Friday, January 11, 2002

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enjoyed meeting you.

Robert A. Jones
Oral History Interview
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Robert Jones
June 25, 2001

Erik M. Conway,
interviewer

Conway: I'm Erik Conway, and I'm talking to Robert Jones in my office at the Langley Research Center. We're going to talk today about hypersonic technologies a little bit, Copper Canyon, and the National Aerospace Program.

The first question I always ask—are you a Mr. Jones or Doctor?

Jones: Mister.

Conway: First question I always ask is a biographical one. Could you tell me who you are, where you were born, raised, educated, that sort of thing?

Jones: I was born in Erie, Pennsylvania. I moved here when I was twenty-one, and this was the twenty-eighth place I had lived. I've lived here ever since. I've lived in fourteen or fifteen different states. We moved all over the country, so it's hard to say where I was raised.

Conway: Yes, I can understand that.

Jones: West Coast, the Midwest, the South, the North, Kentucky, Tennessee, Virginia, Georgia, all over.

Conway: Where did you do college work?

Jones: I graduated from what was North Carolina State College with a degree, bachelor of mechanic engineering. I went to two colleges at the same time, because they wouldn't let me take the courses I wanted to take. So I went to another college at night school and graduated from there first. I graduated from King's Business College, prior to graduating from North Carolina State. After State, I went to work as an engineer for Allis Chalmers, and I was drafted. I had a wife and a little baby.
Conway: Drafted for Korea?

Jones: No, Korea ended right—I was in ROTC in college. The Korean War ended just as I graduated. I was an air force ROTC. They only would take people as officers in the air force who would go to flight school, which I couldn't do; my eyes weren't good enough. Besides you had to sign up longer, and I didn't want to stay any longer. So I got a job in private industry, but I had an obligatory service. Everybody did that was my age; they had to serve eight years in the military, two years in active duty and six years in reserves.

So I was drafted after my child was born, and they gave me a choice of accepting a commission in the air force and coming to this place, which I'd never heard of. It was NACA in those days. But the pay was three times that of an enlisted man, and you got a better housing allowance, so I accepted the commission and came here. That was in '55.

In '57, the year I got out, that spring Sputnik went around and Eisenhower announced that NACA was going to be the center of NASA, so I decided to stay on. I went to school for six or seven years while I was here, through the programs they had here. I attended George Washington, William and Mary, VPI, I guess that's it, studying math and physics.

Conway: Which divisions did you work here in?

Jones: I guess when I first came here it was called the Compressibility Research Division under John Becker. That changed its name, and I'm not sure what the name was. It might have been Supersonic Aerodynamics Division, I'm not sure. John Becker was still head of it. Then it became the High-Speed Aerodynamics Division, which eventually I became head of. Then it was the National Aerospace Plane Program.

Conway: Your commission as an officer lasted two years and then you were free.

Jones: Six years.

Conway: Well, six years for reserves.

Jones: Yes.
Conway: About what time did the idea of scram jets come up?

Jones: In the early sixties. I don't know the year, but there was a hypersonic research engine project, a Langley project, and we were to build a test engine that was going to fly on the X-15. The last flight of the X-15 carried a what I call a boilerplate engine, a steel dummy engine. Had no cooling, no controls, no combustion on a little pylon at the back. That was the X-15, only one of them was left at that time, had been modified with a swept-wing and an oblator, a charring obturator. During that flight it went fast enough and high enough that the obturator charred and the char swept off and impinged on the pylon that held the engine.

When it came down to land, the chase plane saw the pylon was notched out, and they were afraid to land it like that, so they dropped it one of the dry lake beds, and that was the end of the flight program. But two engines were built, an engine to test propulsion, which was finally tested at Plumbrook, and an engine to test the regenerative, the cooling system, which was tested here at Langley at what was then called the seven-foot thermal structures tunnel. I don't know what it's called today.

Conway: That's not the same as the scram jet test facility that's built in the late sixties, is that right?

Jones: That's right. The scram jet test facility, that I know of, was built while I was head of the Hypersonic Propulsion Branch.

Conway: When is that?

Jones: Between '75 and '78 or '79. It became operational probably in '78, or something like that. I don't remember exactly.

Conway: How did it differ from other hypersonic facilities?

Jones: It was specifically designed to test an air-frame integrated scram jet. The HRE was a pod-mounted scram-jet and could never provide any net thrust. It's not possible with that pod-mounted-type engine. That was well known before the HRE was ever flown. So Langley started working on an airframe-integrated one that used the whole airframe as part of the engine. It didn't have pylons and pods on it. The scram jet test facility was specifically built to test that
airframe-integrated engine. Does that answer your question?

Conway: Yes, I think so.

Jones: If you want, I can tell you a little better how.

Conway: Okay, go ahead.

Jones: It simulated a Mach 7 flight. It had a Mach 7 total temperature, but the flow in the nozzle inlet was Mach 6. The way the engine would be integrated on the airframe, the front part of the airframe, the shockwave compressed the air at Mach 7 flight and gave you Mach 6 at the inlet, but it had Mach 7 total [unclear]. It simulated the compression of the forebody. It did not simulate the after body, just had the scram jet module itself, which was mounted in there and it was mounted on a thrust balance that could measure the thrust of the engine.

Conway: I interviewed Roy Harris a couple of weeks ago. He can't remember dates, he has a very bad memory for dates, but he told me in the first few years you guys were able to demonstrate a positive thrust in the scram jet facility. Can you remember when?

Jones: Yes. I would say it was in late '79 or early '80 that we first demonstrated what I called net positive thrust that would be sufficient to propel a large vehicle, an airframe-integrated scram jet.

Conway: By using the word "net," you mean you're subtracting something. What are you subtracting from?

Jones: The drag.

Conway: I was wondering if it had something to do with the fact that you have to feed these things with a pretty substantial amount of energy to start them, but that's a function of the facility, isn't it?

