had a lot of ferry missions going on.

ROSS-NAZZAL: What was your first ferry flight?

BEALL: The first ferry flight I definitely remember was in September of ’84, and I can’t remember which orbiter it was. It might very well have been [*Discovery*]. We went from Edwards to Altus Air Force Base [Oklahoma], and then Altus to here. That was my first landing here at KSC, on the leg from Altus to here. That was the first time I got to make a landing.

Before that, I flew the *Enterprise* over to Vandenberg Air Force Base [California]—if it wasn't before, it was shortly after. We took *Enterprise* over because initially they were planning on launching a lot of Shuttle DoD [Department of Defense] missions from Vandenberg. We took the *Enterprise* over while they were building the whole complex so they could use it to fit-check a lot of the structures they were building. We went over there for about five days. They demated the *Enterprise*, towed it around to make sure the Shuttle was going to fit into what they were building, then we took it back to Edwards. That was a really short ferry mission, less than hour from Edwards to Vandenberg.

ROSS-NAZZAL: How different was it ferrying *Enterprise* from another orbiter that was much heavier?

BEALL: That right there was one big difference. It wasn't nearly as heavy, so consequently your takeoff performance was better, your climb performance was better. The other difference is the Shuttles that came back from space had a lot of restrictions that we had to abide by. Temperature restriction of minus-9 degrees Centigrade so fluids on the orbiter wouldn't freeze. We had a pressure restriction of 8 psi [pounds per square inch], which equates to about 16,000 feet. That was there for the avionics on the Space Shuttle, believe it or not, because when it's in space it's pressurized, but when we're ferrying it's not pressurized. The avionics boxes were only certified down to 8 psi.

We always had a no-rain restriction. The rain restriction is for the Shuttle tiles. The Shuttle tiles are very fragile, and they get damaged very easily. It was proven on a ferry mission. As a matter of fact, one of my first jobs when I got to NASA in 1981 on a T-38 [aircraft] was to

go out and find some rain. They were concerned that rain would erode the insulation on the big external tank [ET] of the Shuttle, and they wanted to know is it hazardous for us to launch with any sort of rain. Is rain going to erode it?

On one of the speed brakes, which are these panels that deploy on the T-38, they put a big block of this ET insulation, just as an “Oh by the way, since there’s another speed brake, let’s put a Shuttle tile on the other side and see what it does for that.” I went over to the Gulf [of Mexico], and I found some rain. We deployed the speed brakes, which exposes them for about 30 seconds, put them back up, and came back and landed. As we were taxiing in—we always lower the speed brakes for taxiing in—I could see the technicians pointing and looking.

To their surprise, the external tank insulation didn’t suffer much of anything, but the Shuttle tile was just eaten alive. All the little black coating was completely gone, and it had eroded about 30 percent of the insulation. That’s when it was like, “We can’t fly this thing through rain at all.” That was our biggest restriction, and only during one ferry mission did the Shuttle get flown through some rain. It was *Columbia*, and it was proven that it was not a good thing to do, because they had to replace over a thousand tiles when it got down to Kennedy. It probably flew through about 15 seconds of rain they said.

I can’t remember if the *Enterprise*—what its thermal protection system was like. I don’t think it was real Shuttle tiles, but they were still probably kind of fragile. I can’t remember if we had that restriction or not, but not having the pressure and the temperature restriction, and it being much lighter gave us more flexibility when we ferried the *Enterprise*.

ROSS-NAZZAL: Who were some of the pilots that were flying at that time? I’ve heard that [Francis R.] “Dick” Scobee was one of the SCA pilots.

BEALL: Yes, he was. Dick Scobee flew the airplane because he flew the E-4 in the Air Force, which was their 747s, so he checked out in it. [C.] Gordon Fullerton—as a matter of fact, Gordon Fullerton and I went to American Airlines together in '83 and got checked out in the airplane in about a month-long course. Joe [Joseph S.] Algranti flew it, he was the chief of Aircraft Operations at JSC. A.J. [Arda J.] Roy [Jr.] and Ken [Kenneth R.] Haugen.

Guys out at Dryden [Flight Research Center, Edwards, California]—Fitz [Fitzhugh L.] Fulton flew the airplane, Tom [Thomas C.] McMurtry flew it. Dave [David] Mumme, Frank Marlow, Dave [David H.] Finney—these are all past guys that flew it, that don't fly it anymore because unfortunately some of them have passed away. Some of them are ill, and so consequently they don't fly it anymore. I think that's it; I don't think I missed anyone. I hope I didn't.

ROSS-NAZZAL: Were you involved at all with the World's Fair and taking *Enterprise* out to New Orleans [for the 1984 Louisiana World Exposition]?

BEALL: I was, but not flying the SCA. I was flying the Pathfinder at the time.

ROSS-NAZZAL: Tell us about your experiences and your role.

BEALL: Being the new guy on the airplane, I would get some Shuttle missions but I flew the Pathfinder a lot also. Back then we used the G-159 [Grumman Gulfstream I], which is just a twin-engine turboprop. It was kind of ironic, because it couldn't fly as fast as the SCA, and

usually about two-thirds of the way through the mission the SCA would pass the Pathfinder and go the rest of the way without a Pathfinder.

After the orbiter was flown through the rain, we didn't use the G-159 anymore—that wasn't the reason that he flew through the rain. It was his decision at the time to fly through the rain, and I was in the Pathfinder on that mission. We advised him, "You should go this way, because there's a lot of rain over there." He says, "Nah, I'm going to go that way," and he went that way and he found the rain.

ROSS-NAZZAL: Was that Joe Algranti?

BEALL: Yes, it was Joe Algranti, old Joe. Probably the only guy who could have gotten away with that at the time, because he was the chief of Aircraft Ops. He flew the lunar lander mockup; Joe founded Aircraft Operations. Joe was a monument out there.

On the World's Fair when I was on the Pathfinder, it was really pretty cool. We landed, and watching them demate the SCA with the cranes was really interesting, because there's no mate-demate facility. We landed at Brookley Field [Mobile Downtown Airport] in Mobile [Alabama]. Brookley Field and Mobile Bay come right up to each other, so they can pluck it off, take it over there and lower it on the barge very easily, and then by the Intracoastal Waterway barge it in over to New Orleans.

