ORAL HISTORY: William Jones

About William Jones

William Jones was born and raised in St. Louis and drafted into the Air Force during the Korean War, where he served as an electronics technician receiving his introduction into radar. He graduated from Washington University with a bachelors in electrical engineering in 1959 and a masters in 1961. He later received an MBA in 1967 from George Washington University. In 1960, while still writing his master's thesis, Jones went to work for Westinghouse Baltimore, where he stayed for his entire Westinghouse career. He started work on radar in Advanced Program Engineering and later Development Engineering, working on projects such as AWACS, Overland Radar Technology, and phased array. He later became Electronic Warfare General Manager, and in late 1990 was tapped to head up parts of the commercial division. After Jones retired from Westinghouse he worked for the Federal Highway Administration, retiring after starting the Intellidrive program.

In this interview, Jones discusses various aspects of his career at Westinghouse. The development and implementation of projects such as AWACS – and the difficulties involved – are discussed. He also talks about changes in technology over his career, like the switch from analog to digital and the vast changes in memory development. Jones also discusses work within the industry and management, touching upon the changes he saw in Westinghouse which eventually led him to retirement. Work with the IEEE and radar conferences is also talked about, along with the general work environment at Westinghouse Baltimore.

About the Interview

ROBERT DWIGHT: An Interview Conducted by Sheldon Hochheiser, IEEE History Center, July 21, 2009.

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Interview

Interview: William Jones

Interviewer: Sheldon Hochheiser

Date: 22 July 2009

Location: National Electronics Museum, Baltimore MD

Background and Education

Hochheiser:

It's the 22nd of July, 2009. I am Sheldon Hochheiser, from the IEEE History Center, and I am here at the National Electronics Museum in Maryland interviewing Bill Jones about his career at Westinghouse in Baltimore. Good afternoon.

Jones:

Good afternoon.

Hochheiser:

If we could just start with a bit of background, where were you born and raised?

Jones:

I was born in St. Louis, Missouri, raised in Missouri, went to high school there. During the Korean War, I got drafted. So I went in the Air Force, spent four years in the Air Force. As an electronics technician, that is where I got introduced into radar, by the way. When I got out of the Air Force I went back to school at Washington University in St. Louis, got my B.S. there in '59 and my Masters in Electrical Engineering in '61. I also received an MBA from George Washington U in Washington DC in 1967.

Hochheiser:

Was your B.S. also in electrical engineering?

Jones:

Yes. Yes, it was in electrical engineering.

Hochheiser:

So is that what you went to Washington U intending to do?

Jones:

Yes. I graduated from high school in 1950. Of course the Korean War broke out about two weeks after I graduated, which was fortuitous, but I went one year in college at a little college in Missouri called Central College. Then I was majoring in chemical engineering. And then I had to go to work to pay my way, and that is when the draft board got me. So when I was in the Air Force, as I said, I was in electronics. They put me into radar gunnery on B-29s and B-36s and B-45s and so I got interested in radar, and so when I got out of the Air Force I went into electrical engineering, and it worked out, it wasn't easy, because in the Air Force, they were teaching electronics, but they taught electronics very differently. They taught current going the opposite direction. I don't know if you were aware of that but in the old electronics schools in the Air Force, everything was absolutely reversed. And I had a heck of a time, my first year in college, because we were taking all the basic electrical engineering stuff, and I darn near failed, because I couldn't quite make that switch. But I managed to get through.

Hochheiser:

Now, were you involved in professional activities in college, I guess with the AIEE, or the IRE?

Jones:

I think it was the IRE. Yes, I was in the student chapter in college. That was my first introduction into the professional societies and I was also a member of Tau Beta Pi, the engineering honorary society. I graduated very high up in my class, number two in the university in fact, and got the Westinghouse fellowship for graduate school, which was very fortuitous, because I was going on the GI Bill, which did not pay very much, as you are aware, and working at the same time, but I got the Westinghouse fellowship and that is how I got introduced to Westinghouse. I didn't know anything about Westinghouse until they came back when I was in graduate school to interview me. So that was my introduction to Westinghouse.

Starting at Westinghouse

Hochheiser:

Now, so you went directly from finishing your Master's to work for Westinghouse?

Jones:

Yes, I finished up all my course work and was working on my thesis, had done all the research, and was just writing, and I came to work in September of 1960. I finished my thesis, submitted it I think in October or November. In fact, I got married in 1960 as well, in the summer of '60, and my wife spent our honeymoon typing my thesis. It was in the days before word processors, and it was typed on vellum and you may recall, you were only allowed to have one erasure per page.

Hochheiser:

I am just old enough that my own thesis was typed that way. In fact, I had to hire a professional typist.

Jones:

Well, I couldn't afford anything, so my wife typed it up. So I didn't get my degree until January of '61, but I started at Westinghouse in September.

Hochheiser:

What was your thesis on?

Jones:

I think it was on a Matrix Analysis of Voltage Regulating Systems. We had a professor that I worked under who was very into matrices and matrix analysis, that mathematical

approach. So he got me into that. I didn't realize that it would be interesting to me again, four to five years later, but anyway, it was a pretty non-descript thesis in my view.

Hochheiser:

[Laughter] What was your first assignment at Westinghouse?

Jones:

Well, the first thing they asked me to do was do some analysis. They wouldn't tell me what I was analyzing because I didn't have a security clearance.

Hochheiser:

Now were you in Baltimore?

Jones:

Yes, I came out to Baltimore.

Hochheiser:

You started immediately in Baltimore.

Jones:

Yes, I spent my whole career in Baltimore. Right.

Hochheiser:

So you came to Baltimore and they gave you some analysis to do while they were waiting for your security clearance to go through?

Jones:

Exactly. So I spent three or four months doing some obscure analysis under the direction of another engineer, a very brilliant engineer, I learned a lot from him, Jim Mimms. Brilliant guy. Absolutely astoundingly brilliant. And so I worked under him for the first year, eight or nine months.

Hochheiser:

And when your security clearance came through, did you discover what it was you were analyzing?

Jones:

Yes, turns out I was doing some analysis of orbits for some kind of a satellite system they were working on, but I didn't know that at the time. I sort of figured something out, but you know, that was all. So as soon as my security clearance came through they started me looking at radar technology, and it is funny, because when I was in graduate school, I took courses in electromagnetic theory. Electromagnetic theory and I did not get along. I never did dig it. I mean, did I pass the course? Of course. But I did not ever understand it. And one of the things, perhaps the only thing I knew when I got out of graduate school, is I don't want anything to do with this radar business, that is crazy, I don't understand that at all. And in fact, I didn't have any idea I was working on radar when they first put me on it. I was doing some analysis of waveforms and stuff like that, you know, pretty simple straightforward stuff, but I didn't realize it was radar for several months. Then they told me, "Yeah, this is Pulse Doppler radar," and so that is how I got into radar. I probably would have never come to work for Westinghouse had they told me that I'd be working on radar.

Hochheiser:

[Laughter]

Jones:

Yes, it was really funny the way it turned out. So I started working on learning more about the APQ81 radar and at that time it was the APQ72 which was in the F4, as you know. I started on those series of radars and started to figure out how they worked. That was one of the things I used Jim Mimms for. He was a very good tutor. I learned a lot.

Hochheiser:

Now what part of the organization were you in at the time?

Jones:

I was in an organization called Advanced Program Engineering. We were doing new programs. That is, proposals for research and development, for Wright Patterson Air Force Base and for the Navy. So I was in that Advanced Programs area and I found it very interesting because I was always working on something different. And I had to learn a lot faster in order to be able to do it. But there were only a dozen of us in that group. And then I went to work for Wayne Fegely in Development Engineering.

AWACS and Rotodome

Hochheiser:

Was that when you started working on AWACS?

Jones:

I started working on AWACS really while I was still in the advanced program area. When AWACS was first conceived, I think it was late '61 time frame, it was called Air Defense Command Post. Some people out at Wright Field, called us and said, "Hey, we would like to talk about something new. And you guys have been working on the Q81, would you come out and talk to us?" So another gentleman by the name of Pete D'Anna and I, went out there. At that time, the Air Defense Systems were really oriented toward bomber defense. Right?

Hochheiser:

Right.

Jones:

That was the primary threat. Missiles were around but they weren't really the dominant threat. So they were worried about low altitude penetration over the pole by Soviet bombers. So the radar we had been working on with Q81 kind of fit that role. So we went out and talked to them and Pete and I wrote the first proposal on Air Defense Command Post. I think it was in the later part of '61. I have thought about that, and I couldn't remember exactly.

