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CARL B. PETERSON AND OWEN G. MORRIS
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is November 12, 2013. This interview is being conducted with Carl Peterson and Owen Morris, in Houston, Texas, for the NASA Johnson Space Center Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. Both men were instrumental in obtaining the Shuttle Carrier Aircraft [SCA] for NASA more than 30 years ago. Today, they speak about the involvement and the actions taken to turn the idea into reality for the Space Shuttle program. Mr. Peterson, would you like to start?

PETERSON: Actually, it was more than 40 years ago.

WRIGHT: You're right.

PETERSON: Early in the 1970s, very early in the 1970s, this was before I got involved, Owen and John [W.] Kiker had done some work with radio-controlled models that played around with the idea. I think you built the 747.

MORRIS: John and I and a guy named [B.H.] Scotty Curran over in the model shop, the three of us built it.

PETERSON: They actually flew these models and separated it. About that time, the early days of the Shuttle program, the first Orbiters had air-breathing engines, which we'd take to orbit with fuel, and then if it landed somewhere where it wasn't supposed to land, we could fly it back, like an airliner. That soon proved to be a very, very big handicap. I was working for Owen then, and I don't know whether it was Bob [Robert F. Thompson] or Owen, but they called and they said, "Hey, these engines are getting to be a pretty big penalty; would you mind just looking around at some studies to see if there's some other way we could do this?" We did some studies looking at the carrier aircraft being a 747, a C-5A, which Lockheed built but the Air Force owned them all. We also looked at a Douglas airplane called a DC-8. At this time, separation and all that, Edwards Air Force Base was sort of looked at as the experts in this area. They had always done things like this using a mother ship; then they used a B-52 and an X-15, so they thought that this piggyback probably was not the way to go. We actually looked at a new configuration of a Guppy, and I remember I had to go to Washington to listen to this pitch from this guy. I don't remember his name. Mike [Myron S.] Malkin was there—you remember Mike—and Mike soon said, "Well, that's more than the whole program's going to cost, we can forget about that one."

MORRIS: This was to build a completely new airplane, design and build a new airplane.

PETERSON: As we did these studies, it became apparent that both the 747 and the C-5A could do the job. It had the power and all of that to carry an Orbiter on top, and we had our aerodynamic people, Ivy Fossler [now Ivy F. Hooks], who you know, doing some separation tests and so forth. It was kind of interesting; Owen and I made a trip to Lockheed. I forget where it was, somewhere in Georgia.

MORRIS: St. Louis [Missouri].

PETERSON: St. Louis, was it? We met with a guy named Kelly [Clarence L.] Johnson, who was the super spy guy for Lockheed. He said, "We don't want you using the C-5A," is essentially what he told us.

MORRIS: He said, "You will not." I got the idea.

PETERSON: We also went to Langley [Research Center, Hampton, Virginia] and visited a general who was head of the Material Air Command. He told us the same thing; he said, "I've only got 52 C-5As, and I don't want to." The thought was then, if we used a C-5A, the Air Force being a partner in the Shuttle program, they would let us modify the airplane. Then they could still use it when we weren't using it, and when we wanted to carry the Orbiter, why, we would put the attach points on top and use it, and then give it back to them. I think Bob Thompson had a lot of history of working with the DoD [Department of Defense] when he was running a landing recovery division for Gemini and Mercury. I think he sort of favored that way.

One day, I got a call from George [M.] Low, who was Deputy Administrator. He didn't call Bob Thompson and didn't call Owen, he called me. He says, "Hey, we're going to have some money at the end of the year, and why don't you go buy a 747. But you got a month to do it."

MORRIS: It was September, and we had to do it before the 1st of October.

ROSS-NAZZAL: Not much time.

PETERSON: I went to Owen and Bob. I says, "What do I do?" They said, "Go buy it!" Fortunately—and you know with NASA, there's no way you can put our a procurement and get it done—there was a guy that worked at procurement, he was Division Chief, I think his name was [Glenn F.] Bailey, but he's no longer living.

MORRIS: I don't remember.

PETERSON: He said, "I'll tell you what, we'll get Rockwell to buy it. They can go out and buy it." Put out the bids, and this was in, I think, '71 or '72, when we had the embargo of the Mid East and fuel prices were sky high, so all the airlines had parked their 747 out in the desert. We ended up buying one from American Airlines, had 5,000 hours on it. We got it for $7,000,000. Today's going price for a 747 is $350,000,000, by the way. It was like getting a new airplane.

Let me go back a little bit. On the C-5A, the studies showed that it could do the job, but the C5-A tail also has the elevator up on top of the vertical tail. Our concern was that if, for some reason, separation didn't work like we thought, and it took the tail off, why, we would lose the airplane. The 747 just had a vertical tail, and the elevators were where they are in normal airplanes. It turned out we didn't need it, but we added two vertical fins to the tail, so that we knew that we were safe. We did that for two reasons. We thought maybe we'd get buffeting, carrying the Orbiter and not have adequate control. Turns out we didn't need it, but they were there, and it was a good safety measure.

By then, I guess George Low made the decision because he said, "Buy the airplane." Looking back, it was certainly the right decision. Bailey said, "Rockwell, go buy the airplane, no fee." It turned out that they were willing to do that. We bought the airplane in '72. We didn't need it for several years, so American Airlines in their proposal said, "You can have it for this price. We'll take it to Stillwater [Oklahoma]," which is their headquarters, "and take all the stuff out of it," because we don't need it and they probably could use it. That's what we did. I remember I made a trip to Stillwater and flew in the back of that thing with just skin there, and our two NASA pilots were AJ [Arda J.] Roy and Joe [Joseph S.] Algranti and the Crew Chief was Skip [Louis E.] Guidry. It was those three and me in this big old airplane, and we took it to Edwards [Air Force Base, California] and parked it at Edwards for essentially three or four years because I don't think we took it to Boeing until '75 or so, to start the mods [modifications].

