

**NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
COMMERCIAL CREW & CARGO PROGRAM OFFICE
ORAL HISTORY TRANSCRIPT**

JOSEPH W. CUZZUPOLI
INTERVIEWED BY REBECCA HACKLER
PANAMA CITY, FLORIDA – 29 APRIL 2013

[This oral history with Joseph W. Cuzzupoli was conducted via telephone from Houston, Texas to Panama City, Florida.]

HACKLER: Today is April 29, 2013. This telephone interview for the NASA Commercial Crew & Cargo Program Office History Project is being conducted with Joe Cuzzupoli, who is in Panama City, Florida. The interviewer is Rebecca Hackler, assisted by Rebecca Wright, who are in Houston, Texas, at the Johnson Space Center History Office.

We'd like to thank you very much for taking the time to speak with us this morning for this project, and we'd like to begin by asking you to briefly share your background before you joined Rocketplane Kistler [RpK], and what inspired you to join that commercial venture.

CUZZUPOLI: Thank you very much. I spent a considerable amount of time, 50 years, in the aerospace business. I started off with General Dynamics [Corporation] down in San Diego [California], working up in Vandenberg [Air Force Base], launching the Atlas [rocket] program. Then President John [F.] Kennedy wanted to go to the Moon. North American Aviation [Inc.] wanted a contract, and included a bunch of us that had some missile experience. We started the campaign to go to the Moon down in Downey, California. During that period of time, I was an engineer and advanced up in the ranks, up to Vice President and Program Manager of the Space Shuttle Program.

I'd been on the Apollo Program prior. I was in charge of the Apollo 8 mission, which was to go around the Moon during a Christmas time period [1968], and the astronaut was Frank [F.] Borman, who was the commander. Of course, that launch operation took place in Cocoa Beach, Florida, where I spent two years to get the vehicle ready for the launch. Then the Shuttle Program came by, and North American [Rockwell Corporation]—at that time, Rockwell International [Corporation]—won the contract and we were to build a completely reusable space vehicle. I advanced up in the process, where I ended up as the Vice President and Program Manager of the Space Shuttle Orbiter. I retired in '81, went into real estate business, and still consulted in the aerospace world.

I was called upon by Admiral [Richard H. "Dick"] Truly and George [W. S.] Abbey back in the latter part of 1986, where I was asked to rebuild an ammonia perchlorate plant in Cedar City, Utah. The original plant blew up in Henderson, Nevada, and this brought both the military and NASA down to one source for a supplier. They didn't like that, so they wanted a plant to be rebuilt out of Nevada and into wide-open spaces of Utah. I had the project to do that, and we did it in eight months, had the plant operating.

The company that had the plant out there was called American Pacific [Corporation]. In turn, American Pacific offered me a job I could not refuse. I then built two more plants for them. One was a sodium azide, which is used in gas for air bags. Then another project called Halotron, which was used to replace Halon.

After that, it was about 1996. I was called by George [E.] Mueller, who was the head of NASA during the Apollo Program. He worked out of Washington, DC. George Mueller was in Seattle, Washington, and he started up a program to build a fully reusable vehicle that was to be

primarily used to put satellites into orbit. He was after a low-cost, simple design of a booster, a second stage, and a capsule.

At that time, there was Dan [Daniel C.] Brandenstein, who was his assistant. With Dan's experience, the four or five times he flew on the Space Shuttle, he was the Chief Executive [Officer]. I joined the company. They negotiated a deal with American Pacific, and I ended up in Seattle working on this program called Kistler Aerospace. I was then made the Vice President and Program Manager, and we started to build this new reusable vehicle.

At that time, we needed \$750 million to design and build it. By the way, our first launch was in a place called Woomera, which is located far out there in the backwoods of Australia. We started off the program, and we got funded somewhat on and off for a period of two years. The funds became very, very hard to raise, and we had our difficulties of maintaining schedule.

Dick [Richard H.] Kohrs, who was a member of NASA for many years, and I put together a straw man proposal about using the Kistler Aerospace [K-1 vehicle] to resupply the [International] Space Station. We went down into Houston and made a presentation, and submitted this proposal. At that time, NASA had no funds to do that particular program. Then we received a study from [NASA] Marshall Space [Flight] Center [Huntsville, Alabama], somewhere around \$50 or \$60 million, to continue studying the possibility of using Kistler Aerospace to resupply the Space Station [Alternate Access to Space Station Program].