Hochheiser:

That's okay. Dates can be looked up.

Jones:

But what happened is that as the Air Force got proposals from at least three people that I am aware of, but I don't remember how many they got, but they started evolving this whole concept. And as time went on, they started evolving into, "Well, they really wanted something that had 360 coverage as opposed to just looking straight ahead." And so that is when AWACS as we see it now started to evolve. The first proposal we did for 360 degree coverage, we had four APQ81s, two in pods on the wingtips of a 707, they were huge pods, they were like eight feet in diameter, something like that. We were working with Boeing, "Could you really do that?" I mean, these were heavy radars, they weren't miniaturized in those days. And so we were working with Boeing on that and worked with Douglas, McDonnell Douglas, trying to come up with a concept that would work. We did that, Pete and I worked on that by ourselves, basically, for a couple of

years and finally it evolved into, I think Boeing was the first one to come up with a rotodome concept for the radar.

Hochheiser:

And that is?

Jones:

Rotodome is the large disc that revolves on top of the airplane. The E2 Navy surveillance plane had one. It was configured like that, except that it was much, much smaller. The AWACS rotodome is like 30-feet in diameter and six feet deep thick at the center. It was not clear that that would work on an aircraft. So Boeing came up with that idea and very quickly McDonnell Douglas adopted it, and even Lockheed was in it at that time. They were going to put a rotodome on the top of the tail of a, I guess it wasn't a C 141. What was the larger aircraft than a 130? It wasn't a C5. But anyway, they were going to put it on top of the tail. Which didn't look too attractive. It was then that we started looking at how are we going to do this 360 coverage. As you are probably well aware, with Pulse Doppler radar you have an issue called sidelobe clutter. Which is for low velocity, low closing rate targets, and so all of the antennas that we had built for airborne radar prior to like '66, '68, prior to AWACS in fact, were all parabolic dishes. And I was not an antenna expert, but we had a really neat guy named Phil Hacker who was a really good antenna guy, and I kept bugging him. I said, "Well, what is it that causes all of these sidelobes? Why can't we get them to be smaller, lower?" And the problem with a parabolic antenna is that you are feeding it with a horn, and you get all of this spillage and you just can't control the illumination function. So I told Phil, I said, "Well, why don't we use an array antenna where you can control it? And he says, "Well, that is fine, except what we don't know how to do is to compensate for all the mutual coupling among radiating elements." In an array, you have a whole bunch of slots, right?

Hochheiser:

Right.

Jones:

Or radiating elements, they can be dipoles, they can be a lot of things. But he says, "We don't know how to calculate the effect of one slot on other slots, and I said, "Well, why not? I said, "Don't you know what the electromagnetic characteristic is?" He says, "Yes, but that requires that we calculate an N x M matrix, and he says, "We don't have any tools powerful to do that. And it was during this discussion that fortuitously, about that

time, we got a new central computer at Westinghouse. I don't remember which one it was, quite honestly, it was an IBM machine, but all of the sudden we had more computing power. So I started scrounging around and I said, "Gee, I think we could do this if we could get four or five hours on this computer," which was difficult to do, as you know, everybody used that computer, right?

Hochheiser:

Right.

Jones:

So, Phil and I put together a proposal and we went to the guy who was heading up Advanced Development at that time, his name was John Stuntz. Great guy. And we said, "Hey, we think we can build an antenna that has really low sidelobes, that will make this pulse Doppler stuff work, and so John gave us 100,000 dollars, and said, "Okay, go see if you can do it." And he also went to the computer center and said, "Hey, these guys need like four or five hours," or I think it was that kind of a time frame.

Hochheiser:

Right.

Jones:

That was huge in those days. On the main computer, to calculate this stuff. So, we got it going and we ran all the equations. I didn't, Phil ran the equations. That electromagnetic stuff did not go well with me, but I knew what I wanted and I knew how to do it except I didn't know how to calculate the mutual coupling. So, we did that. We built an array. It was a rectangular array, I think it was like about—it was at S-band, about five or six feet wide, and about two feet high, but at S-band, those elements were now, I'm trying to remember now how many elements there were, but there were a couple hundred, alright, because they are spaced a half wavelength apart, you know?

Hochheiser:

Right.

Jones:

So we built that and lo and behold, we were able to demonstrate that we could produce the sidelobes theoretically for the illumination function that we had designed. We used a Hamming function, it was a classic function for signal processing, and lo and behold we had sidelobes down to 42 db which was 15 db better than anything we had ever

done with a parabolic antenna. By the way, Phil and I filed a patent disclosure on the low sidelobe antenna technique, which Westinghouse finally obtained a patent.

So Pete, D'Anna, and I went on a selling campaign to the Air Force, saying, "Hey, we know how to go do this." And we showed them some of the antenna pattern results, and that got their interest. And they said, "Oh, you mean we might really be able to do some of this stuff." It turned out, they started working this through the Air Force channels, and I think it was like in '65, we did the low sidelobes work in '63-'64, and in '65, the Air Force convened an Air Force Scientific Advisory Board, and John Stuntz and I went down, and I was briefing them. Now the Scientific Advisory Board for the Air Force at that time was populated by almost all people from MITRE, from MIT. They were all ground based radar guys, alright, brilliant guys, but they had really no experience with pulse doppler radar or airborne radar and they didn't believe anything that we were saying. I showed them the antenna patterns, and I said, "We can even do better than that." And when you start calculating what kind of performance you can get, they didn't really believe it. But there was one guy, he was assistant secretary of the Air Force. Harry Davis. Kind of a Maverick kind of a guy, and he thought it was really cool. He said, "If those guys could really do this, it could be really neat." So he is the one that came up with this idea of doing what we call the Overland Radar Technology program. ORT. Alright? And he put out an RFP and said, "Hey, you guys want to bid on it?" And so, I think the only three bidders were GE, Hughes, and ourselves. And so that was a program, a two-year program to build up sort of a prototype, not really, but really to check the fundamental technology. Could we get the sidelobes the way we wanted them. What was the level of clutter. Another problem we had, in order to get the kind of range that they wanted for this AWACS thing, we needed a huge transmitter, with a lot of power, which we had never built in an airborne environment before, so they wanted us to do that. So, we put together a program and we flew it, I guess, in '68. We flew on B-52s out of Wichita, what is the name of the Air Force Base out there? I can't remember.

Hochheiser:

We can look that up.

Jones:

No, I'm sorry. I'm sorry. I'm sorry. That is not right. That is not right. I am getting mixed up.

Hochheiser:

Okay.

Jones:

We flew it out of Albuquerque, New Mexico, and we flew in EC-121s. The 121 is the Lockheed Constellation. They had a big bathtub like thing, radome, under the belly, especially designed and built for us, and our antenna was in that

Hochheiser:

Okay.

Jones:

So we flew out of Albuquerque, New Mexico. GE, Hughes, and ourselves, we each had an airplane, we sent a whole team out there, and we had about a three or four month flight test program, recording data, primarily, it was not against live targets, it was really proving the fundamentals.

Hochheiser:

Right.

Jones:

And it was kind of funny because the Air Force, very wisely, said they are going to hire another company to evaluate all these results. And they hired, up in Long Island, New York. I can't remember the name of the company now.

Hochheiser:

That's okay.

Jones:

But anyway, so they put some instrumentation together. Unfortunately, these guys didn't know much about radar, either. They were bright guys, but they didn't know much about radar, and so when we were working on ORT, designing and building, I was kind of like the technical director at that time, and we said, "Hey, we better put our own instrumentation on there so we've got something." So we know what we got, and we weren't sure that we were ever going to get anything from those guys, and we aren't sure we even have access to it, so we know what the problems were. So we put together our own instrumentation. So we went and flew out in Albuquerque, and it turns out, AIL was the company. Airborne Instrument Labs. Their instrumentation never did work. And I don’t remember why, but it was a big flap at the time, but our instrumentation did

work, and so we used that data to convince the Air Force that this stuff really does work, this low sidelobe stuff, we could actually do that. So that was the thing that started AWACS. That technology program convinced the Air Force that yes, you could really do that. That is what kicked off AWACS as a brass board program, a fly off, it was one of the first fly offs, you know, between Hughes and ourselves. GE was eliminated at the ORT level. They basically went to just Hughes and ourselves.

Building AWACS

Hochheiser:

So you each got contracts to take it to the next stage.