Jones: Yes. The scram-jet will provide no thrust at all until you get above Mach 4. You have to have the compression that goes along with that speed.
Conway: One of the things Roy told me is that during most of the seventies nobody was interested in hypersonics, and there was a point at which Headquarters was trying to close down hypersonics, and Harris had to negotiate a deal to keep things going. So did things change after your successful test? Did more people become interested?

Jones: When I took over the Hypersonic Propulsion Branch, that was in the summer of '75, I think. Harry, I forget his name, he was head of the Propulsion Research Division in NASA Headquarters. He proposed to eliminate the Hypersonic Propulsion Program, move the money and people to Lewis. This was the only propulsion program at Langley, the scram jet program, and he proposed to eliminate hypersonic propulsion altogether and move the people and the money to Lewis, which is the propulsion center. Why I can't think of his last name, I don't know.

So I came in as branch head under that onus, the branch head, about $200,000-a-year funding, which is not enough to even buy gases to test over there, if they had a facility they could test in. In NASA's normal way of doing things, they appointed committees to review and make recommendation. The first six months or so of my job as branch head was making presentation to these committees and selling them on the idea of what we were doing, keeping the program alive. It grew from $200,000 to $5 million research funds, when I left the branch in 1980.

Conway: So, definitely interest came around.

Jones: Yes.

Conway: You must have also been able to sell the scram jet facility itself, as I think you told me it was operational, or became operational around '78.

Jones: I think so. It was started at the time I took over the branch. It was under construction. It had been a facility for a very high Mach-number test. It had a 100-foot vacuum sphere, and this facility was converted to make it into a scram jet test facility.

Conway: So it was originally a facility probably built for Apollo?

Jones: Yes, built in the early days.
Conway: The early NASA days.

Jones: That's right, early NASA days.

Conway: I spent a lot of my time working in the NACA stuff, so that's not recent to me. I'll have to find out what it used to be.

Jones: I don't remember the name, but it was a Mach--I don't know. Gene Love, who was my first boss here, was the guy behind it, that sold it and got it built, and it did become operational.

Conway: Then also shortly after the facility was finished, you were able to achieve the net positive thrust.

Jones: Yes. The engine that was tested in there had been designed when I took over the branch, and it was under construction, but the contractor was building it and nothing was happening. It just wasn't getting built for good reasons.

Conway: For good reasons?

Jones: Yes. The contractor over in Norfolk, we'd go--I was a section head before, and I was involved in scram jets as a section head. I was involved in the airframe integration of them, and the design of vehicles that could fly with scram jets. John Becker, every week we'd have our meeting why it's not being worked on, and the branch head would say, you know, he talks to the people in engineering and all, and nothing's being done. Well, I was having models built. Becker had signed at highest priority in our division, but nothing was being done.

I was getting models made over there all the time and they had no priority. The way I did it, I got in my car and drove over there and talked to people. I'd go over there and I'd see that scram jet copper thing sitting there. I'd ask what is it and they'd tell me what it is, and they'd work on mine and it just sat there. Nobody ever went and looked.

So as soon as I became branch head, that all changed immediately. The first thing I ever did, I got a hold of the section head who was head of that facility and building the engine, and I said, "You get in your car and you get over there, and you find that engine and you talk to the people that are supposed to be building it." I said, "They put priority on what they hear."
What happens is, engineering gets their priorities set from the center directors and on down, you know, but what really counts is a guy going over there and talking to the people. It got built very quickly after I became branch head.

Conway: They'll put a priority on whoever shows up and has a face-to-face with them.

Jones: That's right. Well, you not only show up; you show an interest in it. You talked about the problems they're having machining it and everything with them and you show them that you're really interested in this thing. You tell them they're doing a good job, and they like that, so they work on it.

Conway: Deckplate management.

Jones: That's always been the way it was. I mean, even in the Langley machine shop when I first came here, you want to get something built, you went over there and talked to the machinist.

Conway: That's good. That's a good story. You're right, that is a perfectly good reason for nothing happening.

Jones: Yes.

Conway: Oh, heavens. So lots of people get interested by 1980 in the scram jet achievement. What happens then? Once you've achieved the net positive thrust, and eventually you must put out a publication, although I haven't found it.

Jones: It would be classified.

I'm going to back up, if I can.

Conway: Sure.

Jones: Back in the seventies, probably '72 or '73, Tony DuPont had a big interest in scram jets. I don't know if you know Tony DuPont.

Conway: I haven't met him, no.
Jones: At the time he owned DuPont Aerospace, but he was the employee at AirResearch Manufacturing Company, who built the HRE, the hypersonic research engine. He was the company's program manager for that program. He came to Langley many times trying to sell airplanes and scram jet and flight tests. Before I was branch head and I was working on engine airframe integration with scram jets, he had a proposal he brought, tried to sell at Langley, for an airplane that could take off on a runway and fly up to Mach 15 with scram jets, but it had the big pod-mounted scram jets under it.

We spent a lot of time critiquing the engine and the engine airframe integration to show that we had to—he'd go to NASA Headquarters and we'd have to answer, because he was pretty well known, a wealthy family. We'd have to answer all his questions and things. It just finally came out to us saying, "You can't get positive thrust with those big pod-mounted scram jet engines."

Also his airplane was very wishful. The structure was extremely light. He's a smart man, a lot of innovative concepts and all, but we had a group that we had a branch with two section heads, no branch head. I did the engine airframe integration and Steve Kirkum did the airframe design and airframe structure. We knew that this structure was going to be much heavier. In addition to not providing thrust, the structure was going to be a lot heavier than what he was designing.

Tony got a little upset with Langley, I guess, over the years. Frank is a very frankly-spoken person. So he came back, after I was branch head, to see me about airframe-integrated scram jets. We spent a couple of days talking about airframe-integrated scram jets and what they were doing and how they worked.

He went back and he designed another flight-test vehicle, came up with a single-stage-to-orbit vehicle that was going to use scram jet power and fly into orbit. And he went to DARPA, the Defense Advanced Research Project Agency, and made a unsolicited proposal there. Bob Williams liked the idea. He was the DARPA program manager for Copper Canyon. He started the Copper Canyon Program, funded DuPont to do a conceptual design of a vehicle.