For the pickup of that, I wasn't involved with the return. I can't remember if that was when they took the *Enterprise* up to [Washington] Dulles [International Airport] after that [when it was transferred to the Smithsonian National Air and Space Museum]. I'm not exactly sure where it went after that, but that was my involvement. It was pretty neat, because we were really

well-received. Everyone was really excited that we were there. Everywhere we went, if anyone said, “There’s the guys that fly the Shuttle,” it was like, “Wow.” It was pretty cool back then.

ROSS-NAZZAL: Everybody taking your photos [photographs], kind of like superstars?

BEALL: “We want an autograph. Let us buy you lunch. Come on over here,” and everything else. It was pretty neat. I think this mission [ferrying *Discovery* to the Smithsonian National Air and Space Museum] is going to be very similar since this is kind of historic, taking these Shuttles to their final resting place. We saw a lot of that when we ferried, because that was one time when the general public really got to see evidence of the space program up close and personal.

We’d fly that Shuttle in somewhere, and the bases would usually allow people to come in. After *Challenger* [STS 51-L accident] they tightened up a little. Pre-*Challenger*, they were very open about letting the public come in and look at it. Then once 9/11 [September 11, 2001 terrorist attacks] happened, it got really tight. It was great see the turnout. People were just so thrilled to see this thing, because it’s just an awesome sight to see the Shuttle on top of the 747. It was one of the greatest PR [public relations] tools that NASA had, and my personal opinion, they did not tap into it nearly as much as they should have.

ROSS-NAZZAL: Tell me about ferrying. Has it changed over the years from when you started until this flight?

BEALL: Yes. Of course the mechanics of flying the SCA hasn’t changed at all, but the managing of it has changed considerably. Initially, once the Shuttle was mated to the SCA and it was

handed over, the SCA aircraft commander and Aircraft Operations at JSC were the people that were in charge for the rest of the ferry mission. We carried maybe 10 people on the Pathfinder, just a couple Shuttle personnel, a security person and a PIO [public information officer] usually, and that was it.

After *Challenger*, it really changed significantly. The management oversight shifted basically to the Shuttle program manager, and he had assigned a ferry program manager that went along with the ferry mission. Now they had to answer to the Shuttle program manager for whatever we did. They ran the show, not Aircraft Operations anymore. Of course, the pilot of the SCA was looked to quite a bit for advice and what to do, but the final say of go or no go, that sort of thing, was pretty much up to the Shuttle program now.

Plus the amount of people that came along in the Pathfinder grew immensely. We started using the KC-135, which is our zero-G aircraft, as a Pathfinder after we had problems with the G-1. It could keep up, and it could carry more people. We started carrying up to 30 people on the ferry mission. We carried a lot of folks. Just the oversight got huge. We started carrying weather people with us to help us with the weather, because that was always one of the biggest things with ferrying the Shuttle—what the weather's like. Staying out of the rain was a real big deal. We started carrying those folks with us, and then DoD started getting involved.

And don't get me wrong, this wasn't all a bad thing. I mean, to carry a weather person with us was really nice, to have a dedicated meteorologist with you looking at the weather. They knew what all our restrictions were so when we came in for the briefing it saved us a lot of legwork prior to the mission. They'd have it all ready for us. The same with the DoD rep [representative]. We'd always land at military bases, then we had a DoD person as a liaison with the bases we were going to, instead of us having to call and get it all set up. It downloaded us

quite a bit, it did really streamline the operation in a lot of ways. Of course, the more people you have, the little more cumbersome a mission becomes also.

ROSS-NAZZAL: You mentioned that you previously had to call and set things up. Can you talk about that in terms of acting as a liaison with a certain DoD Air Force base and the things you had to do before you took off?

BEALL: Well the logistical things, first off, to let the base know that you're coming and is the field ready to support us. It's a big operation. We're bringing in two big airplanes. We're bringing in probably close to 40 people. You're going to have a lot of people that are going to be wanting to come onto the base to look at this thing. So first coordinating it and making sure it's okay to go there. Then once they say okay, we have to arrange things like transportation, lodging, meals for when we depart, security, setting up the fuel requirements—and this is for two airplanes, not just for one.

Someone on the ferry team would have to call ahead and prearrange all that stuff, whereas now when we had a DoD guy, he just had this list of things we needed, and he or she would do it all. And the weather—checking the weather, making sure the weather was okay—we'd usually work with the base weather people once we got on the road. Those are some of the things that logistically had to be taken care of.

ROSS-NAZZAL: How did you develop relationships with these bases without DoD on your team initially?

BEALL: As I understood it, there are some overall guidelines of cooperation between NASA and DoD. For example, whenever we were flying a NASA airplane, if we wanted to land at a military base we knew we would have their support because there was a blanket agreement for DoD to support NASA in its missions since we're both government. That groundwork was already established way way back when, way before the Shuttle program, that DoD will support NASA in its endeavors. Actually, DoD supports all the government agencies, FBI [Federal Bureau of Investigation], and the Secret Service, those sort of things. It's there to help support on the aviation side, anything that any of those other agencies need.

How it got streamlined when DoD came onboard was the DoD liaison at [NASA] Johnson Space Center [Houston, Texas]—and there's a DoD office set up at all the space centers—basically wrote up a complete ferry plan and submitted it to any base that we said that we might use. Now that base had the complete ferry plan and requirements. If we were going to go somewhere, that DoD rep would just call up that day, say, the Carswell Air Force Base [Texas], and say, "Hey, the Shuttle might be coming there today. You guys need to go to the standby status on your ferry plan." They go, "Okay," they knew exactly what to do. It really got streamlined after a while. There were still the specific fields that we wanted to use because they were prepared for us; they knew what we needed.

ROSS-NAZZAL: Were there any in particular that you used more frequently than others?

BEALL: We used Kelly Air Force Base [San Antonio, Texas] a lot initially, because it was about the exact halfway point between Edwards and Kennedy. If we had an orbiter that wasn't real heavy we could fly from Edwards to Kelly nonstop, stay there, spend the night if we had to or

just refuel, and if the weather let us go we could make it down to Kennedy. It was the perfect halfway point, so we used them a lot for a while.