Jones:

We each got contracts to build, development full-scale development models, and test them on a Boeing 707. They eliminated Lockheed and then they eliminated Douglas before the AWACS brass board program, as they called it, started. So the final phase was at Boeing, and it was Hughes, and Westinghouse. And two 707s and two flight test programs. And we only had two years to design it, build it, and get it flying. So it was a major high-speed program at that point. So, that was the beginning of AWACS. At that point, I was working, I was still on AWACS. '70 is when it started and it ended in '72, with the award of the full scale development and production program that we won. So, my job during that whole flight test program, I was stationed in Seattle, and my job was to court and woo Boeing and to make sure that we answered all of their technical questions. You know, Boeing is very capable, technically, and they have a lot of very good people, and we were doing some new things. We had never built a radome that would allow you to have low sidelobes before, there was a guy out there, his name, Ivan Stampallia who was their chief technical guru, and he thought it was really neat, this low sidelobe antenna stuff, but he was trying to figure out how to build a radome that would retain that kind of integrity and by golly, they really worked on it. That is when we built the eighth scale model antenna for AWACS that I think is here in the museum. And we built it out of KA-band. You talk about a challenge. We were building these arrays at S-band and we were holding very tight tolerances, phase, accuracies on the order of a couple of degrees across that array.

Hochheiser:

It must have been quite difficult to build.

Jones:

It was very difficult to build. The first one we built, we had the top machinist in the factory actually machining each one of those slots in these long wave guiders, and then we've got numerically controlled machines. And that made it a lot easier, because they could hold really good tolerances, but yes, we were talking about tolerances that they had never been asked to do before, but that is what it takes if you are going to get the kind of sidelobe control we were asking for, so we had to build this eighth scale model at KA-band. Which was wow, I mean, a little array is only that big, but the tolerances there were just… I must say, the people in the shop thought that was the coolest thing and a real challenge. How do I hold things to within a half a thousandth? That was just not done.

Hochheiser:

Right.

Jones:

So, they did a good job of it, and we built that eighth scale model, and that is what Ivan Stampelia used to develop his radome technology, because as I said, there never had been a radome built. I mean, they were built, they built all kinds of radomes, but you know, they were constant thickness, honeycomb structures, and this couldn't be that way. You had to have something that was graduated in thickness, had to take the stress of flying at 600 miles an hour, and it had to minimize the reflections that would come off of a radome. So it was a real challenge, and I must say Boeing did a beautiful job. They came up with some very unique solutions to a problem that nobody had ever tackled before. So anyway, we were very successful in our brass board program, it worked like a charm, really. We had problems but fundamentally it worked well.

Going to Seattle

Hochheiser:

You actually had to pick up and move to Seattle?

Jones:

Yes, we moved a crew of 60 people to Seattle. The flight test program was to be like six months long, and it was flying out of Boeing field in Seattle.

Hochheiser:

Wait, so you had a group of 60 people from Baltimore go out to Seattle for the six months.

Jones:

Yep. Yep. I was there from like May through September. The majority of the crew was there from like January through September. They were there for like nine months.

Hochheiser:

That was long.

Jones:

Yes. We moved their families, everybody. Paid all their expenses.

Hochheiser:

Rented places for everybody to live.

Jones:

Yes, everybody got to rent a house or apartment or whatever they wanted. It was a fairly large logistical issue.

Hochheiser:

It sounds like it.

Jones:

It was funny. As you know, Seattle is famous for its inclement weather in the winter time, right? It is gray…

Hochheiser:

It's gray, rains every day.

Jones:

Well, we had a number of families, wives, who just couldn't take it. Got really depressed, and left. Left their husbands out there and said, "No, I hate this. I am going home." So yes, it was a strain on families, because we were working, 12, 14, 16 hours a day. You know, this was everything. The whole shebang is right on the line with this flight test, and so it was just endless work. So it was not a fun time, if you will. I hardly saw my family, but my job was to make sure that Boeing understood all of the results that we were getting and what we were doing, and why we were doing it, and to be the

technical interface on the proposal that we had written, for the full-scale development and production of AWACS. So that was my job. So fortunately we won. My understanding is, although I never knew, that Hughes' system didn't work very well. In fact, I have heard that it didn't work at all, or at least very poorly, I don't know what their problems were. Hughes is a good company, they have got bright guys, but whatever their problems were, it didn't pan out for them, and ours worked well. It really did. We got performance out of that like we'd never seen before. So it really worked very well. So that is how we won AWACS and AWACS became AWACS as it is today.

Hochheiser:

Right.

AWACS Goes International

Jones:

A year or so after we won, the Air Force decided that they wanted to try to get NATO to buy into AWACS and make this truly, an international system. I remember, we were at Boeing, and all the NATO countries were there, Britain, France, Belgium, I don't remember how many, and we were briefing AWACS. The Boeing guys did their thing and I was briefing the radar. The room had 40 or 50 people in it, U.S. Air Force and everything, it was their show. And over on the side there was this table, and there were like five or six guys sitting there, and I really didn't know what it was until about halfway through, before I got up, they said, "Don't forget, Jones, speak slowly, because they are interpreting." And it turns out it was the French and the Belgians and they had an interpreter in there," and I said, "Oh, okay, well, I didn't know that. I thought they all spoke English." So I started giving my presentation, and I must say I slowed down considerably from what I normally do, and then during the break, the presentation was a couple of hours long, because the radar was the key issue in all of AWACS, and one of the guys from the table over there came up and started asking me questions in English, and I said, "Oh, I didn't know you spoke English." "Oh yes, we speak English." I turned to one of the other guys and I said, "Why in the world do we have this interpreter if they all speak English?" "Well, you don't understand, Bill. You know, when the French and the Belgians get in the room, they insist on that their native language be used. They don't want any chance of being confused, etc., etc." Oh, okay. I found out that that was the norm in NATO, but I didn't know that at the time. It was kind of interesting. The British were there, asking all kinds of questions, because one of the things that I did around that time was working with the Radar Tripartite Committee, it was an Air Force sponsored radar committee for Britain, Canada, and the United States, sharing radar

technology, and it was classified. And I knew the Brits were working on their own version, if you will, of an AWACS kind of thing, however, it was mounted in the nose of an aircraft and so forth. So I knew some of the guys at Malverne, which was their radar establishment, so they were there. And they were asking all kinds of questions. Good questions. Logical questions. But there was some degree of competitiveness between us and the Malverne guys. Because after all, the Malverne guys, "invented" radar, if you will. So it was kind of interesting dealing with those guys at that point. So that is how AWACS came into being. It was interesting. It was a fascinating time. It really was. It was when we started the brass board program, it was really interesting, because during the APQ-81 days, everything was analog.

Hochheiser:

Right.

Analog to Digital

Jones:

Everything was analog. We had receivers that were all analog receivers, you know, and of course, Doppler radar, the big deal is getting enough linear dynamic range, so that you can handle the clutter and see these little bitty targets, right, without introducing all kinds of spurious [signals] into the system. So building receivers that had 80-90 db of linear dynamic range was a big deal. And so in the APQ-81 we had 10 parallel receivers. Ten, one for each range gate, and in AWACS we were talking about a much larger number of range gates. And so we were talking about building a bunch of parallel analog receivers, keeping them lined up, etc. Well, one of the things during the early days, before we built the brass board, I had been doing some research, or I had a group of guys doing research, I shouldn't say I was, on digital possessors. How do we do this digitally, and how do you build A to Ds that are big enough and so forth. So I convinced Bob Cowdery, who was the program manager on AWACS for years, all during the beginning, that we ought to go digital with this thing, you know, because we thought we could build a 14-bit A to D, never been built before, but that would make life a lot simpler than trying to build a bunch of parallel analog receivers. And so we convinced him to do that and he made that decision early on in the brass board program, so the brass board was where we really developed the digital technology that allowed us to do all of this digitally and with a digital processor. We had done a couple of digital possessors before, but there were none operational. You know, it was all in the lab. So we built a digital processor instead of an old analog filter bank with, you know, good old crystal filters. Yes, real filters. So we convinced him to do that, and that was a major, I

think a major turning point that allowed us to really do AWACS. I mean, conceptually you could do it, but I just can't imagine us ever being able to keep those receivers all lined up, you know, within one degree of phase accuracy, and you know, ugh. It just boggles the mind when you think of it today. But it didn't boggle our minds then.

Hochheiser:

Yeah.

Jones:

We thought, "Hey, yeah, that could be done, with enough care and work we can do that." But could you keep it operational? That is another thing.