We started that program, and we were moving down the road. Again, funds became very hard to get. We had completed most of the design, up to a CDR [Critical Design Review] position, which was about 80 percent of our drawings done. We had fabricated a tremendous amount of parts that were located all over the United States. Our suppliers were not getting paid,

so therefore a lot of this hardware was stopped from being fabricated and put into storage. Of course, they were waiting for the funds to come in.

We never received any more funds. Kistler entered into a bankruptcy situation, and came out of bankruptcy and again promised that they were going to raise money. Again, the funds did not come in. We'd completed the NASA study, and that was the end of the history of Kistler Aerospace.

Now Kistler sold off the design to a fellow named George [D.] French. George French was building, at that time in Oklahoma City [Oklahoma], a modified Learjet [aircraft], and this was called a rocketplane [Rocketplane Limited, Inc.]. The purpose of this rocketplane was to put humans into a suborbital plane, where they would enjoy the opportunity of seeing the good Earth from way up above there, and then come back and land. George, I guess, thought that he could both programs together, raise some money, and complete both programs. He funded the program with very little money. He hired about four or five engineers from the old Kistler organization, and they went to Oklahoma City.

At that time, NASA was now getting a little bit more interested in using some kind of private industry to come in and build a vehicle to resupply the ISS [International Space Station]. An RFP [Request for Proposal] came out by NASA, and it was called the COTS [Commercial Orbital Transportation Services] program. These four or five individuals who were familiar with the Kistler design working down there at Oklahoma prepared a proposal. They asked me to come down—I was not employed by Kistler anymore—as a consultant to review their proposal. I did that, looked over the proposal very carefully and suggested they make some changes. Those changes were made.

Rocketplane Kistler won the contract. A contract was awarded to a company called SpaceX [Space Exploration Technologies Corp.] as well, located in Los Angeles [California]. Both companies had a study, plus a development in building, with a Space Act Agreement. They had to meet certain milestones over a period of time. If they met those milestones, they got paid. There were both technical and financial milestones.

I was asked later on by Randy [Randolph H.] Brinkley, who ended up being employed by George French to run this program. Randy asked me to come on down to help them manage the engineers and get the program together. The Rocketplane people were more familiar with aircraft but not familiar with space hardware. As a consultant, I went down there and worked hand-in-hand with these five or six engineers. We had not much funds, but we did restart most of the contractors who were working on Kistler during the Kistler days.

At that point in time, George French ran into funds. We tried to raise \$750 million with a sort of hedge fund deal from Jeffries [Quarterdeck LLC, investment bank] of New York [City, New York]. We made proposals, we made speeches across the country, to see if we could raise the funds. Those funds were not raised. Therefore, at that point in time, George French shut the program down and eventually went into bankruptcy. That was the end of Rocketplane, the end of Kistler. It was a great idea. It was a lot of money spent, and the lessons learned tell you that you shouldn't start a program unless you have the money. That's how that all ended up.

During that period of time in the COTS program, we were working with the Johnson Space Center, which had the assignment to make that happen. Alan [J.] Lindenmoyer had an organization of about four or five NASA folks that watched over the program and made sure that we were trying to meet the milestones. One of them was Bruce [A.] Manners, who was an excellent individual to help Rocketplane Kistler get through the process. Both technically and

with advice, he did a great job. There were other people there as well, but I would say generally I would point him out as the main guy that we interfaced with at that point in time.

As the story unfolds from here, the COTS program continued with a company like SpaceX. NASA in turn had the funds, even though we did not have the funds. Let me explain that. The commercial private industry was supposed to come up with at least some of the funds to build this vehicle. It was a partnership arrangement between Rocketplane Kistler and NASA. NASA came up with their money, but Kistler could not come up with theirs.

They took the funds and they awarded another contract after it was sent out for competitive bid. It was given to Orbital Sciences [Corporation], who in turn is doing the job right now. There are two suppliers of cargo in the COTS program. One is SpaceX and the other is Orbital Sciences. I think I've answered some of the questions you might be interested in. I'm wide open to any questions.