Bases in between Edwards and Kelly—either Davis-Monthan in Tucson [Arizona] or Biggs Army Airfield in El Paso [Texas]. We used Dyess Air Force Base in Abilene [Texas] a bunch, Carswell up in Fort Worth [Texas]. Altus Air Force Base in Oklahoma, we used that a fair amount. Then going east from there, Barksdale Air Force Base in Shreveport, Louisiana, we used them a bunch. Eglin Air Force Base in the panhandle of Florida, Robins Air Force Base in Macon [Georgia].

We used Whiteman Air Force Base up in Knob Noster, Missouri a bunch. It's a [Northrup-Grumman] B-2 [Spirit (Stealth Bomber)] base, that was a pretty cool place to go. Just B-2s, that's all they have there. We got a great tour once from the wing commander there of the B-2s. The B-2 is very secretive. We go in and he goes, "This does this, and this does this."

About half the questions we'd ask him, "What does that do?"

"I can't talk about that."

"What does that do?"

"Can't talk about that one." It was great.

ROSS-NAZZAL: Very different from NASA.

BEALL: Yes, exactly. We love to talk about it.

ROSS-NAZZAL: How about training? Did it change at all over the years or was it pretty consistent in terms of what you were expected to do in the '80s and '90s?

BEALL: You know, it didn't change much. Our biggest problem with training was, unlike other airplanes, you didn't fly it that often. At the highlight of launching, when we'd launch eight, nine missions a year, you might ferry once every month and a half or two months. And to fly an airplane just every one and a half or two months is not a whole lot for a pilot. [If we didn't] have a ferry mission [that month], we'd go out to Edwards and just fly the airplane on a local proficiency flight. Get some touch-and-goes and a couple instrument approaches. That was always a battle, maintaining your proficiency.

The good thing is at Johnson Space Center we flew a variety of airplanes, so we were always flying. Our flying skills were easy to keep up because we all were multi-qualified. I was flying five different airplanes at one time, so no problem getting in an airplane and flying, but the Shuttle carrier, we didn't fly it that often. We'd also go to recurrent training in the simulator twice a year. FAA [Federal Aviation Administration] requires just once a year, but we go twice a year for just that reason, the fact that we didn't fly the airplane very often. That was usually three to four days with ground school and flying a simulator.

Initially we didn't have anything that simulated a 747 with a Shuttle on top, so we'd fly with the speed brakes deployed to try to equate the drag. Once we started going up to [the] Boeing [Company] and using their simulators, they developed a software program for us. Of course they designed the Shuttle carrier, and Boeing was pretty instrumental in building the Shuttle. They designed a software program that simulated the drag and the vertical CG [center of gravity] that we have, so now we had a pretty good training aid in the simulator that flew pretty close to how the SCA flies with the Shuttle on top.

ROSS-NAZZAL: How did you maintain your proficiency after the *Challenger* accident?

BEALL: By just going out once a month and flying the airplane, and that's pretty much it. It was a stand-down period in general, and that's what we did. We just flew the airplane once a month, so far as flying the 747.

The flying characteristics are different. They're not so much different that it's almost like flying a different airplane, but we knew what the differences were. The airplane's very top-heavy, so when you roll into a bank you don't want to use much bank angle because you've got this big mass on top. It took a lot more flight control to roll out of the bank, so we'd limit our bank angle. Takeoff performance was greatly degraded, climb performance was degraded, and the airplane would take a lot more power just to keep it flying. We knew this, and it was something that you approached slowly.

The good thing is we didn't fly the airplane in the weather, so we never had to deal with instrument approaches. We didn't have to deal with icing on the airplane, that sort of thing. Flying around thunderstorms, our flight roll was no closer than 25 miles to any thunderstorm. And we didn't fly at night so we could see if there was any rain. We wouldn't even fly through clouds because we didn't want to fly through any moisture. We were what we call VFR only, visual flight rules, so we were flying in the day and always flying in clear air. That right there makes the task a little easier.

ROSS-NAZZAL: You talked about how things changed after *Challenger* in terms of management and oversight. Did Joe Algranti leave at that point? Do you think that's part of the reason that that shift occurred?

BEALL: I think that was part of the reason, but I don't think that was the main reason. Things got a lot more conservative after the *Challenger* accident across the board, including on the ferry missions. You can even see, if you go look historically, how long it took to get a Shuttle from California to Florida pre-*Challenger* as compared to post-*Challenger*. The ferry mission length increased significantly after *Challenger* just because it was more conservative.

If the weather looked at all questionable we wouldn't go, usually because there was so many more people in the decision chain that someone along the decision would say, "I don't think it's a good idea to go." So everyone would say, "Okay, then we're not going to go." Pretty conservative and sometimes too conservative, but you didn't want to hurt the Shuttle. The impact of making the ferry mission longer was that they didn't get the orbiter back as soon to start processing it for the next mission. That was the only ramification. And probably a little bit more money for people sitting on the road waiting to get the Shuttle down there.

The consequence of not going was the schedule would just slip a little, and let's face it, that's what got us in trouble with the *Challenger* incident. We were worried too much about schedule and not enough about safety, and we really got bit bad. So it was fine to go to a more conservative mode and say, "You know, if we don't get it down there for three more days and the launch downstream's got to slip three more days, then that's what it's got to be." That was a good approach; that was the way to do it.

ROSS-NAZZAL: One of the other changes after *Challenger* was that NASA decided to buy another SCA. What was your involvement with [SCA] 911?

BEALL: Mine wasn't real direct. Dave Finney, who was one of our pilots at the time, was real instrumental in getting 911 up and running. That was in '88, I believe, when we bought that airplane, so I'd been flying the airplane for about five years. I wasn't the project pilot yet—I became the project pilot in the early 90s—but I was pretty well established in the program, so my involvement was more as a crewmember, helping the other guys understand what the differences were between the two airplanes, because they were different airplanes.

When an airplane comes off the line, depending on who the buyer is, they have the cockpit configured their way. They want certain instrumentation this way or that way, they want this option, not that option. Plus, 911 was a little different 747. It was called an SR [short range], and it's an airplane that was built for short flights. It had bigger wheels, a meatier landing gear, a little meatier wing. It was made for more cycles as they call it, more landings and takeoffs.