Hochheiser:

Yeah.

Jones:

So anyway, that was a key decision that I think made AWACS feasible. That and the low sidelobe antenna was what made it possible. It was an interesting time. Yep. During my early career, the whole analog world turned digital. And all of the sudden, I remember the first digital processor, Jim Mimms came up with the idea. He wanted to build this thing called a Cooley-Tukey transform, you know, the fast Fourier transform, Cooley-Tukey wrote this paper on how to do it with minimum number of calculations or computations. And so he built a digital processor using this algorithm that would do basically a fast Fourier transform, which is what a doppler filter bank is, if you will. I think that was in 1964. That was the first one we did in R&D at that time. And then by '68, we decided we knew enough that we could maybe really do it.

Hochheiser:

Really do it in a real world system for the customer.

Jones:

In the real world. Right. Yes, but you know, trying to do all that, and AWACS was controlled by digital computer. Now, the APQ81 was controlled by a digital computer. But it was a very rudimentary digital computer in 1961. To give you an idea, the first job I had, when I graduated with my Bachelor's Degree from Washington University, I took a summer job, with IBM, up in Binghamton, New York. They were building computers for the DEW line at that time, these great big computers. They were all vacuum tubes. The first job I had was to analyze this new technology called transistors, to see if they could

be used in computers, and they bought me a couple hundred RCA 2N 284s, is that right? Well, I am not sure of that number anymore, but they bought me a couple hundred RCA transistors, and my job was to characterize how much alike are they from one to the other, I mean, if you are going to talk about using these, you've got to have thousands of them, right? So were they really identical? Could you use them, the characteristic curve or the transistor, to actually do a flip-flop, you know? That is where we were. So we had a real challenge trying to make a digital computer for AWACS. It took a lot of software. You know? But then a lot of software, then we were talking 256,000 words of memory, which was huge, right?

Hochheiser:

Yes.

Jones:

But it is almost comical today. My kids, who are both computer geeks, that is what they do, they can't even fathom that we were talking about that.

Hochheiser:

Yeah, they have got more power in their cell phone.

Jones:

Right. Exactly. You know, when we did B-1, we paid, I think it was TI and AMD, about a half a million dollars a piece to develop a 2K RAM chip. 2K. Alright? Because all we had was 1K, and that wasn't good enough. We wanted 512K of memory in the B-1 radar, and we couldn't fit it in, you know? So we paid them to develop 2K RAM, it is almost ridiculous at this point.

Hochheiser:

Right, and you are talking now in the 1980s.

Jones:

Yes, that was in 1981.

Phased Array Program

From AWACS, I went on to another really interesting program. The Air Force put out an RFP to build a phased array for airborne applications. Now, there weren't any phased arrays, I mean we built an array for AWACS and it scanned electronically in one

dimension, okay? So it had like 15 or 16 phase shifters, but they wanted a true electronically scanned antenna.

Hochheiser:

Three-hundred and sixty degrees?

Jones:

Well, no, but plus or minus 60 degrees scanning capability to go in the nose of an airplane. Their idea was to make this a replacement radar for the B-52s, alright? With the B-52s, you know, they need navigation, radar for navigation, radar for bomb runs, radar for terrain following, etc. So they said, "Hey, the way to do that is with a phased array," so they put out an RFP and we won it. In fact Wayne Fegely, the man you interviewed earlier…

Hochheiser:

Yes.

Jones:

He is the guy that really headed that up during the proposal phase, and I give him credit for wining that contract. So we won a contract that was, by development standards, pretty large, ended up to be about 50 million dollars, called the Electronically Agile Radar. It was the first real-phased array that the Air Force had undertaken for airborne use. And so Wayne asked me to be the program manager. I was working on AWACS at the time.

Hochheiser:

Right.

Jones:

And so he asked me to be the program manager, so I started that program in 1974 and it took five years, alright, because the Air Force lost their funding. It was one of those things?

Hochheiser:

Right.

Jones:

But never-the-less, we built two EAR antennas and radars, the whole radar to go with it, to meet the needs of a B-52. They weren't production radars, but they were very close. They were engineering models, is what we called them. They were form factor and so forth. So yeah, that was a fascinating program. It is really ironical because a couple of years earlier, I had been working on another program. I worked on several programs in-between dry spells on AWACS, you know?

Hochheiser:

Sure.

Jones:

And Phil Hacker and I had written a paper at the request of the Air Force to talk about the feasibility of Phased Arrays. Phil and I wrote a paper and what we said was, in essence, we didn't think they were feasible and why in the heck would you want to do that. That is in essence what we said. And here it was, three or four years later and all of the sudden, I got the job to go build one. I thought it was kind of ironical. So the program, it really paved the way for what is now the B-1. Because we designed the phased array, low sidelobe phased array, we had a full digital processor on there, digital processing moved along a little bit, this was in the '75-'76 timeframe, and we developed a multimode radar that could do simultaneously high resolution synthetic aperture mapping, and terrain following, all essentially simultaneously. Now it's obviously not simultaneous, but it is shared functions, so that to the operator it would look simultaneous. So that was a challenging development and a lot of fun, quite honestly. So we flew that in a B-52 out in Wichita. Yes, we flew that in a B-52. We again sent a crew out there, and we had about a three or four month, five month, flight test program, and we sent a crew of about 30 or 40 people out there to conduct that flight test program—there was no other company involved except Boeing and ourselves to do the flight test. It worked very well and it set the stage for B-1, but when President Reagan was elected, he decided to revitalize the B-1 program, which had been cancelled by the Air Force a couple years prior, and so it was put on a fast track. This was in early '81

Hochheiser:

So the radar system you devised in the program for the B-52 was never actually implemented in the B-52.

Jones:

Nope.

Hochheiser:

But rather fit into the B-1 program.

Jones:

Well, it sort of fit in the B-1, yes.

Hochheiser:

In what ways did it?

Jones:

Well, it was interesting. There were a lot of people who didn't think phased arrays were the right way to go. It is difficult. And it is expensive, if you will. And a lot of people didn't believe you could really do everything you wanted to do. They didn't like this idea of not having dedicated functions. Time sharing, even though time sharing on the millisecond basis, just didn't set right with a lot of Air Force people. They said, "You mean I am going to fly an airplane at 200 feet, at 400-500 knots and you are not going to dedicate a radar to the terrain following function? You've got to be kidding me." And I must say, if I were flying those things, I guess I might feel exactly the same way. But that is what we were trying to do. So there was a lot of people that, even though we had flown it in the B-52, and we said, "Yeah, hey, it works. We can do this," there were a lot of people that were very skeptical. So when the B-1 program was restarted by the Air Force, it was on a very fast track. It was like two years to get that first airplane in the air and flying and so what the Air Force decided was that they were going to use existing technology. So they were going to take the radars out of the F-111, which was a lightweight bomber, and had a terrain following radar, had a mapping radar, it wasn't synthetic aperture mapping, but it was a mapping radar and terrain following radar, two radars in the nose, and they were just going to use that. So they put out an RFP for the radar, Boeing did, and what they requested was basically two radars, alright? And so even though we had done all of this work on the electronically agile radar, on EAR, I was put in charge of the B-1 program, and so I said, "Look, the only way we can play this is this is what the customer wants, this is what the customer gets." The customer is right. So we put together a proposal on two radars up front. We did put some digital processing in there, different than the F-111s but nevertheless, it was two parabolic antennas working independently and it was a kluge, quite honestly. We always thought it was a kluge, but if that is what the customer wants, that is what you do. So we won that. It has never been clear to me why we won, but we won. Boeing liked us. We had come off of AWACS and we were very successful on AWACS.

Hochheiser:

Right.