HACKLER: Thank you. That's certainly a good overview. We'd like to ask you to go back to the beginning. Can you overview for us the concept of the K-1 vehicle and what sort of value proposition it brought to the market? Maybe why NASA was interested in developing that technology.

CUZZUPOLI: I think it was both NASA and the military. They needed a cheaper way of putting satellites into orbit. The K-1, which was the Kistler plane, had a very large payload area so they could carry three or four satellites up there at one time, for the price of maybe one or one and a half. The military and NASA were very interested in doing that. Also, along that period of time, carrying large pounds, like 7,500 pounds of cargo to the Space Station at one given time, would

be cheaper than all of the Progresses [cargo transfer vehicles] that the Russians were building as well.

NASA was more interested in getting their vehicle up there. To fly the Space Shuttle back and forth to resupply the Space Station cost a tremendous amount of money per flight. This was NASA's interest, to reduce cost and have a vehicle that can go up there for only \$10 to \$15 million a launch and still keep the ISS going. Their interest was primarily to reduce the cost, because the Shuttle cost so much just to bring cargo up there. Now, the Shuttle had to be used to take the crew up. Kistler could not carry the crew up and back, but it could carry a lot of cargo.

HACKLER: We understand that Kistler received funding from NASA under the Alternate Access to Space Station Program that was headed out of Marshall, and then of course later the COTS program. You mentioned the military was also interested in this vehicle. Did those companies receive any funding from the military as well?

CUZZUPOLI: No, they did not receive any. They got a lot of visits and inquiries, but I think in the area of the satellite world, [Space Systems] Loral [LLC] with the military was interested. There were some other aerospace companies that built satellites who had contracts with the military and were also interested in Kistler. Again, it drove the cost down, and it was fully reusable. You can take a satellite up there, come down with a booster and the cargo carrying area, and just reuse it over and over again.

Schedule was very important to the Air Force. They don't like to sit around and order a vehicle, and 24 months later get the vehicle. Here's a chance for them to get a vehicle ready to go in two or three weeks. They can get one up in the air, deploy their satellites, come back

down, get refurbished a little bit, and go back up again. That was the uniqueness of helping the military from a schedule standpoint, to have a vehicle that was always ready to go. But it was never to be used for any weapons.

HACKLER: We understand also that this vehicle was based on some of the concepts that were originally developed for the Shuttle. Can you talk a little bit more about how the vehicles were related?

CUZZUPOLI: Sure. George Mueller, who is the father of the Space Shuttle Program, had a concept that both the booster and the cargo part of the vehicle, the orbiter for example, be completely reusable. The booster, after shut down, would glide and come right back to [NASA] Kennedy Space Center [Florida] and land after it separated from the orbiter. The orbiter would do its thing around the Earth, then it would come back and land at Kennedy Space Center. It was completely reusable.

When the initial Phase B and studies went out to Lockheed and McDonnell Douglas, North American Aviation, and Northrop Grumman [Corporation], they were working on this reusable concept. Some of the costs were very, very high. Under the leadership of NASA, Max [Maxime A.] Faget came up with another idea of a hybrid, to cut the costs. To have some of the vehicle Shuttle reusable, i.e., the solid rocket boosters, as well as the orbiter. The [external] tank was not to be reusable, so they threw away the tank, but they had the other two major pieces reusable.

George Mueller always believed that was the cheapest and best way of providing proper transportation back and forth to LEO [low-Earth orbit]. He continued his thoughts on to Kistler,

which is the same thing. Except Kistler didn't have the power of engines, they were coming back in with parachutes and air bags. The first stage would glide back in and land back at Kennedy Space Center with parachutes and air bags. The orbiter would do its thing up in space, deploy its payload, come back with parachutes and air bags.

That is the connection to the Shuttle. It was supposed to be, but wasn't, completely reusable. What Kistler had in mind—Kistler was definitely going to be much more, in the hardware world, reusable than the Space Shuttle.