JAL [Japan Airlines] used it just in Japan to fly around Japan. Obviously not a big country, short flights, pack a lot of people in. It had some differences that we had to get used to, but that was about my involvement. I wasn't much involved in the actual modification of it from a regular 747 to an SCA. That's pretty much a big structural thing anyway, the engineers and flight engineers were more involved in that than me.

ROSS-NAZZAL: Did I read that you went and picked it up from [Boeing] Wichita [Kansas Plant]?

BEALL: I did, Joe Algranti and I went and got it. We flew the initial FCF on the airplane, functional check flight. You basically go out and check out every system on the airplane. It was a long, long flight. It was like five or six hours, because there was a lot to check out. We got the

FCF checklist from Boeing and also from either JAL or American, and combined the two to serve us. It was a fun flight. It was long though; it was long and intense. It's not like going up and level off, hooking up the autopilot, "Where's my box lunch?" You're constantly doing something all the time.

ROSS-NAZZAL: What kind of things did you check?

BEALL: For the engines, for example, you're going to check out all the scheduling on the engine, the bleed valve opening and closing, the engine anti-ice. You shut down each engine individually and relight it to make sure it's going to air start okay, that sort of thing. The landing gear, you want to time the landing gear up and down. Then you use the alternate landing gear system and make sure it's working, both the trailing edge and leading edge flaps. They have normal limits, and they both have backup systems so you want to run them through their full cycles using their backup systems. The air conditioning and pressurization, there's three air-conditioning packs. Very elaborate air-conditioning environmental control system in a 747 because it's such a big airplane, a lot of different zones of heating and cooling. There's only two active in the SCA. A lot of them have been stripped out because we didn't need it in the back.

Fire warning system, all the navigation equipment, backup systems. That's kind of a sampling of what we had to do, and a lot of those take a long time. The backup systems take a long time to activate to extend the flaps in backup system and to retract them. They operated like a fifth of the normal speed that they normally do. It just takes a while, and you've got to be at the right altitude and the right speeds for that. You're working with air traffic control also for

the airspace because we're not flying a conventional flight plan, so a lot of times you've got to stop and get set up.

ROSS-NAZZAL: Where did you fly over?

BEALL: I think we went up to northern Kansas, Nebraska. We kind of followed a big round robin, and then we kept doing the same route. We had to ask for different altitudes, and sometimes we'd have to wait because there was other traffic. You'd have to wait till you get by it, or they'd vector it out of the way.

ROSS-NAZZAL: Did you have a flight engineer with you as well?

BEALL: Yes, we had two flight engineers, and I'm pretty sure we had some maintenance guys with us too. Might have even had a couple Boeing guys with us, I can't remember exactly.

ROSS-NAZZAL: After the *Challenger*, there was another orbiter that was built. Did you ferry *Endeavour* for that first flight?

BEALL: That's a good question, I'd have to go back and look. I flew in and out of Palmdale [California] a bunch. We did that a lot. Do you remember when *Endeavour* came out?

ROSS-NAZZAL: I want to say '91, I think that's the year.

BEALL: I was basically involved—all of us were involved in almost every ferry, and we tried to make sure that every pilot was involved in every ferry mission because of what we were talking about before, staying proficient at it. You wanted to make sure that when there was a ferry mission that everyone got to be involved. That didn't necessarily mean that you were going to get a landing on every ferry mission, but we definitely wanted the pilots to be up in either the pilot or co-pilot seat on every ferry mission. I'm sure I was, unless I was doing something else or I was sick. Otherwise I was involved in it.

ROSS-NAZZAL: I understand, there's a lot of them. When you were talking about 911, I was curious. I've asked several people and they've all said no, but I'm curious if you thought there was a difference between flying those two vehicles, between 911 and 905.

BEALL: You mean the actual handling of it?

ROSS-NAZZAL: Yes, did it seem like they had quirks even though they were both 747s?

BEALL: The quirks that I remember is the brakes on 911 were much more sensitive. We'd always check the brakes as soon as we started taxiing. Standard procedure on most airplanes is to just make sure the brakes are working, and almost everyone would over-apply the brakes on 911 because they were much more sensitive than the brakes on 905. That was definitely one quirk between the two airplanes, small small deal.

911 was also a little heavier. I don't think you could really feel it flying, but so far as performance when you're planning your takeoff, we couldn't put on quite as much fuel because the airplane was heavier. If we were going to take off on our max [maximum] takeoff gross weight, which was 710,000 pounds, if the airplane 911 was about 6,000 pounds heavier that was 6,000 pounds less of fuel you could put on the airplane. We didn't like that. I think everyone was happier to fly 905 because you could put just a little more fuel on the airplane. Handling-wise, I can't really say that there was really much difference once you were flying the airplane.

ROSS-NAZZAL: Did you guys have any nicknames for the planes?

BEALL: Not that I remember, to tell you the truth. "Her," like you would call ships and airplanes her.

ROSS-NAZZAL: Someone told us a story earlier this week about flying out of KSC and hitting an osprey. Could you tell us about that flight?

BEALL: Yes. That was my leg, as a matter of fact. That was an interesting takeoff, probably one of the more eventful takeoffs I've ever had. They were taking off to the north, and what happened right before we hit the osprey, to me as the pilot, was more of an issue. Right before we rotated, the number-one inertial navigation system failed. The significance of that is my attitude indicator runs off that inertial navigation system, and it failed.

For the takeoff that in itself is not a big deal, but when that fails the attitude indicator rolls over to 90 degrees of bank, and it also goes to 90 degrees nose high. There's a system on

the airplane called the over-rotation system. If you rotate to over 11.4 degrees, the yolk starts vibrating. It's called the stick shaker, which is also the indication that the airplane is approaching a stall. I don't know if you're familiar with a stall on an airplane, but that's bad. You don't want to stall an airplane. You lose all the lift of the wing.

When I rotated, the stick shaker went off and that rollover attitude also set off the instrument warning system that there's a discrepancy between the pilot's and the co-pilot's instrument system. So right as I rotated, I get this warning horn going off and the stick shaker starts vibrating. We never feel the over-rotation computer because it doesn't happen unless you over-rotate, but you test the stall warning system. Right as I rotate I'm thinking, "Am I stalling? And why is that instrument warning system going off?" I quickly assessed it and figured everything's okay, the plane is flyable. We were past the point where you want to stop on the runway safely because we're hauling ass at this point, so I decide to keep flying it.