Jones:

And Boeing, I think, really respected our technical abilities. I am not saying anything against Hughes, because they are a top quality company, but we won that, nevertheless. And it was really funny, because I took my crew out to Seattle for the kickoff meeting with Boeing, and we knew some of the Boeing guys, so we had our first day meeting, and I was presenting, here is the radar we are proposing, etc., and we had a lot of discussion. So that evening, we went out to dinner. There were about four or five Westinghouse people and four or five of the Boeing guys who were the radar guys, and so we were sitting over the dinner table in the Marriot at SeaTac Airport and what I told the lead radar guy, gee I wish I could remember his name now, his name is Len Gear. Anyway, I said, "You know, what you really need to do here is you really need a phased array." I think this is really a kluge-y thing that you guys are doing, we will build whatever you want, but in my opinion, this is the wrong technology. And he says, "You really think so?" And we talked about it for a couple of hours. And he said, "Well, if you really think that, why don't you write us a proposal. I said, "Are you kidding?" So my Chief Engineer, George Reeder, and I, on the airplane back, sketched out a proposal on how we would put a phased array on the B-1. And one of the issues was, how do we get the kind of coverage that we want for a B-1, for its very versatile set of missions, and George came up with this really clever idea of putting a phased array on a roll gimbo. So that we had a phased array, but the phased array was like this, and if you rolled the gimbo, you roll it out to the side, so you could get almost…I think we ended up with I think 130, 140 degrees of coverage. With that phased array, without scanning it electronically way off, which means your gain, goes way down. So he came up with this really clever idea, and he made a little model at home that night, after we got back from Seattle, he came in the next day and said, "Hey, I think this is how we can do it." So we wrote a proposal in like two or three weeks, because we were already under contract.

Hochheiser:

Right.

Jones:

I had 400 or 500 guys working, designing these radars. And we were going to change horses. So we wrote the proposal, sent it to Boeing, and Boeing read it, called us up about a week later and said, "Come on out and let's talk about this." So George and I

and I think one other guy went out and we made an all day presentation on why we thought this was so cool and so neat, and the right thing to do. Of course, we already were under contract, you know, and could we do it for the same amount of money? It was really tough. So we convinced Boeing that, "Well, you know, you've got an awful lot of equipment in this development program, you probably don't need this many spares, so we cut a little of equipment out and we finally ended up saying, "Yes, we think we can do it for the same amount of money." And Boeing says, "You think so?" So Boeing called up the Air Force General who was the SPO Director, and said, "We want to come talk to you about a major change." So like three or four days later we are out at Wright Patterson Air Force Base. But the Air Force General who ran the B-1 program at the beginning was a brilliant guy. I just liked him. He was such a neat guy, and he was completely open to listening to this, and he got this radar guys, who we all knew anyway, at Wright Patterson in there, and we made a presentation and in one afternoon he says, "That sounds like the right way to go, what do you guys think?" And Boeing said "yes" and all these radar guys said, "yes" and so right there, we changed to a phased array. I think that was in December, we started in the contract in October.

Hochheiser:

That's fast.

Jones:

That's fast. That's incredibly fast. Incredibly fast. But here we were, we're behind the eight ball. We're already three months behind schedule, because that is not the same radar as you have with two parabolic reflectors. So, yes, it just amazed us that it happened like that. But that is how B-1 got the quality of radar that they have got today. Otherwise they would have been stuck with 1960s technology. And the general who made—darn, I wish I could remember his name.

Hochheiser:

Well, if you do later, you can always add it.

Jones:

Yes, I will try to remember. But that is a gutsy decision. I mean, he talked to the commander of TAC, I know he talked to him, but that is all. We didn't go down to TAC headquarters and brief this. We did it all right at Wright Field. They made that technical decision. Which was the right decision? Technically the right decision, but it took real guts to do that. I mean, I just had the highest respect for him. We remained friends for

several years and I used to go down to Fort Belvoir. He ended up, I think he ended his career, he was a two star and he was the commander of the Defense Systems Management College at Fort Belvoir. I used to go down there and teach a class. They asked me to come down there and talk to all the Air Force and Navy potential program managers, you know? Since I had spent most of my career managing programs. And so yeah, I used to go down there and lecture. It was a lot of fun, because those guys, they were all military or civilian government employees, and they had no clue how industry thought about things. I mean they thought we were a bunch of shysters trying to take the government for a ride. And I used to talk to them about [how] we try to figure out what the heck you guys want, you are customers, that is what we do is figure out what you really want. I don't mean what does it say in the RFP, because we can read that, but what does that really mean, what are you going to do? I spent a lot of time trying to figure that out. To be responsive. They had a hard time coping with that idea. "You mean you guys in the industry really do that?" So it was an interesting little sidebar and I did that for three, four, or five years, but it was always a fascinating discussion with those guys. So anyway, I did B-1.

Hochheiser:

So they are now doing the phased array rather than that kluge that was in the original contract.

Jones:

Right.

Hochheiser:

Now you have got to deliver.

Jones:

Yes, we've got to deliver, and you couldn't use the EAR antenna per se, although we used the fundamental technology. The guys that built the phase shifters and so forth, but we had a crash to now design a new antenna, a whole new system, based on EAR. We knew a lot having flight tested it, but we had to fit it into the B-1 and there wasn't near as much room as there is in a B-52, and so that is when we had to go out and see if we could get a 2K RAM chip. And I said, "Ugh, 1K was just not going to make that digital processor, we just had to have 512K of memory to control all these functions." And the Air Force decided that we had to use a higher order language, we weren't allowed to use assembly language or machine language, you know? That was one of the other

things that they did on EAR. EAR was the first program that the Air Force had decided, "Okay, it is time to make higher order language," and they made us use Jovial J3B, which was one of the higher languages, one of the few at that time, but it is one the military had sort of adopted as a standard. So we had to program everything in Jovial which at that time was not very efficient so far as memory was concerned. You paid 10 to 20 percent penalty in memory to use a higher language. And so when it came time for B-1 we were stuck with J3B, so we had to have this 2K RAM, because we need 512K of memory. It was a real struggle. We paid these guys, I think it was TI and AMD: It is kind of amazing when you think about it today, to develop a 2K RAM chip, and boy, we got them just barely in time. They were all struggling, they'd never done it before, We actually got that radar built and we got it delivered to Boeing with the high resolution synthetic aperture mode working in 18 months, from the contract go ahead, and that was like 15 months after we changed our mind. Alright? I must say, during that two-year period, we worked seven days a week, we worked three shifts, near the end, once we got the fundamental design hard, and we were programming things, we were working three shifts on software development, we were working three shifts on building hardware, because we were packaging things using flat packs. Flat packs were, in the mid-80s, the thing that allowed you to compress things. We didn't have processors like Intel builds today. Right?

Hochheiser:

Right.

Jones:

We were making our computers out of essentially flip-flops, if you will. Anyway, we worked, that whole team. I had a team of about 200 engineers, and then there were another couple hundred in the factory. That team of 200 people were in a building all by ourselves, because it was a classified program.

Hochheiser:

Right.

Jones:

Westinghouse decided to build a little building out back so that we could have classified discussions and all that sort of thing. So we were all in one building. I took off Christmas Day, and that was the only day I took off during that whole year or so. And everybody else did. I was there the whole time, you know, from about 7 o'clock in the morning to

get the third shift when they came off, and first shift went on, and I was there at 7 o'clock at night, when the first shift went off and second shift came on. We all were. That is how you did it. The Air Force got a good deal, because none of us got paid overtime. But we worked our butts off, and got it done. It was an exhilarating time. It was exhausting, but it was fun. I've got to say I had a heck of a lot of fun. I enjoyed virtually every minute. Of course, there are always difficulties; managing a program like that is nothing but problems, but it was fun problems, and the people that I had working with me were just incredible, and they just all did their thing. It was really a wonderful experience. And by the way, something unique happened during that program. When we were doing B-1, once we convinced Boeing and the Air Force to go phased array, I went to Harry Smith, who was the President of the Defense Center at that time, and we said, "You know what? We need a flight test airplane. We are never going to be able to get any time on the B-1 bomber to really test this radar. I mean, come on, B-1 has got all the rest of these systems that they have got to test out, you will get an hour every four hour flight time, maybe you'll get 20 minutes, or an hour once every two weeks. We'll never figure out what the heck is going on with this radar." So we went to Harry, and I said, "Hey, Harry. We need a BAC 111 aircraft. That is what flight test says is the right kind of an airplane. They are fairly inexpensive. There are a lot of them around, and we need a flying laboratory that we can put something in, so we can put engineers on board and see what the hell is really going on." And Harry said, "Cool idea." Then he gave me two million dollars, to go buy a BAC 111, just like that. And that was the first time we had an airplane, a BAC 111, that size airplane, to test on. We had been flight testing in F4s and A3Ds, for a long, long, time. But this was a real flying laboratory where all the hardware could be put in racks, even though it was configured for a B-1, we could be put in racks in the cabin, you had instrumentation, you had consoles where you could see what is going on real-time. It made the de-bugging of this software and the processing algorithms just so much more efficient. Harry Smith. He is a neat guy. He really is. Brilliant guy. And he saw it right away. It didn't take more than half an hour in Harry's office and he says, "Sure, go do it." And now, I understand Westinghouse (now Grumman Northrup) has several, I don't even know how many BAC 111s they have now, for flying laboratories. It is the standard procedure now for developing equipment. Because it has so much software in it, you need something that you can look at in real time. So anyway, that was one of the really neat things that happened on the B-1 program. Fortunately, we had the BAC 111 and we could fly our system before we ever had to deliver it to Boeing. Otherwise, in the old days, prior to that time, you delivered your system and the first time you saw what it would do would be in front of the customer, Boeing or McDonnell Douglass, and all the world was watching. And it was a

little bit more difficult. So yes, that was really a major factor in our ability to deliver in the time that we had. So we delivered the B-1, 18 months and Boeing flew the first flight, like 22 months after go-ahead of the full avionics system. Yep, airplane and all.