MORRIS: That's about right.

PETERSON: Everything just seemed to click back then. There didn't seem to be any turf wars or anything, Edwards had two pilots named Fitz [Fitzhugh L.] Fulton, who had been a pilot for Boeing in his earlier years, Tom [Thomas C.] McMurtry, and their Crew Chief was Vic [Victor W.] Horton. They and Joe Algranti, they worked out fine, and whenever the airplane needed to be flown, why they'd get together and fly it. It was our airplane, we needed to keep it there in the desert, and so for three or four years, that's the way it worked.

In the meantime, we started working and we ran the whole contract through Rockwell after that, which turned out to be a real plus. It wasn't any extra cost to the program, but they put a guy on named Don Saendin—remember Don?—who was sort of their contracts guy. Boeing

had a program manager named Frank L. Curtis, who later came down here, and then it was myself.

I remember when we formed the Carrier Aircraft Office, right after we got the airplane, Owen and Bob said, "Keep it small." I think I had four people in my office, and we had a couple of people that were co-located from Operations. Owen said, "Just go do it. If you need help, come see me. If you don't need help, go do your thing." Back then, it was sort of the rule of the day, it was easier to ask for forgiveness than it was permission. I don't think it's that way anymore. I'm not there, so it doesn't matter. That's the way it worked. I didn't come here to brag about Owen, but he's part of the reason the program works so well. Let me go on, I'm digressing here. Like I said, in my office, there were just four people: myself, Ralph [D.] Hodges, who's no longer with us, Woody [Woodrow W.] Wilson—and I'm not sure he's still alive.

MORRIS: He was the last time I heard, about two years ago.

PETERSON: And Bill [William E.] Gandy, who now has migrated up to Oklahoma, and Pat [Patricia L. Stevenson], who was our secretary. Then the two guys we had from Operations were Jim [James B.] McCaulley and Dale Carns. Our whole office payroll was probably less than what one guy gets nowadays, but that's the way it was. It was small.

We got the airplane, so in the meantime, our engineering people, Ivy Fossler's group, were doing a bunch of wind tunnel tests and so forth, which proved what already had been shown, by radio control models, that we could carry it and separate it. I guess in order to make the Edwards people happy, we said, "Well, the way we're going to do this is we're going to fly

up to 35,000 feet with the 747 and the Orbiter on top. Then we'll take a dive, and the Orbiter will generate lift, so then it will drop the 747 from underneath it," just like they were used to doing things. Actually, that's what happened. This maneuver, where we separated, was a very positive thing. There wasn't any danger of hitting the tail. The guys in 747s said they could actually feel themselves drop when they released.

MORRIS: We proved that out with the radio-controlled models. We developed that maneuver, and then the guys out at Edwards said, "Hey, that's a good idea," so we did it.

PETERSON: When we finally went to Boeing to do the mods, there weren't many things we needed to do to the airplane, actually. The Orbiter attached to it; there were attach points up front and one in back. So we had to stiffen—they call them stringers on the airplane—stringers all the way along that they attach the skin of the airplane to. We had to reinforce those a little bit. We also re-engined it. We got different engines, but I don't remember the model number or what, but we got bigger engines.

MORRIS: I don't remember that one.

PETERSON: Yes, we did, and we had to add the vertical fins to the tail, and it was kind of surprising—very little had to be done to the flight controls system. It just flew with what was in there. Boeing makes an outstanding airplane, and I got more impressed as the program went on and as we did the mods there. Of course, all this time we were doing that, we were also working

with the Operations people to do the separation test at Edwards with the, I say "real Orbiter," actually, it was an Orbiter test vehicle. I don't remember the name of that. Do you?

MORRIS: No.

PETERSON: It doesn't matter, but it looked like the Orbiter, weighed like the Orbiter, and so forth. When we finally got the mods done and moved to Edwards, we did, I think, two or three mated tests. By "mated," we just took off with the Orbiter on top, landed, and then we did three or four actually separation tests. They all went very smoothly except the first separation test, when Freddy [Fred W.] Haise had a little trouble landing the Orbiter.

MORRIS: Yes, separation went fine, but when he started to flare to land, he got into a pilot induced oscillation, and the thing hit and hit and hit. Not hard, it didn't hurt a thing, but it was embarrassing to him.

PETERSON: Yes, it was. This was sometime, I think, in '77, when we did the Flight Test program. After that was successful, we didn't try to hang onto the airplane. We said, "Here it is," so we just turned over the Operations and they started doing their thing to be ready to carry the Orbiter when they got the first one, move it down to the Cape [Canaveral, Florida], and then be ready to fly it anywhere if the Orbiter had to land somewhere. One of our landing sites was Hawaii. That was always a requirement, we had to be able to carry that Orbiter from Hawaii back to the mainland, which was about 2,000 miles. The Orbiter people kept adding weight to

that thing. I think finally, we ended up engineering it for, like, 250,000 pounds, if I recall, was the last figure we did.

MORRIS: We increased it and also took weather into account. You couldn't fly that leg without a favorable wind.