Right as I got airborne, that's when we saw the osprey and it's like, "Jeez, now there's a bird there." The bird dove down, and I thought, "Well, I think we missed the bird." Of course we look at the engine instruments, because that's the biggest concern, is the bird going to hurt the engine? No, it didn't hit the engine, and we switch to the backup instrument system so it got rid of the horn and got rid of the stick shaker, and everything kind of settled down. This all happened right at liftoff at one of the most critical times of flight.

We called back to the SLF [Shuttle Landing Facility] and said, "We just missed a bird, a big bird. We don't think it hit the airplane, but you might check."

They said, "Okay." We stayed on the tower frequency, and a couple minutes later they came back and said, "Yes, there's a dead osprey on the runway, but it doesn't look like you hit him, because he's intact."

We thought, “Okay, well great.” Maybe just the downwash messed him up.

We go on our merry way and we landed in Fort Worth, but we had hit him. When we landed—we always carry the Shuttle tile guys with us in case there’s a problem with it, and they could see that, yes, it hit the tile. They had to patch them because the bird had wiped out 13 tiles. The bad thing about flying that way is if the airflow gets underneath the tile it can start ripping them out; it’s like a zipper effect. Fortunately, at that stage of the game they had gotten the tile system down pretty good. Earlier on in the Shuttle program those tiles would fall off all the time, but they got the adhesive technology down pretty good. So they patched it, and we went on from there. It worked out okay.

About four or five months later, I got this thing in the mail from the guys at KSC. They had taken one of the broken tiles and put it in this nice little case, and it had the date and my name on it. It said, “Nice shot, Ace.” I’ve got it sitting on my bookcase at home. I killed the bird.

ROSS-NAZZAL: Are there other exciting or memorable takeoffs or landings that you recall when you were flying the SCA?

BEALL: Well, the time in the Pathfinder with the rain was pretty eventful. There was a lot of rain around, and I remember in the Pathfinder trying to tell the SCA where the rain was pretty bad.

There was another mission—we were at the end. We were at Barksdale Air Force Base in Louisiana, and we were coming down to Florida. There was a lot of weather en route, but more significantly there was some bad weather moving into Barksdale. It was like if we don’t

get out of here, we're going to be stuck here. And if we get stuck here, they're forecasting thunderstorms the next day, and that wasn't good. The Shuttle sitting on the ground getting rained on wasn't the end of the world, but it would take on water and the water would pool in the Shuttle. If there were thunderstorms coming, if it started hailing, that was really bad.

We had two problems. Number one was this overcast deck moved in over the field. It was like 500 [feet] overcast. We're not supposed to fly through clouds. We have flown through thin decks before. If the Pathfinder flies through it and says it's clear above, clear below, and it's not raining anywhere around the cloud, then it's okay. So we decided we'll let the Pathfinder go and if he says it's good, we'll fly through this deck. There was also another bad line of rain down around New Orleans that we had go through, but it looked like there were holes, so we took off.

Pathfinder took off, said, "Good to fly through the deck," so we took the SCA off, flew through the deck, no problem. Next obstacle was this line of rain. The Pathfinder got down—and Gordon Fullerton was in the Pathfinder, I remember this. He's down there and he says, "I can see the line up ahead." They fly 100 miles in front of us, so we couldn't see the line yet. He goes, "We've reached the line. We're looking for a hole."

About this time we could start to see. I was like, "Jeez, that's some pretty bad line of weather up there."

Gordon finally says, "We found a hole. We found a good hole. We're orbiting in the hole," and he gives us the INS [inertial navigation system] coordinates to get through.

I said, "You found a hole? You're in a hole? We don't see a hole."

He says, "We got one. Fly to these coordinates."

As we got closer, we could see. There was a C-141 Air Force airplane, big four-engine transport, and sure enough, we could see them orbiting in this one little gap. I said, "Okay, Gordon. We're coming."

He said, "You'd better hurry up. The hole's not getting any bigger." So, whew, we made it through. We finally made it through. It was like, okay, clear sailing.

We get close to Florida, and Gordon says, "Well, there's some showers around Florida, but you should be able to get in okay."

I said, "Okay, we're coming."

The last transmission we got right before he landed was, "We're on about a two-mile final [approach], and we're getting rained on pretty good here."

I was like, "Oh, god." The Shuttle carrier doesn't carry much extra fuel on board. We can't. We get to a point where we're committed, so we said, "Okay, we're coming." We were just keeping our fingers crossed that when we got there there wasn't one of those showers that we could avoid.

We did get rained on a little on final, but what we learned was that if you're going slow enough, the force of the raindrop is decreased enough to where it won't damage the tile. When we were on final approach, instead of going 250 knots indicated, we were going about 160 indicated. That was enough to where it didn't damage any tiles.

There was another ferry mission, now that you mention it, with Dave Mumme. We got into Florida and there was a lot of virga, rain that doesn't reach the ground. There was a solid line in front of us. I said, "Here's what we're going to do, David. We're going to go down as low as we can, we're going to go as slow as we can, put out a whole bunch of flaps and slow up,

and fly underneath the rain and hope it doesn't damage it." We didn't have any other options. We did get some rain, but it didn't do any damage. It's always weather with this thing.

The airplane always performed very well. I personally never had any big in-flight emergency in the airplane. I lost a hydraulic system once, but the airplane's got four hydraulic systems, and you can operate the airplane pretty easily on two. Even on one you can fly. We lost one, and it wasn't one of the main systems.

They did have an engine fire indication on 911 on one ferry mission. I wasn't on the SCA, I was on the Pathfinder. Shortly after takeoff they had the gear up and the flaps up and they had some altitude and speed, but they got a fire indication that wouldn't go out. They went back and landed it at Edwards. They opened up the cowling, and there was lot of heavy soot, black soot on the inside, so there was some sort of condition there. They never really figured out what the real problem was. They never found any raging fire indication, but it wasn't a false indication with all that heavy soot inside.

That was kind of interesting, because with the Pathfinder you take off and then you wait for the SCA to take off. They call you once they're airborne and say, "Okay, we're airborne. Here's our position."