Hochheiser:

Meeting the two year schedule that the overall B-1project started with.

Jones:

Yes, they met the schedule. Working with Boeing is an interesting process. Boeing is very, very good. But they really know how to manage a program. The first program I worked with at Boeing, I kind of liked it because they were in Seattle, and they'd come to work at 8 o'clock and that is 11 o'clock our time, so we would have all morning before we started getting calls from Boeing. On B1, those guys outfoxed us. And they decided they were going to come in at like 5 o'clock in the morning. So Boeing manages a program, I mean day by day. So we would be on the phone with Boeing Company at 8 o'clock our time. It took George Reeder and myself almost full time just to talk to Boeing. But they did a marvelous job. They kept us on our toes, they were demanding, but only rightfully so. That was my real crucible of managing a program. I had managed the EAR program and I had managed a couple other things, but I had never managed a production program. And Ben Vester called me into his office, and he says, "Bill, we're going to find out if you are just a good pitch man or if you can really deliver. He says, "You are going to manage the B1 program." I said, "Oh, okay." I thought cool, that's fine. But Ben wasn't sure. It is a difficult task to manage an advanced development program and going right into production. There was no big long program; the first production radar was due out in like 36 months. So I didn't realize what he was asking me to do of course, but it was fascinating and I loved it, even though it was 14-16 hour days. That was the training in the crucible of fire.

Hochheiser:

So the second half of the program then is the production.

Jones:

Yes. I stayed on the program until 1985, spring of '85. We had just finished negotiating the production program. We had already started building production hardware but the Boeing program manager and I finally came to an agreement on the production program in May of '85, and we shook hands and we had our teams negotiating for six months.

Hochheiser:

Right.

Jones:

And everybody was arguing about this and arguing about that. You know what that's all about.

Hochheiser:

Sure.

Jones:

So finally I got on the phone with Jerry Gimness who was the program manager at Boeing, good man. And Jerry and I finally said, "Hey, look, we've got to get this done, and so here," we cut a deal, a deal satisfactory to both of us. And that is when I left the program, right after we finished negotiating it. I had a Deputy Program Manager, Dave Merow, a good man, who took over the production program, and did very well.

Electronic Warfare General Manager

Ben Vester tapped me to be the new electronic warfare general manager. And I went to Harry Smith. Everybody knew Harry. Harry was a good guy, he knew everybody. So I went to Harry and I said, "Harry, I have spent 25 years building my reputation in radar and all of our customers know me, right? And I think they have a certain amount of respect for me." I said, "Why in the hell do you want me to manage the electronic warfare division? I don't know anything about electronic warfare. He goes, "Well, you know radar," he says, "That's easy." And he says, "Because I need you to go do something, change that mentality over there." So I did, but it was shocking to me.

Hochheiser:

In what way?

Jones:

Well, I mean I really didn't have any aspirations of being a general manager, right? I never really thought about it, to be perfectly honest. I was okay, right? And electronic warfare is a different discipline, I had spent my life trying to defeat those guys. You know, they were my enemy in the radar business, right?

Hochheiser:

Right.

Jones:

I didn't really know that technology intimately, and quite honestly, I had seen some people become general managers who didn't understand the technology and I think that is a very dangerous thing to do. I had seen some guys that came up through the accounting business. They were division controllers, but they didn't understand what their engineers were telling them, and there was a whole trend in the 80s of a good manager can manage anything. You remember when somebody from, I am trying to remember the name of the fast food company, took over IBM. They brought in a new CEO of IBM who had no clue what the computer business was all about, but he was a good manager.

Hochheiser:

Gershner?

Jones:

Maybe so, I don't remember.

Hochheiser:

It was in the early 90s, I guess.

Jones:

Yes. There was a trend that says a good manager can manage anything, it doesn't matter if you understand the business, right? Well, I didn't subscribe to that and I think everybody else has said that is not necessarily right, but that seemed to be the trend, and I was concerned because I did not understand the electronic warfare business. I didn't know that part of the Air Force customer, I didn't know their technology. But Harry said, "I want you to do this." And I said, "Okay." So the first thing I did was to get their Chief Engineer and I said, "Hey, you are coming in at 7 o'clock in the morning, and we are going to spend two hours every day and you got to get me up to speed so I understand what the hell it is you are talking about." Otherwise how can you ever make a decision if you don't understand it? That was a watershed change in my career. I had not anticipated it at all. I remember in 1990, I went to the Paris Air Show. It was after the wall had come down and all that stuff, and the Soviets were there and they had their MIG-29, I believe. We were there, and I was really there as part of the electronic warfare group. We were in our booth, at the Paris Air Show, and we get this phone call and they say, "Hey, Bill it is for you." And this guy comes on and says, "Hey, we'd like to meet

you." And I said, "Well, okay. Who is this?" "Well, we're from the Soviet Delegation." And I said, "Oh?" And he says, "Yeah, we'd like to get together." "Alright." He said, "I'll show you the MIG-29 radar." I said, "Oh, cool." You know, because we had fought against them all these years, right? My whole career. And so I had this meeting with the soviets. There were about eight or nine of the Soviet engineers or whoever, and just me. I didn't have any of my radar guys with me. It was all EW guys.

Hochheiser:

Right.

Jones:

So we had a very interesting conversation. They knew that I had managed the B-1, they knew that I had worked on AWACS, they knew what papers I had written, so I was absolutely astounded. They knew who the heck I was. I didn't know any of them and they were asking all kinds of questions, of course, which I could not answer, but they did show me the Mig-29 radar, and it was then that I realized how far ahead we really were of those guys. They had been painted as 10-foot giants, right? Well, they weren't close to what we could do. But I found it fascinating that they knew all this stuff, but it was all my radar background.

Hochheiser:

Right, and by this time you were off doing something else.

Jones:

I was off, managing the electronic warfare division. I started with the electronic warfare in the summer of '85 and stayed there until '90.

Hochheiser:

What were the major programs of the division?

Jones:

Well, at that time, we were building the ALQ-131, ECM pod for the Air Force. That was a biggie. That was the mainstay of the division. It was kind of in trouble when I went there and Harry wanted me to kind of "straighten it out", and I don't know, I did sort of. But that, and ASPJ. ASPJ was the new jamming system for the Navy. It has a designation now, it did not when I was there, and I don't know what that designation is, but it is, I think, fairly successful now, but it was really in deep trouble. It was one of those joint

venture programs. Remember the DOD decided that they were going to make industry team up together, right? Yeah.

Hochheiser:

So who did they make you team up with?

Jones:

We teamed up with ITT, up in New Jersey. So here I am, a new General Manager, learning the EW business, and I have got this big program, the ASPJ, that is in deep trouble, I mean they are way behind schedule, over budget, things weren't working right; it was a very ambitious development. It was not terribly surprising, that when you push the state of the art, you run into the UNK, UNKs, right? The Unknown Unknowns. But nevertheless, it was high profile, and besides it was a joint venture, where every decision has to be made jointly with another company. I mean, it is bad enough to have a joint program manager within your own company, but with another company, it was the most cumbersome, difficult thing, to maintain relations, and we had a requirement in the contracts that things needed to be split 50/50 financially. So new work that needed to be done, who would do it, would they do it, did we do it, it was just a God-awful mess. It was, it was I would say at least 60-70 percent the cause of the problems that we had. It was just unbearably difficult to manage, yet DOD thought that was a really cool thing to do. That is the way to spread the wealth around. So one guy doesn't get with these big contracts, and then they have two guys to compete for production. That was the whole idea; we would go through development together, and then we would compete for production. Well, sounds pretty good, except doing it like that was very difficult. It was terrible. That was not a fun time. We had meetings every week down in Washington with the Admiral in charge, why haven't we met this milestone or that milestone, it was one of those God-awful terrible things. It was just painful. Nothing but solid pain. So I did that for about five years.