PETERSON: Right, yes. That's the history of the program. It wasn't just hatched; it was a lot of, I guess, lucky breaks. It wasn't because I was smart. It was because I had some good people in my office; I had Owen and Bob. Looking back—these are comments that I'd like to say—probably couldn't happen today. Can you imagine the Deputy NASA Director calling just a worker down here at JSC and say, "Hey, buy me an airplane." It didn't upset Owen. He just said, "Go buy it."

MORRIS: No, I wanted it. That was music to my ears.

PETERSON: What I'm saying is nowadays that would never happen. That would never happen, and the way it worked that we were able to buy that thing in just a short time, and able to work the program. The way we managed the program was Owen said, "Unless you got trouble, don't bother me." Don Saendin and Frank Curtis and myself, we had a phone call every morning for three years, solved every problem before it ever got there, and we did the whole program, including buying the airplane, for less than $50,000,000. That was the mods, the flight test, and everything. We were real proud of that.

ROSS-NAZZAL: Mr. Morris, several times Mr. Peterson has talked about you being over the project. What office were you working at that point?

MORRIS: I was head of Systems Engineering and Integration in the Shuttle program, Level II. It was kind of oddball that they put that program in our office. One of the basic tenets in setting up the organization was since we were in charge of systems engineering and integration, it would not be appropriate for us to have any hardware. We would do the analysis, we would make the tradeoffs, and say this project should get so much and this project should get so much, and that's the best answer. To try to make sure we weren't prejudiced for our own bailiwick, they said, "You're not going to have any hardware."

Let me go back a bit, and I'll get back to your question. In designing the Orbiter, I worked in that office for a few months initially, after the contract was led. They had a very difficult time with the gross weight of the Orbiter vehicle. The original design requirement was that the air-breathing engines, to be able to fly like an airplane, would be in the Orbiter. They could make a go-around if they came from space and started to land and saw they were short or long. They could fire up the air-breathing engines and go around and make another pass at landing.

It became very obvious that they just could not do that with the weight that they had allocated. There was a big discussion at Thompson's level as to whether they could remove that requirement or not, and, finally, the decision was made. We will not put the engines on permanently on the orbiter, but if it lands at Edwards or Pearl Harbor [Hawaii] or wherever, we want a kit that you can go strap the engines on, put fuel tanks in, change the flight control system because it controls differently as an airplane rather than a spacecraft coming in, and that was the

program design for six months, eight months, not very long. It became obvious that that was a very major change that had to be made after you landed off-site and had to do this change. It would be months or years, to get all this stuff in and verify it and be confident to fly it as an airplane. That was a big problem.

A guy in the Engineering organization there in Houston, John Kiker, came into my office one day. We were both model-builders, and we were both airplane nuts. He said, "Hey, I got an idea." It turns out back in World War II—well, even before World War II, back in the '30s—in trying to develop airplanes that could fly across the Atlantic Ocean commercially, the British designed a piggyback arrangement with a big flying boat on the bottom and a twin-engine pontoon airplane on top of it. The idea being that the flying boat would take the combination out as far as they could with the fuel they had on board, then they would launch the smaller airplane and it would go on across the ocean to New York. That worked.

They actually built the airplane. I don't think it ever took passengers; they turned it into a mail plane, so when you sent airmail, you could really get airmail, instead of airmail to the coast and then ship across, and then airmail again. They used that for a couple of years. Then during World War II, the Germans developed a bomber that had a medium bomber—it was a Junkers 88, actually—that had remote controls in it, and they put a fighter up on top of it. The idea was to fly over the target, and the fighter would release the bomber, then guide the bomber into the target, whatever that was, and then he could fly home. You lost the bomber every time because it was a missile, really, at that point in time. They did that operationally. As I remember, they flew something like 150 or 200 flights with that thing. The idea of separating in midair was not new. In both the British and the German programs, they had trouble, they lost some vehicles, but basically, it worked.

John had been reading some of this stuff, and he said, "Hey, that would solve our Shuttle problem." We could get a big airplane. The initial thought was a C-5, because the Air Force had them and we wouldn't have to buy an airplane. We could do this, and we could ferry basically anywhere in the world. The longest leg was Hawaii to the United States, but we developed flight plans with the average of—I'm not sure my memory's right—I think it was a 20-knot tailwind all the way across. We could make it with the 30-minute reserve fuel, which isn't very much when you think about it with a new vehicle. That looked reasonable. We took this initially to the Orbiter program and said, "Hey, you guys got a big weight problem, and this is a way to get around a major part of it." Not just a little bit, but a major part of it. They decided that that was just too dangerous, there's no way you're going to do that. Off the record, I think they also saw a fairly good size chunk of the program moving out from under them in the design and development of all this extra control and propulsion system. They had business reasons at least not to want to do this.

John and I decided, well, heck, we'll try to make this where they have to refuse some pretty good things. We had an Orbiter model that was about two feet long that had been used for some flotation test. We got the NASA guys to give us that model, and we put radio controls in it and control surfaces on it, just like the Orbiter, and then used a utility radio control model to represent the carrier aircraft. We flew that for three or four months. Our techniques were pretty ragged when we first started out. We had some pretty exciting flights, but once we found out how to really go about it, then it became a pretty routine thing.

One day, we got Bob Thompson to come over and watch. He saw us do it, and fortunately, at least that time, it worked just like it should. The Orbiter came down and landed on the runway there at the Center. He said, "What do you know, that's a good idea, but you

can't build a great big airplane like this carrier you're using. Would it work off of a 747?" We said, "Well, we'll show you." This was all outside of normal business. He said, "I'll give you a $10,000 chit into the model shop here at the Center, to help you build a 747 model and do the same thing with the real flight configuration."