HACKLER: It sounds like you were able to use a lot of that experience you gained in the Shuttle Program as a consultant. You mentioned your involvement in putting together their proposal. What sort of changes did you make? Can you talk a little bit more about your role as a consultant in helping make this a valuable proposition?

CUZZUPOLI: Certainly. When I was called to consult down at Oklahoma City on Rocketplane, I think the organization that was being proposed did not show enough space experience. I knew that NASA would not be familiar with some of the characters that were being called out, and their backgrounds, so we made some adjustments there. They were also going to have their program office located in Oklahoma City. I thought it would be much smarter to either locate it in Houston or locate it somewhere near the Cape [Canaveral, Florida]. We made some adjustments there.

As far as the technical end of it, the four or five fellows that worked on it did an excellent job. Then the schedule was adjusted to fit more to the NASA needs than it was laid out by the

initial proposal that they submitted. We made changes to the schedule as well. Those are the ones I recall. There were other minor ones, but nothing great.

HACKLER: Were you involved in any of the negotiations or due diligence visits when NASA representatives came to visit the company?

CUZZUPOLI: The answer is yes.

HACKLER: Can you talk about your role in that capacity, please?

CUZZUPOLI: Sure. I was asked to come down for the due diligence review NASA attended. I sat in the audience and was asked questions that the four or five could not answer. I don't remember those questions, but it was in support of Rocketplane and I think it was called by George French. Again, to have more people who were familiar with the NASA folks, to be there for the review.

The review was mostly handled by Randy Brinkley, the due diligence. And Will [Wilbur C.] Trafton was also there, who also was with NASA. Brinkley and Trafton were both NASA Headquarters [Washington, DC], as well as Houston folks that NASA were familiar with. It was more bringing people together that knew each other, and therefore had the same ideas and same goals, and communicated extremely well with each other. The Rocketplane people had never worked for NASA before.

HACKLER: You were sort of a liaison?

CUZZUPOLI: Yes, I think so.

HACKLER: When you were helping answer questions, were those primarily technical, or more financial, business-side questions?

CUZZUPOLI: There were both. I really think the NASA folks out of Houston were very familiar with the technical end of it. A lot of questions were financial. “When are you going to get the money? How are you going to get the money? How much do you need?” All of those arrangements.

The Space Act Agreement that was agreed to had some technical milestones in it, but also had some finance milestones. I think NASA came in with the idea, “Hey, these guys can go off and build this vehicle and make it work.” There was no doubt that we had a heck of a team at Kistler that were very, very talented and knew their systems in and out. It was more a question about, “Who’s going to get the money? Where is it going to come from? How much are you going to get?” Those were questions dealt by the finance people that were there.

HACKLER: Throughout the length of Rocketplane Kistler’s Space Act Agreement with NASA, did you also have any involvement in trying to help them raise the necessary financing?

CUZZUPOLI: The answer is yes. I attended some of the meetings that they would have. They called it a “road show,” where they went around and spoke to a bunch of investors, hedge fund people. I attended those sessions. I gave them top-level briefings about what this vehicle looked like, what the technical capability was, what the schedule would be, what customers are talking

to us about. I gave them an overview. Then any level of detail was given by the engineers. The finance stuff was briefed primarily by Randy Brinkley and George French. I also want to add that NASA also cooperated and attended some of those meetings, to show their seriousness about this program. Of course it still didn't make it.

HACKLER: From your perspective, why do you think that in the end, they weren't able to secure the financing? We understand that they had a very solid technical plan, but investors still weren't attracted to that as a business opportunity.

CUZZUPOLI: I really think that unless you come in with firm contracts to show the financial world that you have contracts, not just promises—that was one of the problems. You show them that you have this contract of \$1.9 billion to resupply the Space Station, like Orbital has right now, or the \$1.6 billion that SpaceX has—no doubt you would've gotten the money. We did not have that kind of arrangement. We did not have a service contract at that point in time. We only had a Space Act Agreement with certain milestones, and certain values to the milestones.

My view of all of this, and I'm not the financial guy, was that unless you have the hard contracts—you're going to launch these 10 satellites with Teledesic [LLC] or some company, and here's your schedule, here's how much money you're going to make, here's how much money it's going to cost—unless you show stuff like that, it is hard to raise money.