When he had the conceptual design finished, he put together, Bob Williams did, a committee to review it. Christmas Eve in 1983 in Washington, and it snowed that evening, and there we were until dark-thirty with the snow falling, so I couldn't get home.

But at any rate, he had several people meet there to review Tony DuPont's concept. The question he asked was interesting, and one I'd been asked, he said, "Can you prove it can't be done? Can you prove you cannot fly a single-stage orbit with this device?" It's pretty hard to
prove something can't be done.

We couldn't prove it couldn't be done, so he decided he was going to launch the first phase of the Copper Canyon Program. At that time, he treated it as what was popularly known as a black program. Are you familiar with the black programs?

Conway: Yes.

Jones: It wasn't legally a black program, but he and DARPA, they handled a lot of black programs, and it was handled by him as a black program, which meant even with a top-secret clearance you don't get to know what's going on. You have to be briefed and have to have a purpose to know, and you get to know only what you need to know to do what you're doing, that kind of a program. So it wasn't very well known, but I knew about it. But I couldn't tell anybody else at Langley anything about it.

Come '84, the center director had been after me to go spend a year in NASA Headquarters. Everybody, when they get into the Senior Executive Service, has to spend a year in NASA Headquarters, which I did not want to do at all. He kept pressuring me to go and pressuring me to go, and he told me I had to go, and I said, "Well, how about if I were to go to DARPA?" I said, "The reason I don't want to go, there's a program going on in DARPA, a black program that I know about, that involves hypersonics, and I think Langley would be a part of it."

So he told me, no, I had to go. I said, "Well, how about if I went to DARPA instead?"

He said, "Okay, but you have to get your way in there." NASA couldn't send somebody there.

So I went up there and met with the people and talked to them, and they decided they'd like to have me helping with the Copper Canyon Program. So I went there in the spring of '84, I guess it was, and worked with Bob Williams on the Copper Canyon Program for a year or so, until it was decided to become a national program. We sold it to the Congress. We sold it to the White House Science Committee. Reagan had an impressive White House Science Committee, with people like Edward Teller, father of the hydrogen bomb, and Dave Packard. I don't remember any of the others, but they're impressive people. We sold it to them. We sold it to the science advisor, who wasn't impressive at all.

Conway: He was one of Edward Teller's favorite students.

Jones: Who?
Conway: Keyworth.

Jones: Didn't impress me at all. But at any rate, Edward Teller impressed me. After he was briefed on it, he came back over to DARPA and he spent two days, two full days with us at DARPA, one full day reviewing the whole program, then he spent a day with me. He was a very interesting man.

He was interested in it for a weapons system that he had in mind, which was also highly classified. Went by another code name. For his weapons system it needed to be unmanned, for example. He was trying to get the size down by taking the man out and making it smaller. He's a good scientist, but he wasn't a good engineer. He couldn't understand why you couldn't just scale it down to a little bitty vehicle. I spent a whole day with him, telling him, you know, how things scale and why you can't scale it down any smaller than what we had it. But that was interesting.

But Reagan, the day of the Challenger explosion, January 28th, 1986, was going to make it a national program, and on his State of the Union Address bring it up. The Challenger exploded that morning, and the State of the Union Address was postponed until February 4th. But on February 4th he came out, he called it the Orient Express, what this country needed. He'd been to China and it took him a long time to get there or something, and what this country needed was an Orient Express to get us to China kind of an airplane. With his support, it was launched as a national program.

Before that time, there were five contributors. The army, the Strategic Defense Initiative, DARPA, the air force, and NASA were contributing money. I actually went over and briefed the head of OAST on the program. They didn't know what it was. They didn't know what I was working on over there. So I had briefing authority, and I briefed Ray Colladay, head of OAST. When it became a national program, it was decided by someone that it would be NASA and the Air Force. The other three agencies would not be in there. It'd be a joint Air Force-NASA program.

To get a big piece of the pie, Ray Colladay did something I thought was terrible. He took all the hypersonic money, which came under OAST, and said he was putting it into the NASP, National Aerospace Plane, pot to try to make the funding bigger, so we'd have a bigger role in the program. That didn't give us any bigger role in the program and it ruined the hypersonic program.

So when the program got started, the Air Force--I can't think who the general head of the Air Force Systems Command was, I forgot his name. Four-star. He came out.

Well, back up. In the early days we had General Applied Science Laboratory, GASL, in
New York, a little small company, which all the facilities were owned by Langley. My branch ran it and funded it when I was a branch head. They contracted to them to build and test the get-off-the-ground engine. ScramJet can't provide any thrust until the speed gets close to Mach 4.

Conway: Right, so you needed a some other engine of some sort.

Jones: Needed some other engine to get off the ground. That was a part of Tony DuPont's proposal. So we built and tested this engine, which I can't think of his name, the general had been told by the people at Wright-Pat could never produce any net thrust.

So I went to GASL, when the general went, and DuPont was there and Bob Williams was there, and they build a wood and plexiglass and boilerplate version of this little engine, a little engine.

They had these big old scales, old-fashioned scales with a thing you stand on, and they hooked a bunch of weights on it. They mounted the engine on a plate that just held the weight, but it could flex any little force. They hung all these weights, set these weights on the back of the scale, and they fired it up. When they turned on the hydrogen, it went blam, and big flames came out the rear, weights came up off of the scale, and the general, he was standing there watching it behind the safety shield and all. He says, "Damn, it can produce thrust." They like a lot of noise and thunder and flame. I mean, that's how Air Force people are. I guess I have to be careful; you're recording this.

But it showed you could produce net thrust at zero speed with this concept, which could integrate with a scram jet. So he went back and he put a pretty high priority on it, and he appointed a brigadier general, Ken Staten. I remember his name. Ken Staten. It seems like the general's name was Frank somebody, but I've forgotten his name. Ken Staten was a brigadier general and he was going to run the program office at Wright-Pat. His job, NASA wanted an equal partner person to manage what was called the technology maturation.