We did, and a guy in the model shop, Scotty Curran, a very good Scotsman with a very strong accent, as I remember, he was a real nice guy, was our lead in to the shop to get the pieces that we wanted. Basically I built the body of the thing, John Kiker built the wing, Scotty built some special parts that required some machining and stuff that he could do in the shop easily, and he did the final painting, so that it looked like the real 747. We flew that several times, and it worked.

I was talking to Bob one day, and he said, "Well, how did you determine you could do this?" It was at that time, as Carl said, we said, "Hey, the idea is you don't fly the Orbiter off of the 747; you put the nose of the Orbiter up so that it will create excess lift. So, when you let go, the Orbiter jumps up, the 747 drops, and you get the separation immediately." It really worked that way. As Carl said, we then performed a half a dozen flights, five or six separation flights, at Edwards with the real vehicle. After Carl got the 747 and got it modified, by that time, the Orbiter people had come on board and they thought that was a real good idea. The rest pretty much is history. We used it all through the Shuttle program to ferry orbiters different places as well as the drop test early on. I don't remember a single incident report—do you, Carl?

PETERSON: No.

MORRIS: I don't think there was ever an incident reported; it just did it.

PETERSON: The question she asked is why did they let you have the project in your office.

ROSS-NAZZAL: We'll get to it.

PETERSON: See, I want to know, too!

MORRIS: Because John Kiker and I had done all of the radio control model work and understood a little bit in the engineering part of getting this thing done, and also at that time, the Orbiter people still hadn't come on board strongly. He said, "I want you to do this." I said, "Well, Bob, you told me I never would have any hardware in this program." He said, "Well, forget what I said, but you do the 747," so I got Carl to take over and make it happen.

PETERSON: That's why y'all said keep it small, so it wouldn't be noticed.

MORRIS: As you say, it was a fairly simple job. It was a new concept and new idea, but it didn't require major redesign of the 747. It was beefing it up at the attached points, beefing the vertical tail up to take some buffet load, and then adding the two outboard fins to get better—we call it Cn Beta, but better directional stability. One of the things I was against—the Operations people wanted to put a destruct system in the 747, which would blow the cabin door off, blow all the windows out, to decompress immediately, and then put in a chute that they could get in, go down, and get out if something went wrong, which is nice. I got to thinking about all the ways that thing could fail, and this whole process could go wrong, and I was very much against that.

The guys at Edwards were successful in getting the program to put that emergency system in. That's the only 747 flying around with big explosives, as far as I know.

PETERSON: Yes, I might add, you and I actually made a trip to this company that built these explosives, and we watched them blow tips off helicopters. There's no way you could test it because you don't want to test a hole in the 747. I remember this bothered me before we had our final, what do you call it, design review? When the thing came out, Mike Malkin and [John F.] Yardley were there. Of course, they said, "Well, did you test this thing?" I said, "No, you gave me $250,000 to put this thing in, and that's it. If we use it, we use it; if we don't, we don't." John says, "That's fine with me." Remember that?

MORRIS: Yes. It never did go off unneeded, so my worries were not justified.

PETERSON: One thing I'd like to add to what Owen said about trying to keep the thing simple through the whole program. I have nothing against our reliability, quality, and safety people—we didn't want the airplane to be R, S, [reliability, safety] and QA [quality assurance]-ed to death because it was already built. There was a guy in Shuttle office, Scotty [Scott H.] Simpkinson, and I went and talked to him about that. He says, "I'll solve your problem; I'll be the guy." Remember that? He went to all the reviews, and he represented R, S, and QA. We didn't need a bunch of added studies to prove that the airplane would fly and all that.

MORRIS: Yes, the only studies we needed were to study the modifications and look at the safety of the modifications. The basic airplane was carrying passengers all over the world every day.

PETERSON: There were a lot of things that happened just right for us. The early things that were done showed the system would work. There was a lot of people, even when we started, that said, "This is not going to work," but it worked. I think George Low, who is no longer with us, as you know, went a long way and said, "I want the airplane; I want to own it." He did. We only had one 747 all through the first part of the program, and then it was after one of the major safety reviews, I'd already left NASA—and you probably had, too—they decided, "Hey, we can't get along with just one 747, if something happens to it." They actually bought another 747, it was the test vehicle, the one we rejected in the beginning. There is another SCA somewhere. I don't know where it is.

ROSS-NAZZAL: Yes, I think it's out in California.

MORRIS: Yes, it's at Edwards, I think. I don't know whether it's flyable now, but probably is.

ROSS-NAZZAL: I think they're using it for the SOFIA [Stratospheric Observatory for Infrared Astronomy] program.

MORRIS: No, that's the 747-SP. That's the short-bodied 747. The other carrier aircraft, do you remember the tail number of that one?

PETERSON: I don't remember the tail number.

MORRIS: That was a duplicate of the one we modified, so we didn't have to do any engineering at all on the second one. As far as I know, it's at Edwards, and it may be used, but I don't think it has any major program activity. It was used intermittently in the main part of the program just to put time on it and keep the capabilities of the airplane up and make sure it was okay, but it was never really needed.

I was adamant I wanted it initially. We were talking about flying space missions maybe 20, 25 times a year, and my point was, "Hey, you've got a single point failure in the program if something happens to that 747. Every time you land at Edwards, you take an Orbiter out of operation because you can't get it to the Cape until you get another 747." They decided not to do it at that time, and it was, I don't know, five years later or more that they bought the second one.