I say, "Okay, great." Now we can get going. So I'm sitting there on the Pathfinder going, "They should have called us by now, should have called us by now. NASA 905, are you there?" No answer. Finally we called the Center, said, "Do you guys show NASA 905 is airborne at all?"

The guy goes, "Let me check. No, they took off and they went right back and landed at Edwards."

“Oh, okay. We need to go back to Edwards too.” We didn’t know what happened, because they never had a chance to call us. They’re busy dealing with this situation. We got back and we got close enough to Dryden where we could talk to Dryden operations. They told us they had a fire indication, so they came back and landed. Everything was okay. Those are some of the interesting things that did happen. It’s always weather battles. That was the main thing, sitting on the ground waiting for the weather to get better.

ROSS-NAZZAL: Did you ever get up and have to turn right back around because of the weather?

BEALL: I don’t remember ever turning back around and having going back to a destination, but if we knew the weather was going to be iffy—sometimes we’d take off, say from Edwards and we’re going to try to make it to Kelly in San Antonio, but we’ll land at Biggs Army Airfield in El Paso if the Pathfinder says we can’t get there.

That ended up happening to us a few times where we decided let’s go give it a look, give it a try. Maybe we’ll get through, but if we can’t we had a safe out. If it’s not going to work, we know we can go over there and land safely without any problems. That happened a few times. We had to divert a few times in flight, but it was few and far between because we didn’t have much fuel to veer off our beaten path. We could land short if necessary, but that was about it.

ROSS-NAZZAL: When you land here in Florida, you land on that nice long cement runway. At Edwards of course they have that wonderful lakebed. Do you land on the lakebed out at Edwards, or is it also cement?

BEALL: No, their runway at Edwards is almost identical to this runway [at KSC] in length and width. The hard-surface runway is 15,000 feet and it's at least 300 feet wide—that's what this one is. The landable surface is 300 wide, and then they've got these big aprons on the side. It's over 500 feet, easily, and Edwards is the same way. I don't know that the Shuttle carrier ever landed on the lakebed out there.

I mean, you could if it was dry, but it kind of messes up airplanes. It's hard, but it's still dusty. It's dirt, or gypsum, so it gets in the brakes. That's the main thing, it can cause you to have brake problems if you land on that stuff. It was always there for an emergency if we had to, but we never did. The one place it did land was at White Sands [Space Harbor, New Mexico]. It landed on the lakebed out there on STS-3. That is the one time it did operate on a lakebed, out of necessity.

ROSS-NAZZAL: You weren't flying the plane, but were you involved in some other way with that one?

BEALL: I was on the Pathfinder of that too, went out there with Joe Algranti as a matter of fact. We went out in the Pathfinder and landed out on the lakebed.

ROSS-NAZZAL: That must have been interesting.

BEALL: It was. That was on STS-3, so I was still pretty new with NASA. STS-2 was right before or after I came on, so I hadn't been with NASA more than a year when STS-3 landed. I

was still really a new guy, so it was pretty eye-opening for me just to be involved in that operation. Those were still test flights with the Shuttle back then.

ROSS-NAZZAL: What was your role other than flying the Pathfinder?

BEALL: We always start out flying in the T-38s. That's the first thing a research pilot starts out as, a T-38 pilot. Back then, you always also got checked out in the G-159 because we used that airplane for a lot of different things. It did a lot of flying. Then from there on which airplane you'd go to depended upon your background, the need of Aircraft Ops, what other pilots were doing, where they needed pilots, what airplane.

I ended up flying all the big airplanes because I flew [Lockheed C-]141s [Starlifters] in the Air Force, the big transports, plus I was a T-38 instructor in the Air Force. When I went and talked to them Joe Algranti said, "We like your qualifications. You can check out as an instructor on the T-38 really easy because you've got all that time, and we need guys who have big airplane experience because we don't have many guys." We have the KC-135, the 747, and the [Aero Spacelines] Super Guppy. I had a four-year tour in the big airplanes in the Air Force, so that's where I went, T-38, and then got checked out on all the bigger airplanes.

ROSS-NAZZAL: What are your recollections of STS-3?

BEALL: I don't have a lot of specific recollections, more just being amazed that I was there. Just in awe, having been with NASA for maybe a year. I wasn't the type of guy who had dreamed of

flying for NASA all my life. When I got out of the Air Force, I wasn't sure where I wanted to go fly, and I wasn't even that knowledgeable on what JSC did.

I went and talked to Joe Algranti because I knew a friend of a friend of a friend who knew Joe. I moved to Houston and everyone said, "Go talk to Joe Algranti if you can get in to see him, because he knows everyone who flies everything in all of Houston."

I thought, "Well, he's a good guy to know."

He looked at my résumé and said, "Have you ever thought of flying with NASA?"

I said, "I thought just the astronauts flew all your airplanes."

He said, "No, we're developing a pretty big operation here with the Shuttle program," and he gave me a tour.

A couple months later, I got hired on. Me getting on with NASA actually happened very quickly. I hadn't even thought of flying for NASA at that stage of my career. I was going to go fly corporate jets or maybe the airlines or something like that. I was kind of done with the Air Force basically. To suddenly be flying with NASA, to be flying the T-38 again, NASA T-38s, working with the astronauts—I know I had the same feeling of every new guy that's come there. It's just like, "My god, how did I end up here? How could I be so lucky, how could I be so fortunate to have this job?"

And that's still how I kind of felt when we went out to White Sands. Joe said, "Come on, Ace, I want you to be the co-pilot on the G-1 with me. We're going to go to White Sands and we're going to check out the whole operation there and then be the Pathfinder." "Okay, Joe. That's great." I was still a little kid in a candy store.

ROSS-NAZZAL: Were you still working at JSC when there was that simultaneous ferry flight [of *Columbia* and *Atlantis* in March 2001]?

BEALL: Yes, I was. I can't remember which one I was on. I was on the one that got stuck in Abilene for many days. That was something else. Don [Donald L.] McCormack was onboard then, so Don managed one of them and Denny Gagen managed the other. We went to Dyess in Abilene and sat for many days, and the other one went to Altus and sat for a bunch of days. We ended up getting down to the Cape almost at the same time, so one airplane went to the SLF, and the other plane had to go to the skid strip because they couldn't accommodate both airplanes at the SLF at the same time. Once they had the one demated, then me and [Frank Marlow] actually flew the airplane from the skid strip over to the SLF so they could demate that one.