When the program went public and was going to go to the president, John Einsminger [phonetic], who was head of the Tactical Technology Office, the office that Bob Williams and I worked in at DARPA. DARPA's a little bitty outfit with an amazing way to work, which has now been castrated by Clinton. It doesn't work at all now.

But at any rate, Einsminger didn't know anything about this. He was a radar stealth airplane man. He said, "I don't know anything about it, but that's not enough money," what Williams was proposing.

He wanted to know, and I said, "Well, the technology's not here yet. We need a
technology development program."

Williams objected to calling it technology development, because that said it had to be developed, so he called it technology maturation. So it became a technology maturation program.

The discussion with Ray Colladay, NASA would have the technology maturation program, and the Air Force would have the engine and airframe programs, to design the airframe, design and build the engine.

So they asked me to take over as head of the technology maturation program. They had to pick somebody, and NASA had to have the same pecking order in the Air Force as a brigadier general, and I did. I think that's why I got the job, but also because I was very familiar with it. So I became the head of the technology maturation program. They set up a little office at Langley to do that, and I reported not to Pete Peterson, the Langley director, I reported to Ray Colladay, the head of OAST. They wanted an office in Washington, but I refused to go, so the Air Force gave us a building over on the other side. We call it the halfway house. My office was over there, and I had a deputy from Lewis, a very good man. Another man from Lewis, and a couple from Dryden that came out there. There was a concern in the agency that me being from Langley, all the money would go to Langley.

Conway: Would go to Langley, of course.

Jones: Yes. So they were there to help out. That's how the program got started, but because he had taken all the hypersonic money and put it into the NASP program, it bled the three centers, OAST centers—Langley, Lewis, and Ames—of their hypersonic programs. That upset people a lot, all the way up to the center directors were upset by it.

So we laid out the first technology maturation program, and supposedly I had a letter from Ray Colladay said I had technical control of the program and control of the money in the program. Neither were true, I believed it then.

I was ordered that each center had to have an equal share of the technology and maturation money. Each center decided each research division had to have an equal share. Each research division decided each branch had to have an equal share. Because of the money having been taken away wrongly in the first place, probably. So I was flat outright directed to fund things that had nothing whatever to do with Aerospace Plane Program and could not in any way help it. There wasn't that much money there.

When they asked me to take that job, I went to Ray Colladay and told him that I had a real problem, because it had been sold to the Congress and the president as a four years to first
flight with a cost of $3 billion. I said, "Ray, it's going to cost 15 billion and it's going to take
twenty years, fifteen or twenty years, and the program isn't going the right way. You don't want
to build that thing and fly to orbit the first flight. You want to test a scram jet somewhere else in
a cheaper way and have several go, no-go, points in the program."

Conway: The program flew as a $3 billion four-year program to first flight.

Ray said not to worry that was the way all new programs were sold.

Conway: Who sold it that way? It obviously wasn't you.

Jones: Yes, I helped sell the program, there's no doubt about that, but not the dollars and the
years and the timing. That was Bob Williams' doing. I sold the program to OAST, to Ray
Colladay, I helped sell it. I met with many congressmen and their committees and helped sell the
program. The reason I helped to sell the program was because we had tried working with
DuPont...

DuPont said they could be developed and made practical, would have 3 times the
strength-to-weight ratio and 4 times the stiffness-to-weight ratio of the best existing
materials.

I had a little group, when I was in the division office, it had the ability to design and cost
and do the performance tests on the vehicles. So we put together what I thought was the most
optimum thing you could ever make to go with scram jet to get a single-stage orbit, a cone with
engines all the way around, a cone with a great big nozzle for big afterbody. Lightest weight thing
we could get, and it couldn't get to orbit. We didn't even worry about getting it off. We started it
at Mach 2, but it still could never get into orbit. Made me pretty well convinced that you're not
going to get to orbit with a scram jet power alone, and not single stage.

But when I went to work with DARPA, I was able to brief a couple of people. We
needed people with certain expertise, and so I had briefing authority to brief people within
NASA who had certain expertise in structures, Williams and I. He's a helicopter man, came up
through the helicopter program. So I briefed a man at Langley, who was in my division, Bob
Jackson [phonetic], who's a good structures man into the program. He had been a part of the
program designing a thing that couldn't make it to orbit, so he knew the problem.

He came and said he had an idea for the new material, two of them. They were classified
secret and they were called AMMC-1 and AMMC-2. That stands for advanced metal matrix
composite. He told me how they might be made. That made sense to me. They had three times
the strength-to-weight ratio of the finest super alloy we had, metal alloys, and four times the
stiffness-to-weight ratio. Part of this vehicle is defined by strength-to-weight, portions of it are
defined by stiffness-to-weight, portions are divided by minimum gauge. The AMMC-2 had
several times the minimal gauge of AMMC-1.

When I got the idea of these materials and those strength-to-weight ratios, I was involved
in designing transport planes, too, and you look at that. If you could get something three times the structural strength-to-weight and four times the stiffness-to-weight, you can carry the twice payload, or fly twice as far as a subsonic transport. It sounded to me like a good idea. Whether the Copper Canyon Program went or not, if we could get that material developed, and make it work, that would be a good idea. To me this was NASA's job, NASA's job to take the high-risk, high-priority, high-potential payoff programs that industry can't afford to take on.

So while at DARPA, I funded, through Langley, money for developing advanced metal matrix composites and they did it, because when you're at DARPA, you're a little czar. You do have control of the money. When you say you want it to go on this, and you review it, they spend on that or they don't get it. It's just that simple.

So by the time I had come back to Langley, the people here at Langley, the structures people at Langley had built a one-inch-square, there were a lot of problems in making this stuff. They'd built a one-inch-square sample of AMMC-1, thin plate, and they built a one-foot-square sample of AMMC-2. That looked pretty good to me. But when I came back here and became head of the technology and maturation problem, I didn't have control of the money, like the letter said. Structures director stopped funding those two materials, which caused me great pain. There was nothing I could do about it, though. I mean, I had to give them their fair share. I was ordered that you have to give them the money.