PETERSON: It must have been because I wasn't around.

MORRIS: I wasn't, either. It was sometime later.

PETERSON: I got one call because they wanted to know where all the molds were, to build the vertical tail.

MORRIS: The outboard fins?

PETERSON: Yes, the outboard fins. I said, "I think they're either at Ellington [Field, Houston, Texas] or they're at Boeing, I don't know." I think Frank Curtis helped run that down.

MORRIS: Yes, he mentioned Frank Curtis—Frank Curtis was really a big help in that program. He was a very strong supporter, knew a lot of people within Boeing. He worked for them at the time, and he was really a big help in getting all the way through the program. I thought very highly of that man.

PETERSON: As a matter of fact, the turf wars were more at Boeing than they were here because Boeing then had two divisions. One was their military aircraft division—well, they had more than two, but the two that I was aware of—and Frank Curtis worked in there, and then they also had BCAC, which was their Boeing commercial airplane division. The commercial people wanted nothing to do with this program because if something happened, it would ruin their image.

MORRIS: Yes, if a 747 went down and killed people, they wanted no part.

PETERSON: Frank, he had to work this problem back there, keeping the big money-makers happy while he was doing this program. You're right, and like I say, that probably couldn't happen today. I don't know. Anyway, that's how the 747 was hatched.

ROSS-NAZZAL: I wonder if you both could elaborate on the nay-sayers of this idea? You mentioned that they thought it was too dangerous, but what were some of the other thoughts?

MORRIS: Let me go back to a comment Carl made. The meeting in St. Louis before the program was approved, and we were still looking at a C-5A maybe as the carrier aircraft. We went to St.

Louis and there was a four-star general, a three-star general, and Kelly Johnson there. Were you with us on that trip?

PETERSON: Yes, yes.

MORRIS: Yes, I think because you and I and one other person, I can't remember who the other person was, we were the NASA guys. Kelly Johnson was probably the most famous airplane designer in the world at that particular point in time. He had an extremely high reputation. We made our pitch and told them what we wanted and that we really didn't want a C-5; we just wanted to modify it, and when we needed it, to borrow it for two weeks or however long we needed, and then it would go back in their fleet. Kelly Johnson just bounced as high as he could. He was off the ceiling, "You're not going to do that, you're going to kill people, you're going to crash airplanes, you will never do that with my airplane." Of course, it wasn't his airplane, it was his general's, but he said, "You'll never do that with my airplane."

Years later, I found out that in their SR-71 program, the big Blackbird program that flew Mach number 3, they had developed a piggyback arrangement of an unmanned powered missile, whatever you want to call it, that they could put on top of the SR-71, fly into the coast of, say, China, wherever the target is, separate, put the unmanned vehicles in to go on to the target while the SR-71 turned around and the crew was not exposed to the defensive fire at the target site. In the process of developing that and making, I think, three trial flights, they separated the missile the third time. It went up about 20 feet, and it came back down on the SR-71 and killed a crew. That had just happened a couple of months before we saw him. Of course we didn't know

anything about that, but that was the reason that he took that real high bounce, as it turned out. He had just been burned because he had lost an SR-71 and a two-man crew in trying to do this.

It turned out that design did not take the missile and crank the angle of attack up so that it was developing more lift than its weight, so the interference flow wasn't strong enough that it went up, I don't know how far, but just a little ways. Then, it pitched over and came back down and hit on top of the SR-71. They did not understand some of the things that the Brits and the Germans had developed in World War II. He was very much against it and the generals backed him up. That was the last we heard of the C-5, that was just verboten.

I think as far as the Rockwell people were concerned initially, they were looking somewhat programmatically that this would move not a large part but a little part of their program out from under their immediate jurisdiction. It would be under NASA here and under Carl as being the leader, here. For that reason, they didn't like it. I think some of their technical people had honest technical doubts that it would really work at that point in time. I don't remember anyone else that really gave us a lot of problem. Do you?

PETERSON: The Edwards people, who were the experts, supposedly, in this sort of thing.

MORRIS: Yes, they, of course, had been through the X-15 program and the X-1, X-2, X-3, X-5, X-15, where they used B-52s and the test aircraft was under the wing of the carrier airplane, and they dropped it like a bomb. The re-contact problem was a totally different concern for them. I don't remember any published reports that they had a lot of trouble with their technique.

PETERSON: They didn't.

MORRIS: When we were talking about putting a 250,000 pound Orbiter on top of the 747 and then trying to ensure separation, initially they were really concerned. As Carl said, we ran wind tunnel tests where we actually took the models and separated them and measured forces and moments on both the carrier aircraft and the model, and reconstructed mathematically what the flight profile would have been. We were really quite confident that, hey, this thing would work, and there were ways to prove it before you actually flew. I, in a previous life, worked on the B-58 program, which was a Mach number 2 bomber. It had a great big droppable fuel tank that was really bigger than the airplane, that was right underneath, and it wasn't on a pylon down below; it was physically attached to the airplane. Once that fuel tank became empty, then you had to separate it away from the aircraft. I spent six months running wind tunnel tests of how that separation would work. We ran the separation at different locations, different angles of attack. It was fairly crude, at that time.