HACKLER: As you talked about, this was not a contract with NASA but rather a Space Act Agreement. Can you talk about how the company's relationship with NASA was different under this new type of arrangement, as opposed to a traditional contract?

CUZZUPOLI: The Space Act Agreement was set up, to NASA's view, to buy services. They wanted this vehicle to be built right, so they put some milestones in there. They did not oversee the program. They came into monthly meetings, but they did not have any oversight, commitments, or any insight in this Space Act Agreement. We just had to have proof to show that we met that milestone, and they would come and verify the proof.

It had no FARs, Federal Acquisition Regulations, on it. Where you had to have an affirmative action program, or had to have a certain accounting ability—all those things that cost money were not in the Space Act Agreement. Without the FARs, the Space Act Agreement was just a buy-in of the certain milestones.

But believe me, there was no problem if NASA wanted to see something, come in. The door was wide open with Kistler. They had a relationship with NASA, that if NASA requested to look at something, even though it's not a part of the Space Act Agreement, Kistler would still open the door and let them come in to see what they had.

To answer your question, that's the difference between a Space Act Agreement and a regular contract. With a regular contract, you've got FARs, you've got insight, you've got oversight by NASA. You perform with a lot of visibility, and a lot of cost. Cost goes up of course.

HACKLER: Can you talk about your role in some of the milestone verification meetings?

CUZZUPOLI: Yes. Some of the milestones that I was asked to look at, such as Preliminary Design Review, Critical Design Review, Test Readiness Review, were milestones that fit the

normal NASA sort of procedure. We tailored it to the way NASA has looked at all of these programs in the past, where we go through step-by-step, or phase-by-phase, so they can see how the progress is made, and that they're familiar with it.

We sort of copied that process. We would sit down with NASA and discuss that milestone, and we would say, "Here's a certain milestone, and by the way, we think that milestone is worth x amount of million dollars." As that money came in, it had to be partnered with the money that we and the commercial world were raising, so that we had money to make progress in an orderly fashion.

These milestones were very important. We negotiated these numbers as well with NASA. They'd say, "Well, that milestone is really not worth \$2 million, it's worth only \$1 million." But we knew the total amount of money we had to work with. The schedule was put together, and the milestones were put in to meet that schedule. They were incrementally put into the program. As we reached those milestones, NASA would come and review how we did on that milestone. Then as we completed it, they would either sign a paper that says, "We're going to send you a check," or sign a paper saying, "You didn't do a good job, you better work on it a little bit more."

HACKLER: The last question I have before I turn it over to Rebecca Wright to see if she has anything else—what happened to that technology since the company was dissolved? Is that design still out there?

CUZZUPOLI: That's a sore spot for me, because that was a lot of effort, and a lot of time by these engineers, and by the investors. It's money down the drain. Some of the design has been used

by other programs from the concepts. The design is still out there, it's still in the technical library. It could be located anywhere. Last time I heard, it was in Oklahoma. French was trying to sell it to other companies, but I don't think that was successful. The hardware was put in warehouses, and some of the hardware was actually destroyed.

HACKLER: That's a shame.

CUZZUPOLI: The electronics were probably used again or put in storage. I believe some of the parachutes that we had were used for some testing on some of the other programs. Generally speaking, all that was history and gone. The concept of a completely reusable vehicle will come back over and over again. I think the Air Force has talked about building a completely reusable vehicle. We don't know enough about the Air Force, what they're doing on their black programs. You just never know with them.

The concept is an excellent concept. The one thing I'll have to say—reusable, in the short term, costs more money than a non-reusable. In the long run, the reusable definitely saves a lot of money compared to a non-reusable. The problem is, it costs more money up front to get that reusability. Therefore, a lot of companies and a lot of folks do not like to put that money up front. They'd rather spend it over periods of time.

HACKLER: Is that design still considered proprietary information, or is that in a publicly accessible library?

CUZZUPOLI: I just don't know that answer.

HACKLER: Okay. Thank you very much.

WRIGHT: Hey, Joe. This is Rebecca Wright. I just have one question, and this is more of an opinion or a reflection. You worked for almost 50 years in pretty much the traditional scheme of NASA. When you were on the contractor side, you had a great deal of oversight from NASA in a different way than you did with this COTS program. Could you share with us what your thoughts are of what the pros and cons are of what the COTS program was trying to achieve by stepping back and letting these commercial companies take the lead?