That was interesting. That was a real test of the system, to be ferrying two Shuttles at the same time. It wasn't planned that way at all, it's just the way it happened. The other one just happened to land at Edwards right around when this one was coming out of processing at Palmdale. It was like we could slowly see it happen. I remember talking to Don and I said, "It looks like if this and this and this happened, we'd be ferrying two orbiters at the same time. Can we support that?"

I was the project pilot now, and he said, "Do you have the crews and the maintenance people to support it?" That was the big thing.

I said, "We've got the crews; we have the pilots." We generally had six pilots to fly the airplane and four flight engineers. You need two pilots and two flight engineers for a ferry mission, so we had enough flight crew.

We went and talked to our maintenance guys. Pete Seidl was the supervisor at the time, and he said, “Yes, we can support that. We can pull a couple guys off of some other airplanes.” We always carried the maintenance guys. They didn’t fly on the SCA, but they definitely came on the ferry missions and flew in the Pathfinder, because we needed our maintenance guys on these ferry missions.

Then Don had the same issue, “Do we have enough people to support—security, PAO [public affairs office], Shuttle tile, safety?”

So we did it. It was crazy. We wanted to fly them in formation together, but they wouldn’t let us. We did do that about four or five months ago. They weren’t mated, but we got to finally fly them in formation.

ROSS-NAZZAL: Were you on one of the planes that was flying in formation?

BEALL: Yes. Jeff [Jeffrey L.] Moultrie and I were in one, and Frank [W.] Batteas and Bill [William F.] Brockett were in the other one. That was fun.

ROSS-NAZZAL: Kind of interesting to see two 747s, not really the plane you normally see flying in formation.

BEALL: No, exactly. Then the SCAs with their funky little nub sticking out of the top and the tip fins to boot.

ROSS-NAZZAL: Tell us about your role on this ferry flight [to Washington D.C.]. This is a pretty historic mission. A lot of people have their eyes on things that are happening out at the Cape, you see it on the news.

BEALL: Interesting for me to end up back here on this because I retired in '05 from NASA. I kind of goofed off for about a year, and then I got really bored and decided I need to go back to work. I started flying some Learjets, which I still do, filming and that sort of stuff, but I've always had my eye on the SOFIA [Stratospheric Observatory for Infrared Astronomy] program, even before I retired. I wanted to go right to SOFIA, but it's taken forever for SOFIA to get up and running. I stayed in touch with them, and last April, just about a year ago—I'd been talking to Frank Batiste out at Dryden, who was at the time the acting chief pilot. He said, "Yes, we'd love to have you. As soon as we start going operational here, we're going to bring you onboard." They started and last April they brought me back onboard. I got recalled to the 747.

The guys at JSC were happy to hear that, because they were starting to get low on SCA pilots, so it was just kind of a natural thing for me to help out with the SCA through the end of the program. I started flying on all the local missions every month. We'd still fly the SCA every month, so I started doing that and been going to the simulator. I told Jeff, "Listen, I had my day in this airplane, I had my time. It's your guys' turn now." Bill [William E.] Rieke has not flown a ferry mission yet.

ROSS-NAZZAL: Oh, he hasn't?

BEALL: No, this is going to be his first ferry mission he's really flown on. His first landing, he's going to get into JFK. That will be his first landing. It's like, "Jeff, if you can use me on this, I'd love to participate, love to be a part of it." He said, "Yes, we want to use you, Ace." So on this one actually, to be honest with you, I'm not doing a whole lot. I'm the Pathfinder weather pilot, which can be a pretty significant role [if there is weather]. If the weather's good, there's really nothing to it, nothing much to do.

Hopefully I'll get to fly on the *Endeavour* delivery out to Los Angeles [California]. I'm hoping to be able to fly the airplane then, but on this one I'm the SCA weather guy on the leg up to Dulles. Then from Dulles to JFK [John F. Kennedy International Airport] I'm on the SCA as the third pilot. Jeff decided, and I think it's a good idea, to have three pilots. Number one, just to have another guy in the cockpit to help out. Also these ferry missions—and this is aviation-wide—you always worry when you're out on the road if something happens to one of your pilots, they get sick or they get injured or family emergency. That usually can bring a mission to a grinding halt. So to have three pilots, you don't have to worry about that.

They were good enough to say, "Yes, we want you involved also to be there to kind of oversee. Let us know if anything looks like we're not doing something quite right, speak up." That was nice also, that's kind of my role here on this one. I'm just thrilled to be part of it. I'm running into a lot of people I haven't seen in seven years, and just to be back down here again at the end of it is great, terrific. Sad, but it's always sad when you retire a project or a mission or an airplane. That's life.

ROSS-NAZZAL: Rebecca, do you have any questions?

WRIGHT: I have a couple. You mentioned that you were project pilot. What does that entail, what duties?

BEALL: NASA always assigns a pilot to every airplane to have the general oversight from the operational standpoint. Specifically what a project pilot will do is determine what the crewing on the airplane needs to be. When a mission comes up, he'll usually schedule the crews, find out who's available, who isn't. He'll do all the initial planning for the mission so far as where you're going, what the logistics concerns are, what you're going to need to do. You're the main interface with the user.

Day in and day out, you manage the training for all the air crews. You make sure everyone's staying current. You usually schedule people for the training. Flight manuals and flight checklists, you make sure those are up to date whenever any changes come out. You oversee the rewriting of them and the proofreading of them and the distribution.

You're kind of the line guy who manages the day-in and day-out operation of the airplane. You answer to the chief pilot, and the chief pilot of course is watching what you're doing also. You're making sure someone who knows the airplane well is the one who's down in the trenches running the show, because the chief pilot usually doesn't fly every airplane, is not active in every airplane at the Center.

WRIGHT: Were you a project pilot for the SCA 905 or for both of them?

BEALL: For both of them. There were four Shuttle Training Aircraft at JSC, the STAs, so the project pilot oversaw all four of those airplanes. If there's just one airplane for the mission, he just oversees that one. For me it was two.

WRIGHT: How did you interact with the pilots at Dryden?