We didn't have the computers we have now. A computer at that time was a young lady with a calculator, sitting at a desk. That's what we called a computer. To work through the mathematics of this thing was a pretty difficult job with that computational capability. That program was successful; they were able to drop empty tanks. The tank being empty, meant that a given aerodynamic force would have a very strong effect on the movement of the tank because you weren't moving a big mass around, you were moving a big object that was quite light. That worked, so that, to me, since I had happened to work on that program, gave me confidence that hey, if you do enough wind tunnel tests, you can be pretty darn sure things are going to go right.

PETERSON: Of course, we did more testing during the program, but when I got involved, everybody here was all for it. We were sure it was going to work.

MORRIS: Yes, we had been through the preliminary wind tunnel test, we'd been through the radio-controlled model stuff, and I don't think we had any nay-sayers in JSC.

PETERSON: No, I don't recall any. I remember I had to go out and get a memorandum of understanding signed with Edwards to do a test program. [Christopher C.] Kraft says, "Get it signed." I said, "Yes, sir."

MORRIS: Fred Haise was the commander of the first separation flight. [C.] Gordon Fullerton was the pilot.

ROSS-NAZZAL: You had mentioned that phone call that you received from George Low. How did he keep up with what was going on here at the Center and the tests and then make that decision?

PETERSON: I don't know, and how did he ever find my name?

MORRIS: The Orbiter weight problem was a major problem within the program, so all of the program management levels were really concerned about the weight problem. If you knew George Low, he was a very quiet guy, very, very deep, could understand 99 percent of the technical areas that all the specialists represented. He was really concerned about this. As we

said, finally it worked its way up through the chain of command, and it looked like a good thing. We were a bit short on money, but in early September, the money guys said, "Hey, we have this surplus that for some reason tied to Congress we can't transfer into next year, or we're going to lose it." Then, there was a major push to get that money obligated before October 1. George, I think, was aware of this primarily because of the Orbiter weight concern, and this was a potential way out of it, at that point in time.

PETERSON: Of course, he was an engineer.

MORRIS: Yes, he was a heck of a good engineer.

PETERSON: I remember after the separation test. I don't know if you went out for that; I did.

MORRIS: Yes, the first one.

PETERSON: The control center, I went in there afterwards because I'd been out watching it, and I saw George Low, and I said, "This would never happened without you," and he says, "Oh, you know," he's very modest. I think he said, "I didn't do anything."

MORRIS: He would take no credit, personally.

PETERSON: I said, "I still remember that phone call."

MORRIS: We had set up your project office at that time, and I guess there had been some paperwork going up and down about the project office.

PETERSON: Must have been.

ROSS-NAZZAL: Would you tell us more about the project office? What was its purpose and what were you working on between the time you purchased the plane until those tests happened?

PETERSON: We called it the Shuttle Carrier Aircraft Office, and we bought the airplane, and like I said, then it just sat for two, three years. During that time, we were working with Boeing on the mods at fairly low level, working with the Operations people. Joe Algranti and AJ Roy, I sent them to 747 school, $25,000. When I say "I," I mean the program did. We did more wind tunnel testing and that sort of thing, but it was very low level, and that's why Owen and Bob wanted the office to stay small. We knew there was a little bit of work to be done, but we didn't want to have a big office.

MORRIS: We had time to do it.

PETERSON: We had time to do it.

MORRIS: I remember another interesting meeting. There was a discussion of who was going to fly the 747 for both the attached test and also the separation test. We went out to California, to the Rockwell Plant, and I guess Mike Malkin was there. I don't think George was there at that

time. Dale [D.] Myers, who was a big guy in Rockwell. Dave [David R.] Scott, the Apollo 15 commander, had transferred out to Edwards, and he was Assistant Director at Edwards. He was there. Edwards said, "Our test pilots are the best guys to fly that airplane because we're used to things not going quite right and taking care of emergencies."

PETERSON: Fitz Fulton, he also was the SR-71 pilot out there, so he was a very well qualified guy.

MORRIS: Yes, but the other idea was to have a Boeing guy fly, and there were some Boeing test pilots that had, like, 8,000, 10,000 hours flying 747s alone, all 747 flights. It was my idea that, hey, if something goes wrong, I would sure like to have the guys flying the machines thoroughly familiar with it and what it could do and what all of the backup capabilities were because of personal experience. The meeting decided, I think primarily because of David Scott—I wasn't in the meeting; I was sitting outside the door, they were afraid I was going to get too emotional, I think.

PETERSON: I can't believe that.

MORRIS: The results of the meeting was that Dave Scott won. The Edwards guys were selected to fly the 747, and they did a super job all the way through the program.

PETERSON: I think our pilots were on board, too. I think we always had a dual crew.

MORRIS: Yes, yes, but the Edwards guy was always the pilot.

PETERSON: After getting to know Fitz and his background, I was comfortable with that at the time.

MORRIS: It wasn't that I didn't have confidence in Fitz.

PETERSON: No, I know.

MORRIS: It was that I wanted the guy who had the most experience with that vehicle, and the Boeing guys were quite good, too, but the decision went the other way. It was a very interesting meeting.

ROSS-NAZZAL: I'm sure it was.

MORRIS: Chris Kraft was there. In the middle of the meeting, Chris came out and I was sitting outside the place. He walked over to me and he said, "Well, I guess you would just like to see a decision made so you can move on, wouldn't you?" I said yes. That's probably more than you ever wanted to know.

ROSS-NAZZAL: No, we always want to know more.

WRIGHT: No, this is great information.

PETERSON: Little tidbit about Fitz Fulton—this has nothing to do with the program, but when he was at Boeing, he was a test pilot there before he went to Edwards. He was the first guy to fly when Boeing first made the first jet, the 707, so the day he flew it, he flew it over Lake Washington, and there was a big crowd all around.