So I got out of the program. I went back to my job as division chief, and they got somebody else to do that. Several years later, Roy Harris, who was director of aeronautics, wanted to reorganize the center, and he wanted me to go back and take that job back over again, which changed. The technology maturation, through negotiations with Headquarters, had also gone out to Wright-Pat, but the NASA part of the funds went through that office. The hypersonic research money, they had a new start in hypersonic research that came about because of this NASP program went through that office.

As director of the office, I was going to be a technical consultant to program manager at Wright-Pat. General Starnes [phonetic] had gone. I went back over there for a year, and see if I could change things, and I couldn't. I had forty-two years of federal service, I was fifty-seven years old. I wasn't going to be the manager of a program that was doomed to failure before it got off the ground. I retired.

Conway: So you retired.

Jones: And that's why. Not many people know that, but I retired because I was the head of an
office I was ashamed to be, and there was nowhere else to go, really. So I went out. It cost me a million dollars over the next ten years to retire then. That's a big price to pay to get out of something. But I sat down and I figured, well, I can live. I have a nice income. I have other things I can do, and I just was not going to manage that program, so I retired.

Conway: So NASP was doomed to failure when it started.

Jones: No.

Conway: Not NASP?

Jones: No.

Conway: What am I not getting?

Jones: I firmly believe if the program had developed those materials—and it could be done—you could find ways to join them and build a structure out of it, you could go single-stage orbit. I believe that if the engine concept, the scram jet wouldn't work, but it took something to get off the ground, and it took something at the very high-speed end, at the very high Mach numbers, above Mach numbers 18 or so to work. I felt like there was a chance those technologies could be made to work. If the structures, if either one of those materials came along, it was doable. Even if it didn't work, if the materials came along, what it would do for airplanes was just fantastic. It would put Airbus out of business, which is a pet peeve of mine, Airbus.

Conway: That's a pet peeve of everyone around here.

Jones: Except the people that can do something about it.

Conway: I suppose that's true.

Jones: We give our technology to NATO. We have a special organization in NASA set up after the Second World War, to do nothing but transfer aeronautical technology to NATO.

Conway: Yes. AGARD [phonetic].
Jones: AGARD. Well, as a division branch head, the French would never tell us anything they did, so I wouldn't tell the French anything we're going, until the center director ordered me to. Okay. I was opposed to that, because you can see where it's going. Then Airbus is supported by the federal four governments over there contributed money supporting it, giving it 2 percent interest loans. I mean, what do you expect?

Conway: I was just thinking of something else. Of course, Airbus can FOIA everything from here anyway. Airbus uses Freedom of Information Act to request, get stuff from here, too.

Jones: They don't have to go that way; they've got AGARD.

Conway: They have AGARD, but they do it anyway.

Jones: Yes, they can just come over here and talk to people like me. I was directed to cooperate with them and tell them what they wanted to know. I was opposed to it, because I felt like it was going to do our aviation—you know, at that time, agriculture was number one and aviation was number two in our exports. We've had an export imbalance all the life that I've kept up with politics. Of course, it's worse now than it ever was. Sooner or later it's going to come grab us by the seat of the pants, too.

Conway: Yes, eventually it will.

Jones: Yes.

Conway: You were interested in the program for the materials.

Jones: That's one reason.

Conway: You also thought the DuPont engine would work out, or could be made to work?

Jones: I thought there was a chance. Not the DuPont engine, no. There's a lot of things wrong with his. He had an airplane engine integrated system, had a new tank made of titanium. It had an inlet that could close off in front of the scram jet, that he called a chevron inlet. It had an inlet
like, which there's no way to build a chevron inlet and make it open and close. So that concept, which DARPA ruled, Bob Williams ruled, that that's what we're going to study, all the airframe contractors were going to use that as their baseline, that couldn't work.

But the composite engine cycle, an engine that runs in several different cycles, so that it could integrate with a scram jet might be made to work. It would take a lot of work, and it could be built and tested on the ground in facilities that we had, up to Mach numbers like 7, on the ground. So those two things, the materials and the engine, were what it took to make this aerospace plane work. I wasn't sure that the engine could be made to work, but it was worth a try, and if the materials could be made to work, it was a huge benefit. But research stopped in 1987, '88, or somewhere along there.

Conway: They started focusing in on construction?

Jones: No. I'm saying Langley was the one doing the carbon carbon. Langley wanted to spend all their structures money on carbon carbon.

Conway: Oh, I see.

Jones: Which in '72 was the Shuttle leading edge, carbon carbon. Bob Williams had a $50-million program to develop carbon carbon for the little engines, turbo ramjets that go in the cruise missiles. Because of the carbon, you'd get a higher temperature, you'd get a longer range. So he was developing carbon carbon, 50 million, while Langley wanted a $5 million program in carbon carbon. It was just a drop in the bucket. All the major aerospace companies were working on carbon carbon with their IRAD funds. Huge program going, and what Langley could do was pretty small, but it was a popular thing to work on.

The way the air force operated, General Staten, I went out and showed him what needed to be done and what needed to worked on, trying to get money to go where it needed to go. I figured maybe he could get the money to go where it needed to go. He told me, he said, "Bob, I'm not a technical person. I'm a fighter pilot. I'm a go-fly fighter pilot. I was given this job, I was told to take the technical direction from Bob Williams at DARPA and I'm to set up the management office and manage the program." So that's what he did.

Conway: So that's what he did.
Jones: Yes, and he's a good man, I liked him. He was probably a good solider. Last time I saw him, he had three stars.

Conway: Interesting. So Langley wanted to work on carbon carbon, even though by '77 or '78 it was already pretty well developed.