CUZZUPOLI: That's a great question. I didn't fully use the commercial approach in the way I operated and ran the program. I was sort of a hybrid type, where I used a lot of NASA ways of doing business. I kept the communications line wide open, compared to commercial, which doesn't do that. I found that NASA has more experience, more talent, than I had in our program. You had to use that talent. It was a partnership arrangement, and that talent was there. I'd be very stupid if I didn't use it. It was free to me.

Now, where you get in trouble is where it goes too far. Unless you control that relationship with NASA, it could eat you up alive. I found that you keep an open door, use the people wherever you can use them. I used to call Bruce Manners up and say, "Hey, I need some help here," and he would say, "I'll get you the help." Then we would set up the guidelines of how NASA was going to help us.

Now, saying that, you've got these other companies that don't like that idea. They want it just, "Look, when I get done with this particular hardware, you can come in and take a look at

it.” I don’t think that is a good idea, because you’re going to make mistakes. NASA tends to bring the proper check and balance to a design. Unless you have them inside the process, they can’t do a check and balance. You have them come in at the last minute and take a look at something, they’re not really seeing what’s going on. I don’t advocate the commercial world where, “Here it is, take it or leave it.” I think that is very dangerous, I think that they’re making a terrible mistake. I think the relationship and the experience that NASA has is going to waste if you do it that way.

I don’t know much more about SpaceX or Orbital Sciences, how they’re working with NASA. I have been at Orbital Sciences. Some of their meetings with NASA, I really don’t see a change there. I see a close net, and I think it’s working out, and surely they’re taking advantage of NASA’s talent. I guess I would say that I like that whole operation. I think NASA is doing more of that now.

I think on this commercial crew, they better not work like they did on the cargo. They’d better have some insights as they go. They ought to have some people within NASA living with the contractor, just like we had in the past. Now will that slow down the operation? The answer is yes, but it’s going to give them the visibility they need to know about how that vehicle is being designed, how it’s being built. I’m sure that’s the way it’s going to end up, and I’m sure there’s going to be some FARs put into the system where they have to follow the regulations. I hope I answered your question.

WRIGHT: You did, thank you. Like I said, looking back over how many years—not just the years you spent, but the incidents and events that you were involved with, I know gives you a

good overview about what's best to do for the future. Are you continuing to work as a consultant on any of this type of work, Joe?

CUZZUPOLI: Yes, I am. First of all, I'm on two committees with NASA. One is the Stafford Committee. I've been on that committee for 17 years. That's working with the Russians, and we're due to go to Russia in July on the Space Station. And I'm on the Human Exploration Committee, which is part of the NAC [NASA Advisory Council]. To answer your question, yes I am, and I can't talk about it.

WRIGHT: That's okay. I appreciate the fact that you're still using all that good experience, we're glad to hear that. Is there anything else that you want to add, or anything that you can think of that we should know about your involvement, or RPK's experience with the COTS program?

CUZZUPOLI: I would say that the COTS program has been a very successful program, and that the whole concept of how this thing was going to be put together and housed and played out is a great idea. I think using commercial vehicles—even though I don't like the word commercial, I think there's still a government and private industry hardware and design. I think this is a partnership that is working real well. I think the NASA folks that are located at Johnson Space Center have done a tremendous job.

I think it's set the stage for the crew. I think the Commercial Crew Program is a necessity. It's got to happen, because relying on the [Russian] Soyuz is a single string failure waiting to happen. We have to have something to bring our crews up and back, and to rely on just the Russians is not the way to go. The COTS program is one stepping stone for commercial

crew, and then from commercial crew to deep space exploration. This is all going to work out. I think a lot of people are learning through this whole process, and so far, so good.

WRIGHT: Thank you so much.

HACKLER: Yes, thank you. We talked to Bruce Manners and he had very good things to say about working with you and being able to learn from your experience, and we also really appreciate hearing your perspective on this whole program.

CUZZUPOLI: All right. I hope I answered some questions.

[End of interview]