MORRIS: Big boat races.

PETERSON: The guy that was running Boeing at that time, I don't remember his name. Fitz did his thing over there and as he was leaving, he did a barrel roll.

MORRIS: He came in slow right over the lake, pulled up, and rolled the thing.

PETERSON: The story goes that the Boeing CEO called him in and just ate him out for doing that. He says, "If you had crashed, we'd have gone bankrupt." As Fitz was sort of creeping out of there after he gave him this tongue-lashing, why the guy says, "But it did look pretty good, Fitz."

ROSS-NAZZAL: Can you share with us your memories of the testing when you were out at Edwards, witnessing your plane actually doing what it was supposed to do?

PETERSON: It was, to me, just a great feeling. Of course, it took off and then you didn't see it again because they go up to 35,000 feet and you don't see it, and then somebody said, "Well, here comes the Orbiter."

MORRIS: Really, that whole test program went extremely smoothly. We had no unexpected happenings. The biggest anomaly we had was Fred Haise's first landing, where he got into pilot-induced oscillation. That had nothing to do with the test program we were running; that could happen on any Orbiter landing from space or anywhere. I don't remember any other significant problem in that whole test program. It was, at least from my part, there was always a bit of tension when you started any given flight, but the outcome was pretty much by the book.

PETERSON: On the way out, I know I've told you this story, flying out on the airplane, Scotty was with me. He was on the same airplane. Scotty's a guy that was Mr. R, S, and QA, and he was really a fairly unique guy. He was showing me; he says, "Carl, look, I just bought this new camera. I'm going to take all these great pictures of the Orbiter landing, the take-off, and all this and that." Saw him later, I said, "Scotty, how'd your pictures turn out?" He says, "Camera didn't work."

MORRIS: All of the test flights really went pretty much by the book. I don't remember any significant and unexpected activities. The emergency escape system never blew up.

ROSS-NAZZAL: Yes, that's a good thing.

MORRIS: Every flight, that was in the back of my mind, "Boy, I hope there's not a short in the circuit somewhere."

PETERSON: Yes, what it was, they actually built a chute. The pilot'd sit up on the second floor, and it was just this chute that if there had been trouble and they had to ditch the Orbiter, there's no way to bail out through a door or anything, so they of course were wearing chutes. They punched a button which hopefully would blow a hole in the side of the 747, they'd dive in a chute, and they'd go out that way. We didn't test it and didn't have to use it. I know that we had some concerns about that, but there's nothing we could do about it.

MORRIS: I did. Yes. But it worked!

PETERSON: Actually, the truth of the matter is, we probably did that just to please Edwards.

MORRIS: Yes. After the test program was over, they deactivated that system, so they didn't have the danger of a premature any longer. They had been through the entire flight envelope several times in the thing. The airplane worked fine, so they deactivated that system.

ROSS-NAZZAL: Once the test flights were over, did they move the office?

PETERSON: I'm glad you asked that because I was going to say, when the test flights were over—I think this was in '77—we didn't try to hang on to the airplane or the program. We just said, "It's yours," and we dissolved the office. I went on to a different job. Actually, I didn't have a job. About that time, there was a NASA RIF [reduction in force], and they RIFed a guy. Jack Heberleg got RIFed, and they called me up and I took his job over there in the new SPIDPO

[Shuttle Payload Integration and Development Program] Office that Glynn [S.] Lunney ran. Remember that?

MORRIS: Yes.

PETERSON: I say I didn't have a job—you had asked me to stay on and do the engine program.

MORRIS: Yes.

ROSS-NAZZAL: You just transferred the program to the Shuttle program office?

MORRIS: Actually, it went to Flight Operations, as far as flying the 747, and then it went to the Flight Operations at the Center to determine the scheduling of when they needed it and where they needed it to do its thing. It was just a tool from there on, just like any other corporate airplane. I want this thing to fly from here to here and carry that load. It was treated just like any other airplane.

ROSS-NAZZAL: Do you think there were any significant challenges when you were working on the SCA? Or compared to going to the Moon, this was a piece of cake?

MORRIS: Yes, absolutely.

PETERSON: No, we knew it was going to work. We knew it'd work.

MORRIS: The big challenge was to get it approved, and once we got that thing approved, there were really no technical surprises during the development or the modification program. There were, as we've alluded to, some fairly heated discussions on the flight test program and who would fly it and where and so forth, but there were not major program problems. They were just operational planning and how's the best way of doing it. For a development program, it was quite unexciting, once we got it going—fortunately.

ROSS-NAZZAL: That'll be a good quote for Space Center Houston. They'll put that in their exhibit. Rebecca, did you have any questions?

WRIGHT: I just wanted to ask if there was anything you remember during the modification process. Did that go as smooth as you had hoped to as well?

PETERSON: Yes, it did. I went out there quite often to look into it, and I think that that went well. Of course, Frank Curtis, who was the Boeing program manager, he had to fight a lot of daily battles that I wasn't aware of because the commercial division was the one that had to do the mods, and he was in another division. When I was there, they were building three or four airplanes for the Shah of Iran, so it was very interesting to go over and look at our airplane and look at the ones that they were building. Remember those?

MORRIS: Yes, those things, absolutely unbelievable. It was like a great big hotel suite put inside a 747.

WRIGHT: Difference in pricing, I guess, between your plane and his plane.

MORRIS: Yes.

PETERSON: Probably, I'm sure, yes.