Jones: Oh, no. I mean, it was in use. It was on the Shuttle leading edge, but they were trying to still work on carbon carbon that would have other features and be better. But at any rate, when the program was split and the technology maturation program came up and I was put in charge of it, Langley, the director of the structures, just stopped worked on carbon carbon. Excuse me, he worked on carbon carbon and stopped working on AMMC-1 and 2. I don't know if it could ever work or not. He probably knows more about materials and structures than I did. It sounded good to me, and if he could work with carbon carbon, everybody in the country working on it and other countries, as well. Nobody was working on this.

Conway: Might as well try something that's different.

Jones: Right. It had a real high payoff, much higher than carbon carbon, if it works.

Conway: Who did the idea for the advanced metal matrix composites come from again?

Jones: It came to me from Bob Jackson. It came from--gosh sakes, the materials guy here in the material directive, gave Bob Jackson the idea and he was briefed in the program and he told me. Oh gosh.

Conway: I can ask.

Jones: Nice guy, I can't think of his name. He's probably retired long ago, but he's as old as I am. It's terrible. This is the first time I've been at Langley, probably, in seven or eight years. Oh, that's not true, I came out to watch the X-43 movie, and they didn't show the movie because--

Conway: Because it blew up.

Jones: Well, not the X-43, but the--
Conway: I know. The booster.

Jones: Yes, Pegasus.

Conway: Yes. The fins came off it.

Jones: So I was out here a couple of months ago. I brought four grandchildren, four grandsons and my wife and my children, and we got out here and it was canceled.

Conway: It was canceled. That's too bad. But I guess when you retired, you really did retire to fishing.

Jones: What?

Conway: You really did retire.

Jones: I retired.

Conway: Yes, you didn't continue as a consultant.

Jones: Oh, yes.

Conway: Oh, you still do that sort of thing?

Jones: Not with NASA.

Conway: Not with NASA?

Jones: No. I mean, if you want to consult with NASA, I'm working for them. That's another round, but you know, Langley had a lot of contractors who worked in the offices just like NASA engineers.

Conway: Right.
Jones: We had a habit of NASA engineers retiring and going to work for the contractors and making twice what they were making at NASA and getting their NASA retirement, too. I wasn't in favor of that. When I was division chief, I didn't allow it in my division. I had several people that had worked out agreements, they were going to retire and come back as a contractor, I said, "No, I'm not going to give a contract to them." I said, "You retire, and if they want to submit a contract, we'll evaluate it fairly, and if we get it fine, but I'm not going to agree before you retire."

[Begin Tape 1, Side B]

Jones: Not the right thing to do, so I wouldn't do that. Nor would I work at Langley once I retired, because if I want to work in that program, why retire? Okay. So I worked as a consultant for several years with several companies--Rockwell, McDonnell Douglas Astronautics. McDonnell Douglas had a different concept for single-stage orbits that they bid on for the air force, and I was part of writing their proposal.

Conway: Was it DCX?

Jones: Yes. Yes, took off vertically, landed vertically. I went out there and worked with them, helped work on the technical part of their proposals. They won the first-phase contract, and I worked with them during the first-phase contracts. Spent months out there in California. The wife and I, we moved out there and rented a long-term apartment working with them. Then I helped put together their RFP for the second phase, which they also won. That was interesting, because I had to evaluate a lot of proposals on the NASA side, and that's who they liked to have, so I worked as a consultant for several years.

Conway: I want to go back to the end of Copper Canyon, the beginning of NASP. I wrote down a note, there was a meeting down here at Langley late in 1985, in November and December, that some White House people attended. It was a briefing on Copper Canyon and on other possible concepts, other than the DuPont concept, at least as far as I can tell from the White House documents. Do you remember anything about that meeting?

Jones: I'm not sure which meeting you're referring to. When I went to DARPA, SDIO was in office in DARPA, Strategic Defense Initiative. Reagan pulled it out, put General Abramson,
three-star general who had worked at NASA, in charge of that program. After I came back in the fall of '85, we did brief General Abramson on the program, although he wasn't funding it, he wanted to know about it. He was interested in it, as part of the Star Wars scenario or something, perhaps. I remember that briefing, because he's an interesting person. I had briefed him before—not him, whoever was head of the thing before he was.

I did brief him at DARPA, but he wanted to hear from NASA. I was representing DARPA. Here I was NASA, and I could be more on the NASA side of things than I could in DARPA.

Conway: Interesting.

Jones: We briefed a lot of people. I don't know. I kept a record, I kept a diary. I never did until I went there, and I have a diary that shows every day from then until I retired who I talked with, what was done, what came out of it, because I met so many congressmen. It's interesting the way DARPA works. Bob Williams is just fantastic. They had a congressman, Bill something, a Democrat from Florida, his district--

Conway: Bill Nelson?

Jones: Bill Nelson. His district is Kennedy. Kennedy's in his district. He was one of the people we were going to brief, and I was involved in the briefing, the engine part of it. Well, DARPA doesn't have any people there. They have all these program managers and one or two secretaries and that's it, and the travel office. So each program manager contracts with one of the Washington bandits to get his work done, to do his charts and help with everything. Bob Williams had a contractor, he'd come in every afternoon at six o'clock. We worked until six and seven o'clock every night, because Bob Williams didn't start until ten in the morning, because of the West Coast, which is where most of the contracts are. So he came in late and worked late. I came in early and worked late.

But every night when we'd leave, he'd come in--George, I forget the name of the company. His first name was George. I forgot his name. He'd take all the stuff we had, take it home, and the next morning it would all be typed up and made pretty charts and stuff, and bring it back to us.

At any rate, he knew his boss lived in McLean, in a house next door to Bill Nelson. He had a ten or eleven-year-old boy, Bill Nelson had a ten or eleven-year-old boy, so we went over
there and we met Bill Nelson's son, long before we were going to go talk to Bill Nelson. I mean, you don't know how we worked it up there. NASA doesn't work that way.

Conway: No, no, I don't think so.