Hochheiser:

It doesn't sound like you enjoyed that as much as…

Jones:

No, I didn't. No, it was alright. But no, I didn't enjoy that near as much. Well, I mean when you are the General Manager, you are responsible for it all. The way Westinghouse was organized, a general manager was a business unit. It was a division within the

corporation, you are responsible for your profit and loss, you are responsible for all your people, you are responsible, it is running a big business, and it wasn't near as much fun.

Hochheiser:

It sounds like there were two changes at once, and one is you are moving to be a general manager and having the business unit responsibility and the second, you are moving to a new area of the business at the same time.

Jones:

Yes, at the same time. It was really difficult, I thought. But, it worked out. I think I was considered to be a fairly successful general manager; the business went fairly well. We got ASPJ pretty much on track. We kept the Navy from canceling it and we worked with the other company, and we didn't lose our shirt, the division ended up making money, so overall, I was fairly successful. But it was not near as much fun, you know? Not near as much fun. So…

Commercial Business Divison

Hochheiser:

And you moved on to one more position?

Jones:

Yes, in late '90, after the wall came down, and everybody was really concerned about the military electronics business, the whole military business, how much are they going to cut back, now that we are not fighting the Soviet Union all of the time. So Westinghouse decided that we needed to start some commercial activities building on our technology. A guy named Ed Silcott was given the job of starting a commercial division and within it they transferred some of the existing businesses that were less dedicated military. So Ed tapped me, and said, "Hey, I want you to take over part of the commercial business," and he gave me the division Electrical Systems division out in Lima, Ohio, that built generator systems for airplanes. They built the generators for most Boeing airplanes. They gave me that division. They gave me the FAA business that we had, we built all the ASR 9s used at all airports in the US, and we had the development contract for the ARSR 4, the new en-route surveillance radar for the FAA at that time. And they gave me the ground based military radar business and then said, "Hey, go find some other new commercial business. Go find and develop a new business."

Hochheiser:

Now, were you still in Baltimore or did you move out to Ohio?

Jones:

No, no, I stayed right here.

Hochheiser:

Okay.

Jones:

So I had three different divisions, about 400 million dollar a year set of businesses, and was trying to develop some new business, commercial businesses. So that wasn't near as much fun, either. That wasn't near as much fun. When you go to develop a commercial business, it takes several years and a lot of money to develop a product line and get it accepted in the marketplace, etc., etc. Right? I had never done that before. I spent my life in the military business, which is a very different business.

Hochheiser:

Right.

Jones:

So first of all, I didn't really know a lot about that. And secondly, Westinghouse wasn't really willing to spend the kind of money that it was going to take to do that, so we started looking, can we buy some businesses that are "self-sustaining" to help. So, that wasn't much fun. And then the ARSR 4 program that I was handed on a platter, was in deep trouble financially. It was a mess. I did not like it at all, and it only lasted about three years and Westinghouse finally concluded, "Well, this commercial business really isn't all it is stacked up to be." And we got a new CEO, Michael Jordan. And basically he didn't understand any of this technology stuff. He was with Frito Lay, for God's sake. And I remember briefing him when he first came on board, "What do you mean you are spending two million dollars on IR&D? Don't you realize, that is profit?" I mean, you want to put it there, go put it there. So, it was very clear that what he had decided to do was to make these businesses look real good so he could sell them. I didn't tumble to it right away, but looking back it was clear that was his game plan, to make money for Westinghouse stockholders. And that was what he was supposed to do I guess. So he was preparing to sell all of Westinghouse, piece by piece, to make money. Well, I guess that is one way to look at it. He destroyed a 100-year-old corporation, in doing it. But, so after about three years, Westinghouse finally figured out, no, this is not going to work. So they decided to disband the commercial operations and so I just decided, I

don't belong here anymore. What they are doing to try to make this business look good, to sell it, so I just retired.

Moving to Federal Highway Administration

Hochheiser:

So you took early retirement.

Jones:

Yes. I was 62 at the time.

Hochheiser:

Oh, not that early.

Jones:

No, it wasn't that early. And I had had a lot of fun, but I wasn't having fun anymore.

Hochheiser:

Right.

Jones:

So I just decided, "Okay, it's time." And Westinghouse was perfectly willing to get rid of me, you know? So, it was a mutual thing. That ended my career there. But I went on and had another career.

Hochheiser:

I noticed that.

Jones:

That was a hell of a lot of fun. It is really interesting. One of the things I did when I was in the commercial business--we started a business that is still in existence today, that is called Automatic Vehicle Location for transit companies, for keeping track of where their busses are and on schedule. That was a business that was started right in 1990, 1989-1990, it was the only successful commercial enterprise that I had in my business. And I got to know some of the people at the Department of Transportation. In fact, I sat on one of their technical advisory boards, it is like a scientific advisory board. They had some technical advisors. I got to know some of those people, and it was pretty

interesting, because in the transportation business they had been building bridges their whole life, and roads. That is what they did.

Hochheiser:

All civil engineers.

Jones:

All civil engineers. And there were no electrical engineers there. And so after I retired, I did a little consulting for them, and they had a program called the Intelligent Transportation System where the whole idea was to infuse technology (computing, sensing and navigation) into the transportation business, which was the source of some of the funds for these automatic vehicle location that I had been working on when I was at Westinghouse. So I got to know some of those people, and then the Intelligent Transportation System Director, a lady, Christine Johnson, was looking for somebody to help her technically. And one of my friends a FTA, The Federal Transit Administration, we had become kind of good friends, and he said, "Bill you ought to apply for that." And I said, "You've got to be kidding me. Go to work for the government? I mean, I worked with those guys all these years, but I would not survive in the government." He says, "Yes, you would. You'd be good for them." So I said, "How do I do this?" He said, "Well, you've got to fill out all these papers." "What do you mean, fill out all these papers. I will give you my resume. I am not filling out any papers." It was really funny. He says, "No, Bill. Sit down and fill out the damn papers." So I did, and then I got a call from Chris Johnson, and she says, "Mr. Jones, are you really interested in this GS 14 job?" And I said, "Well, I don't know." And she says, "Well, if you are, would you come and talk to me?" I said, "Well, I don't know if I want to do that." I said, "You know, I'm retired. I plan to travel and do things I want to do, so I am not willing to do this for two weeks vacation." I said, "I take off four to six weeks to go down to the Caribbean." I said, "I don't need this. I did very well at Westinghouse, I don't need your money." And she says, "Well, it might be interesting." So she says, "Come down and talk to me." So I did. And I said, "Well, I am not going to work 60 hour weeks anymore. I did that for 35 years. I am not doing that. I will give you my all from 8 to 5 and that is it. And I don't work at home, I don't travel, alright? And I am taking off when I want to take off, on vacation." And she says, "Okay." So I said, "Well, okay, they are going to pay me 80 grand a year, alright, I'll give it a try." And so I started out there, and there was one other electrical engineer in all of Federal Highway Administration. One. And they didn't know anything about that stuff. So I became their technical advisor, and I had this wonderful job of offering my opinions on everything and not being responsible for anything. Wow, what

a great job, right? I didn't want to manage anything, I told her, "I'm not managing people. You want to promote me, I am out of here like that. I am not managing any people, I am not managing programs, nothing. Alright? I will work my butt off for you but I will do technical stuff for whatever you want me to do." Well it turns out the first job she gave me to do was to arrange a speech for the Secretary of Transportation. She was very clever, because here I was, coming in from industry, "Oh, this is not so hard, right?" She gave me two or three pieces and said, "Work with these guys." And it turns out that in the government, when the Secretary makes a speech, everybody in the world has an input into that, and you have got all these people that you have got to go through, you don't go talk, "Hey, Mr. Secretary, I have to talk to you about your speech," no, he's got all these people around him that protect him, right? She knew all of that. Well, I didn't. So she gave me this job, and the first road block I walk into, I picked up the phone and called the Deputy Administrator of Federal Highways and said, "Hey, I need to do this. Can you get it done for me?" "Who are you?" So I got it done. And everybody was saying, "Bill, you can't do that. Bill, you can't call him. You've got to go to this person and that person and that person, go up through the chain of command." I said, "Oh, baloney. If you want to get something done, go get it done." And so I did. And I stepped on a lot of toes. But fortunately, I didn't care, see? Fire me. Okay, I don't need this. Right? It was really fun. She did that on purpose. But then she used me like that. She says, "I'd rather have Bill go do this and apologize for him later on." It was fascinating, because I got to do all kinds of really neat things. I went to the FCC and got spectrum for a short range communications system for vehicles. I got 511 established as a transportation information number nationwide. I did all these things that she just let me do. It was really cool. I loved it. And the only reason I really retired finally, was I started a program, came up with this idea with the auto companies and started a program, convinced everybody to put money into it, and then they made me manage it. They made me the program manager. (That program, called Intellidrive, is still going today) And all of a sudden, I was doing what I used to do, you know, managing a program is nothing but headaches. It is nothing but decisions and solving problems and I hated it. But I got it started, and then I said I am going to retire. I don't need this. I don't want to do this anymore. I stayed on for another six months because they were getting a new director in, and then I left. But that is why I left. I just didn't want to do that stuff anymore. It was a fascinating job, I had more fun, I was able to do whatever I darn well pleased, whatever interested me. All I had to do was go convince the boss that this is cool, let's go do this. It was really neat. And they benefited a lot, because I had a whole different perspective on how you manage things, I had a whole different

perspective on how you do business, and the government does business very differently.