MORRIS: He was buying new ones off the line, and then he was spending beaucoup money putting this penthouse inside this thing.

WRIGHT: Yes, you're stripping out, and he's putting in.

PETERSON: Yes, that's right. We took all the seats out and left them there in Stillwater.

WRIGHT: That plane does have some legroom, lots of legroom.

MORRIS: It does have some legroom, yes. During the test flights, we put three or four instrumentation consoles that were monitoring loads and that kind of stuff, but then that was taken out once the test flights were over. I think they reinstalled a dozen seats or so, just for super numeraries that flew on a flight somewhere, but other than that, it was a great big cavern.

PETERSON: Yes, it really was.

ROSS-NAZZAL: I thought of one more thing. We were interviewing some of the guys a few years ago about the SCA and one of the folks out of Dryden was curious about turf wars, and you kind of alluded to the fact that there were some turf wars between Edwards and JSC.

PETERSON: There were, but we worked through them.

ROSS-NAZZAL: What I wanted to ask about is—this is a JSC asset, or it was a JSC asset, but it was always housed in California.

MORRIS: Compared to the salt and humid environment that we have here and the environment they have at Edwards, that's a very easy decision. If you look out around Edwards today, in Arizona, California desert, you'll see big transports all over the place, and they're put there just because deterioration is much, much slower than it is in this kind of environment. When we got the Guppy that the French built for us, it was here initially. Then someone said, "Hey, it's a whole lot better for the airplane to put it out there." For a while, at least, we still had control of it here, as far as scheduling and flight operations were concerned. It was really just parked out there.

PETERSON: That's right, yes, because whenever they flew, Joe and AJ would go out to fly it, but Fitz and Tom McMurtry, they would be a double crew. They would always coordinate that. There was no problem in that.

MORRIS: Thos guys got along well. They were all extremely experienced pilots. They all knew each other for years before this thing came up, so there was really no friction without the flight crews. As a matter of fact, one of them said, "We just want you to tell us what you want to do."

WRIGHT: They just want to fly.

MORRIS: They just want to fly, and make sure the thing goes right. That was their job.

PETERSON: I've got a picture at home that Fitz and McMurtry and Vic Horton gave me of the separation, "Thanks for giving us a good airplane." I got the same thing from Joe Algranti. Got them in my little trophy room at home.

MORRIS: Yes, one of the things, I guess, that really pleased me, when they flew the 747 through here on the last flight, taking the Orbiter out to California, they had taken the radio-controlled model that we flew, taken it out of the museum, put it on that airplane, and it made the same flight as the 747 made.

PETERSON: Did you get that picture I sent you?

WRIGHT: Yes.

PETERSON: It was a year ago.

MORRIS: Yes, you gave me one. Yes, I've got it.

WRIGHT: You've given millions of people some excitement, every time they looked up and saw it, people would stop.

ROSS-NAZZAL: Yes, it's such a unique sight.

WRIGHT: Pull off the side of the road.

PETERSON: What was amazing to me that day, and this is a different story. I think I told you over the phone, that day, my wife and I had been out and watched it fly around and come in. Went home and guy that lives out at this little airport where I do said, "Let's fly over and look at the Orbiter." I said, "No, they won't let us in." We took off, and he's a guy that's good with words. He called air traffic control and says, "Hey, I want to go to Ellington," and they said, "Okay, you're cleared straight in." We landed, and some NASA car came up. This guy says, "Hey, this is the Shuttle manager," and he says, "Okay, I'll take you over there," and that's where they took the picture.

WRIGHT: Great story.

PETERSON: I just thought, well, the good luck is still following us.

MORRIS: Yes, that day, I was in a car driving out to see it, and I never got there. Traffic was just jammed up for miles. I guess I spent an hour or more just getting turned around and getting back home again.

ROSS-NAZZAL: It was tough. It was packed. Everybody wanted to see it.

MORRIS: Yes, it was amazingly packed, I thought.

PETERSON: Our friendship has continued ever since because after we got over that program, Owen got a bunch of guys together and we built an airplane.

ROSS-NAZZAL: Did you, really?

MORRIS: Yes.

ROSS-NAZZAL: What kind of plane?

MORRIS: It was a Burt Rutan Long-EZ. I don't know whether you're familiar with that or not, but it was a very advanced, aerodynamic design for a home builder, and used fiberglass construction rather than wood or metal and fabric. It was a very sweet-flying airplane, and then I managed to tear it up.

WRIGHT: Could you conclude the session today by telling us what you think about the SCA coming home? It's going to be here for people to be able to walk through it.

PETERSON: I think it's going to make a great display. It's going to be very, very eye-catching, especially with that mock-up on top of it. I think the biggest thing of interest to me is how are they going to get it out here.

MORRIS: Yes, I want to see that happen. That's going to be something. The other thing that I was very happy about was that they got 905, the original one here, and not the 747 they bought later.

WRIGHT: I think the other tail number's 911.

PETERSON: Is it?

MORRIS: Yes, okay, I didn't know what the other tail number was.

WRIGHT: It's an easy one to remember.

PETERSON: Nine-one-one.

MORRIS: Nine-eleven.

PETERSON: But you know where it is now?

WRIGHT: No, but we'll check and we'll find out for you. Is there anything else that you two think you can add?

MORRIS: Not particularly. You'll probably want to edit 60 percent, but that's fine.

ROSS-NAZZAL: No, it's great information and we certainly appreciate you coming in today.

MORRIS: It's no problem.

PETERSON: It's nice being in here.

[End of interview]