Jones: We had a history done on everybody we briefed in Congress. This guy, the contractor, would go out and come in and bring us a briefing on this guy, what he's voted for, what he hadn't voted for, what his background is. We knew all about him. So we knew all about Bill Nelson before we went over there. He was sort of a liberal Democrat kind of person, which isn't always in favor of defense and things like this. But we met his son, got his son interested in airplanes and the National Aerospace Plane Program and all, before we ever went to see Bill Nelson.

Conway: That's just sneaky. That's good.

Jones: Well, I knew a lot about him. But he's the most interesting congressman that I met. When we briefed him, I had a model of the engine explaining how it would work. It's a multi-cycle engine, works on different cycles, low speed, mid speed, high speed, very high-speed cycles, all combined in one engine. I explained and he came down and sat on the floor of his carpet, right in front of the model, and got all excited about it. He said, "Gee, why are you briefing me? This ought to go to the president." This was before it ever got to Reagan.

But just to give you an idea of how it works, same thing, George Brown was another one. I was interested, and he was head of the office in the representatives, that had the NASA budget under, Office of Technology and--

Conway: At the White House? It's the Office of Science and Technology.

Jones: No. Congress. It was the professional committee.

Conway: OTA was the non-congressional committee that worked for them. In the House it's the Committee on Science and Technology and the Senate, yes.

Jones: George Brown had just become chairman of that committee. He's from California. We did the same thing, we had people come in and brief us all about George Brown, and he had a degree, a Ph.D. in physics. I thought, here's a guy who'll understand what we'll talking about. He
wasn't an engineer or a physicist or a scientist; he was a politician.

Conway: Ph.D. by mail order.

Jones: So I was disappointed a little bit. I thought, because nobody else that you meet up there in these kind of things knows anything about what you're talking about much. They're smart people, but they don't know about how airplanes are built and how engines work and things like that, and how structures work. But I thought maybe he could understand it.

Conway: No such luck.

Jones: No.

Conway: This is 1985 that you're selling Copper Canyon.

Jones: No. '84. '84 and '85. I came back to Langley in September of '85. Then it was known that Reagan was going to push it as a national program. The center director didn't believe it, but we knew at DARPA. I mean, DARPA has information channels and connections that NASA just would never get. NASA worked so different, it's just unbelievable. When they submitted the budget request that went in in September of '85, or whenever that time frame, for the budget for '86, to put the Aerospace Plane Program in the budget, they asked DARPA to write up a description of the technology and what was needed and how much money. Guess who did it? I did it.

They wanted a ten-page article, I wrote four pages, because I said everything I wanted to say in four pages. I went over and briefed the Congress and gave it to them. I saw what NASA wrote. They asked NASA to do it, too. Now, when NASA does it, they don't get somebody like me, you know, it's done up at OAST, and Ray Colladay and a hundred people work on it. It was exactly ten pages. It didn't say anything. What it says was, "We've done all these great things in the past, and if you want us to do this, we can do this, too." I heard about it, why can't NASA—you're from NASA, why doesn't NASA send us something like this? Interesting. But at NASA you don't talk to congressmen unless you--

Conway: Unless you work at Headquarters.
Jones: Not just work in Headquarters, you have to be one of the associate administrators.

Conway: Interesting. Let's see. Good grief, I think you've gotten all of the questions that I had worked out for you. Then I guess you didn't have too much relations, too much interaction with the White House Office of Science and Technology Policy?

Jones: That's the White House Science Advisory?

Conway: Yes.

Jones: Yes. Keyworth wasn't there. He was there when it started, but he had gone and had another young man that we met and talked with on several occasions. When Beggs left the agency, Beggs got into some kind of a lawsuit problem and left the agency, and he took Beggs' place as the acting administrator of NASA for a while. He came over from the White House Science thing to do that.

Conway: Victor Reis?

Jones: No, Vic Reis was, he was head of SAIC, Science and Information Company. Vic Reis chaired a wizard's committee that we had set up at DARPA to review this program. We called it the wizard's committee and Vic Reis chaired it. I'd ever forgotten about that. But he was science information and applications thing. They are one of the Beltway Bandits, but they have a fairly large office. It wasn't Vic Reis.

Conway: So somebody else in George Keyworth's office was your contact?

Jones: No, he was the White House science advisor after Keyworth.

Conway: I don't have a name for that person. I'll have to look.

Jones: He was fairly young, blond hair, thin person. Smart.

Conway: Keyworth was doing publicity for hypersonic space flight during 1985, just before he left, because he left in early '86.
Jones: Maybe it was '86 that this guy took over. I don't remember the dates. But we did go to Keyworth's office, but we went to his office, too, and then I went and briefed him as a NASA administrator also.

Conway: Keyworth seems to have been quite an enthusiast for the technology.

Jones: Yes. So was his follower, but he wasn't there long. He wasn't the present science advisor for just a little while and then he went over to NASA, where he went after that, because he was just acting.

Conway: I didn't think Reagan had had a science advisor after Keyworth left. I thought he had dissolved the office, but I guess I'm wrong about that.

Jones: Well, maybe he did, but this guy was in that office.

Conway: Yes. I just wish we could come up with his name.

Jones: I know I'm right.

Conway: I'm sure you're right.

Jones: I know I'm right, because I went to his office many times, several times, not many times.

Conway: Yes. I just wish I could come up with his name, but I can't come up with it either.

Jones: I could. I mean, it will be in my diary, in my notes.

Conway: It's a diary you should put in a museum one of these days.

Jones: No, because I wrote what I thought about everything, too, and as you've already found out, people don't want to know what I think about things. I've told you more than I've told anybody in the agency about Copper Canyon and my feelings and why I retired. I've not told anybody in this agency why I retired, except that I wanted to do something different.
Conway: The NASP problem that you mentioned actually was mentioned to me as being a problem for supersonics, too, by putting all the money, by pulling all of the money out of the other disparate hypersonics areas when--

Jones: They didn't pull it out of supersonic areas, though.

Conway: No, no, but they did the same thing with HSR, they pulled all the supersonics money together into the HSR Program, so that when the HSR Program was killed, they lost all supersonic funding.