Hochheiser:

Yes.

Jones:

And so they did use me. They would ask my opinions on how they are going about this RFP or whatever, and so forth, and I always gave them my opinion, I didn't care whether they liked it or not. But I think it was valuable to them to have a whole different perspective, because I was the only one with an industry background. Most people work for the government for 20-30 years and go into private business, virtually nobody works for private business and then comes into government. So I was an odd ball. But that was the fun part of it.

IEEE Membership

Hochheiser:

Since I am with IEEE, I would like to ask you about your participation in IEEE over the years, which you touched briefly on your joining the IRE back in your student days.

Jones:

Yeah, well I was always a member of the IEEE, and I am trying to remember. I was on the, let's see in 1970-ish, I became a member of the radar panel, of IEEE. I did that for a couple of years. And then, another guy, Bob Hill, who was at that tim, one of the technical directors for the Navy, good radar guy, Bob Hill, and myself, and a couple of others decided that we ought to have an international radar conference-- unclassified—all the radar conferences prior to that time had been classified.

Hochheiser:

Right.

Jones:

And so there was a very limited amount you could do. So we decided we will have an international radar conference. An international conference. So we started working on this international radar conference, and the first one was held in 1975. I was on the committee for establishing that, and I was the papers chairman on the first one, and we did them every five years, '75, '80, '85, I think the last one I was involved with was '90, I

was co-chair of that one. I did that, because those things, as you know, take a couple of years of preparation. So yeah, I found that interesting. We met a lot of people, cohorts from the international community, and at that time, there was a lot of stuff going on that you could publish unclassified. There was a lot of stuff going on with satellites and stuff like that. So it was kind of interesting. I did that with the IEEE, and finally, in I think 1990, I said, "Hey, I don't want to do this anymore."

Hochheiser:

Right.

Jones:

I am out of the business. See, in '85, I was just transitioning from the radar business over to EW. By '90 I was out of the radar business, if you will.

Hochheiser:

Right.

Jones:

You know, I wasn't in the community anymore. I wasn't going to the conferences, I wasn't keeping up, you know? So it just really didn't make any sense, so I co-chaired the '90 one, I believe that is the one, and then just dropped out of it and said it doesn't make any sense, and then I left Westinghouse and so it didn't obviously make any sense. So that is what I did with IEEE. I never became one of the exalted members. I was a member and I guess I am a senior member or something. I am not sure, quite honestly. But I never became a fellow or anything. I had the papers one time to go do that, but it never… it just didn't turn me on, so I didn't do it. I may not have been elected a fellow anyway, who the heck knows.

Hochheiser:

[Laughter] Well, if you never put in the paperwork, you will never know.

Jones:

Yes, so I guess now I am a life member, now finally at my advanced age.

Westinghouse Baltimore Environment

Hochheiser:

Great, great. How would you characterize Westinghouse Baltimore as a place to work, colleagues, social life?

Jones:

It was a wonderful place to work. It was wonderful. Up until 1990, it was wonderful. Harry Smith was a true entrepreneur and he was a brilliant engineer. Absolutely brilliant. He understood what we were doing. All the people he put in charge, Wayne Fegely, Ben Vester, John Stuntz, all those guys, were top quality engineers. Alright? And they were good businessmen as well. I mean, it is possible to do both.

Hochheiser:

Oh yes.

Jones:

It is. And the atmosphere was can-do all the way. It was just a wonderful environment to work, and everybody, virtually everybody, felt that way. And so it was just fun. Harry used to come down to the labs when we were doing something. Harry loved to play around with stuff. He would come down and he would start punching buttons. You would set up a demonstration for Harry, you know, the big boss. And that is one of the nice things. He understood what you were doing. And so you can set up a demonstration and right away Harry would come down and "What's that? What happened?" And he would push buttons or turn dials, you know, on all the instrumentation, and it was just funny. So, when we built the B-1 radar and we put it in the BAC 111, on the main console we put an HBS button, it was a button about that big, it said HBS for Harry B. Smith. [Laughter]

Hochheiser:

[Laughter]

Jones:

But it was that kind of environment. Harry was the soul of the corporation for a long time. And then he retired, and Dick Linder took over, and I liked Dick Linder, but he was under pressure from the corporate headquarters to make these businesses look good, and as I look back it is probably because they were getting ready to try to figure out how to sell them. But it stopped being fun. It was not just a neat place to work. As neat. I shouldn't say that, I mean, there are a lot of people right now who love it I guess.

Hochheiser:

Yes.

Jones:

But it changed. And it wasn't the comradeship, and the whole environment just changed. So I was very fortunate. I spent 35 years in a wonderful, nurturing, creative environment. And it inspired you. I neglected my family because of it. I was so taken with all of the neat things we were allowed to do that I neglected my family. I remember when my youngest son was about 16, I think that was when I was working on B-1, if I remember correctly, and I came home one night and I said, "Well, I'm going to Seattle tomorrow." I went to Seattle a lot. And he turned to me and he said, "Well, so what is new? You've never been around our whole lives, so go ahead." That was hard to take. Because I did travel a lot. And it is true; I gave up things in my family life, because it was just so fascinating. Now, I must confess, I didn't do it 'consciously,' you know? It just happened to me, and that is why, a few years ago, I got my two sons together, and I said, "Listen, don't let happen to you what happened to me. Alright? If you want to go down that career path, and be 'successful,' fine. But make it a conscious decision and you and your wife better say, 'Yes,' alright? Don't let it happen to you like it did to me." My wife and I never talked about that, it just happened to me. And I told them, don't allow it. And you know what? My youngest son quit working for a particular bank because they wanted to make him a Vice President and he was working all kinds of hours, and it meant more hours, and he quit. And he went and found another job. And I was just so proud of him. I said, "Hey, cool. You know? Right decision. What is important in your life?" But that environment sure was intoxicating. It was a fun time. And the technology was changing, dramatically, from vacuum tubes and analog computers to the digital world, and God, it has changed so much now I don't even recognize it anymore, right? I have been out of it for 15 years, really. That advanced technology stuff, and it has changed so dramatically. So, it was a fascinating business to be in though, I must say. I enjoyed every damn minute of it.

Hochheiser:

Well, unless you can think of anything we didn't cover…

Jones:

I think we're done, huh?

Hochheiser:

Yes, all these notes I took about things I wanted to make sure you talked about are now face down, so…

Jones:

Okay.

Hochheiser:

I think we're finished.

Jones:

Well, good. Well, that has been enjoyable.

Hochheiser:

It has been a pleasure for me to sit and listen to you.

Jones:

[Laughter] It has been interesting to reminisce. I must say, since I left Westinghouse, and went to work down in Washington, I have had no contact. I came back one time. They had the 30th anniversary of AWACS and they invited me back. That was the only time I have spent one hour thinking about my old life. I mean, I really said, "That is past, I am on a new journey now."

Hochheiser:

Yes.

Jones:

So this has been very interesting.

Hochheiser:

[Laughter] Good.

Jones:

Because I haven't done this.

Hochheiser:

Well, it has been very interesting for me as well.

Jones:

Very good. Well thank you all very much for inviting me. It has been a real pleasure, it has been kind of fun. Yes, there is nothing like old guys recounting old times, right? [Laughter]

Hochheiser:

Well, that is what we do.

Jones:

Okay.