BEALL: The pilots at Dryden with the SCA—that was kind of an interesting situation. The way I understand it, when we got the 747 and they started doing the approach and landing tests, that was really in the test arena. That was true test flight, and that's what Dryden does. Dryden is the premier NASA test center. At JSC, we're not so much test. Most of us are not formal test pilots. We haven't been to test pilot school, whereas at Dryden they're all real test pilots. They do all the testing, and at JSC we do more support flying and operational flying.

So when they did the approach and landing tests, Dryden was naturally involved in that. I think there was at least three Dryden pilots: Gordon Fullerton, Tom McMurtry, and Fitz Fulton. I'm not sure if Fred [W.] Haise flew the SCA. The JSC pilots were A.J. Roy, Joe Algranti, and I think Ken Haugen, because it was a JSC airplane.

See, that was the thing. It's a JSC airplane and it's supporting a JSC project, but we needed Dryden's test experience to run the test program. Once the test program was over and we started ferrying, it just made sense to still use some of the Dryden test pilots because they were all qualified on the airplane. Plus we kept the airplane out there, so you had someone to kind of shepherd the airplane. But it was a JSC airplane.

You have these turf wars. The Dryden guys would say, "Here's the Dryden airplane."

"No no no, it's not a Dryden airplane. It's a JSC airplane, we just keep it out there."

Joe Algranti would get upset a lot about the Dryden guys, “We don’t need those Dryden guys in the airplane,” but we kind of did. It traditionally always kept a couple Dryden guys flying the airplane. Gordon Fullerton was initially at JSC, but then he transferred out to Edwards. Bill Brockett got checked out on the airplane a long time ago, because he had a lot of big airplane experience. It made sense to do it. Frank Batiste has been flying the airplane, but he hasn’t been on any ferry missions. He was a big SOFIA guy, so he’s just stayed proficient.

That’s kind of how it transpired, the mesh. The program essentially started out there with the approach and landing tests. It’s a JSC airplane, but the airplane is kept out at Dryden. A couple Dryden guys fly it, but it’s a JSC airplane. There’s always good fodder for a little fight.

WRIGHT: I’m just curious, because as a pilot you spent a lot of time flying a classic set of airplanes. These are all 40-, 50-year-old airplanes, so when you have trained the new people coming in, do you find that interesting for them as well? They may be proficient on the latest aircraft, but now you’re taking them back.

BEALL: Yes, definitely so, especially as time went on. Where I really saw this was in the T-38s. They’d hire a new group of astronauts every two, three, four years, and they were always the same age basically, so we’d start getting astronauts that had flown more of the modern fighter airplanes. Take the [McDonnell Douglas] F-18 [Hornet], for example. I’ve had a couple flights in the F-18, so I’m kind of familiar with their system. They’ve got this great avionics system that makes flying the airplane, especially on instruments, really easy.

We call them “Hornet Babies,” these guys have only flown the Hornet. They were so used to flying the Hornet with this heads-up display right in front of their face, and they had this

thing called the velocity vector, which is this little pipper. Wherever you put that on, that's where the airplane was going to go. Plus the F-18 would trim itself. You didn't have to manually trim it, which was a real big deal. You couldn't over-G it, you couldn't stall it, because it's a flyby-wire airplane. It's very easy to fly.

Now they come to the T-38, which is an old airplane. Basic instrument flying is what we'd call it. When we'd try to get them to fly instruments in the airplane, you could see it was a little harder for them than other guys because they didn't have the experience of flying basic instruments without a lot of the flight director aids that the newer airplanes have. That's where we'd see that the most pronounced.

In the big airplanes like the Super Guppy—I did a lot of flying in the Super Guppy. That thing is the most ancient airplane flying instrument that you see, and even if it had nice instruments it doesn't matter, because that thing flies like it looks. It's a flying tank. It's a fairly stable airplane in its own way, but then again it's not. It's got all these big broad surfaces, so any gusts of wind push it. It's got a lot of inertia whichever way it goes. It's got a very antiquated flight control system, very unresponsive, very heavy on the flight controls. It was just a handful to fly, and to fly instrument approaches on it was a real challenge. So people that were not used to flying just basic stuff with a real sluggish airplane, it was a learning curve for them. We saw it more and more as time went on.

ROSS-NAZZAL: I did have one other question for you, and it's about *Enterprise* going to the [1983] Paris Air Show. They put that defense system on her. I don't think you flew that flight, but can you talk about that defense system? I understand it was on there for some time.

BEALL: Yes. I don't know that much about it to be honest with you, because that was before I even got checked out on the airplane. But yes, they did have some sort of chaff system, a flare system. Of course this was way prior to 9/11, but still they were concerned about a threat to the airplane going overseas. They wanted something on the airplane to give them a fighting chance if someone fired a shoulder-mounted missile, a heat seeker against them. That's basically what it was going to protect them against, a heat-seeking missile, which is probably the most likely thing to get fired at you.

It probably would have worked pretty well, because that was a standard defense against heat-seeking missiles. You'd fire out these hot flares in all directions, and the heat-seeking missile is, "Okay, I've got to pick something." If it's hotter than the engine plume, that's where it's going to go. That's the whole idea. The flares are hotter than the engine plume so that's what the thing is going to relock on and hopefully go after that, not after your engines. That's what the heat seeker is going for, is your engines.

Fortunately I never had to use it, but in talking to the flight engineers that flew that mission, they said that was a real experience taking that thing over there.

ROSS-NAZZAL: I'm sure it was, I'm sure they were rock stars.

BEALL: Oh, yes. I wish you could interview some of those guys, because they had some real stories. Something else.

ROSS-NAZZAL: Well, I think we're getting close to time. Is there anything else you'd like to talk about, about the SCA, that we haven't covered?

BEALL: I don't think so. Your question list was great, it really jogged my memory on a lot of this stuff. I think we've covered all the pretty interesting stuff about the program. It was a great program. I just feel really fortunate to have been such a big part of the Shuttle program, in that respect of carrying the Shuttle. It was really a neat thing to do, a great thing. Never would have dreamed in a million years that I would ever have been doing that.

ROSS-NAZZAL: Yes, it's pretty impressive to go out and look at it.

BEALL: Yes, it's something else. It's amazing that it flies.

ROSS-NAZZAL: Yes. Well, thank you so much for your time today, we appreciate it.

BEALL: You're very welcome, thanks for asking me.

[End of interview]