Jones: I didn't even know that was killed. They lost all supersonic funding?

Conway: Yes. They were having to start over, essentially.

Jones: How did they keep the unitary plan wind tunnel running, for example? That used to be in my division.

Conway: That's the facility's budget, so the contractors can come from outside and pay NASA to use the facility.

Jones: Yes, they pay some of it. They pay the electric bill, which is nothing.

Conway: Yes.

Jones: I mean, $700 an hour when I was division chief, but that's nothing compared to the cost to run the facility. They just paid the electric bill.

Conway: But what I mean is, it eliminated all the research funding.

Jones: The research is what ran the facility. You don't understand NASA. Yes, we have a facility budget. It's not enough to run the facilities. The research budget was taxed. When I was division chief, the tax on my research program was 50 percent to go to run the facilities. Most of the money to run the facilities here at Langley when I was a division chief and until I retired,
came right out of the research program, not out of the facility money, because it just is not enough. You can't even upgrade the facilities, you can't buy instrumentation or anything else out of that money. You can't even do preliminary design with the money in the facilities budget. Langley is facilities-heavy, and that's why I asked the question, how did they run the facility. Because things have changed. I retired December 29th of 1989 and stayed on as a reappointed [furloughed] until April of '90. That's eleven years ago. So I don't know how they do it now, but I sure knew how they did it then.

Conway: It probably hasn't changed much since.

Jones: I doubt it.

Conway: Why change the management structure if you don't have to.

Jones: Oh, they've changed the management structure all around.

Conway: I mean the financial management.

Jones: But they probably haven't changed the financial. It's probably gotten worse, if anything.

Conway: Yes, probably, given the way the budgets have gone. I have run out of questions for you. Were you expecting me to talk about something that I didn't?

Jones: Let me ask you a question.

Conway: Okay.

Jones: What is it that you want to do in writing this history of the Aerospace Plane Program?

Conway: I'm not really going to deal with NASP itself. What I'm doing, because I'm working on the supersonic transport stuff, is I'm going to show how, I'm going to use the development of--how do I want to put it? I'm going to use the construction of the National Aerospace Plane Program into '83 and '84 and '85, that gets NASP going, in order then to take the idea that some of
the technology is coming from NASP could be commercialized, because that's the theory in which Headquarters and Langley and the White House decide to release contract studies of a potential hypersonic commercial transport. Anywhere, in fact, anywhere from the supersonic range Mach 2 up to Mach 25.

So I'm going to write probably eight or ten or twelve pages on how NASP gets going as a program, and then start dealing with the contract studies that become the High-Speed Research Program. The contract studies only last two or three years, and as I'm sure you know they quickly come from Mach 25 back down to Mach 2.4 again, when they figure out the infrastructure costs of fuels, other than jet A, and so forth. That gets the HSR Program going.

So what I was looking for was background on how Copper Canyon comes about and its basic technologies, and that's why I wanted to talk to you, since, as you say, it was a black program and therefore there is no published record. I called DARPA's historian, too, just on a whim.

Jones: They have a historian?

Conway: Yes. He's a part-timer, he's obviously a retiree. He said I think he works Tuesday and Thursday afternoons.

Jones: Are you a Langley employee or are you a contractor?

Conway: I'm a contractor, yes. Yes. So I owe them chapters every three months, is basically how it works. In between I spend my time--

Jones: My reason for asking was to see if there was something else that might help you do whatever you were going to do, and since you were interested in how they got started and all, the only other thing I can tell you are the people who were involved when it first got started. It was Tony DuPont, Bob Williams, myself, Fred Billig [phonetic].

Conway: Fred Billig. That's a new name.

Jones: Dr. Billig. He used to be a professor at Johns Hopkins Applied Physics Laboratory. They had a scram jet program there. It had gone the way of a lot of programs. He was working on submarines at the time, but he came back in and he was involved in this. When I was at
DARPA and we were going around running the program as a black program, Tony DuPont, Bob Williams, Fred Billig and myself, and the guy who had the money budget. He now is head of the X-43 Program here. Vince Rausch was a major, and he was a business administrator, graduate, and he did money things. He never went with us, he'd sent somebody else until he found out that it might become a national program, he was political, Vince, then he went. So we would go around to the different contractors every week. I mean, we'd leave on Monday morning and we'd get back on Friday night. We'd leave again the next Monday morning, you're back on Friday night.

Conway: Good grief.

Jones: We just traveled all the time. But Vince Rausch went with us. Funny history with that guy. He was so anti-NASA in the air force. He would give presentations for DARPA to the Air Force Science Advisory Committee. He would get up and just ridicule NASA. I'd take him aside and tell him, "Look, that's not"--he had a configuration with scram jets and podded engines he said was a NASA configuration. I said, "That's not a NASA configuration." I said, "Don't show that," but he would, and he'd ridicule NASA. Then he retired and came over to NASA to work, and now he heads that office.

When they wanted to hire him at NASA Headquarters, they wrote up a description and they asked me to review it. I said, "You won't get Vince Rausch with that description."

They said, "Why?"

I said, "Because he's not an engineer. He has a degree in business."

So they recalled the thing and wrote a new one. They wanted Vince Rausch. He's salutes nicely, he knows which way the wind blowing, and he's a good soldier, he goes that direction.

Conway: But he's not a technical person.

Jones: Not a technical person, has no technical judgment whatever, in my opinion. It's a shame, because that's what you have all over NASA now.

Conway: Yes.

Jones: I'm probably the last person to make a division chief who had any technical ability, or I
used to think I did anyway. Now, it's all bureaucratic finesse and you have to be articulate. It's all of knowing which way the wind blows.

Conway: Yes, I've heard that. It's unfortunate.

Jones: That's why I don't go back. I know a few people here and they say, "Bob, you don't want to come back. You wouldn't like it."

Conway: Some of the older hanger-ons, huh?

Jones: Yes.

Conway: That's too bad.

Jones: You told me you had another meeting, didn't you?

Conway: Yes, I have one at 2:45.

[End of interview]