ORAL HISTORY: Kenneth Plante

About Kenneth Plante

Kenneth Plante was born in New York City in 1935. Interested from childhood in technology and science, he attended Brooklyn Polytechnic Institute in electrical engineering. After graduating, Plante began working at Westinghouse Baltimore as an assistant engineer in the Bomber Defense Group on tail turret radar systems. Plante later became engineering manager for the Electronic Warfare Division (EW) in the 1980s. In 1993 he was chief engineer for EW, his final position at Westinghouse. Over his career, Plante worked on many important projects such as the B70, ULCER, Pod programs, RWRs and ALQ-165. Plante officially retired from Westinghouse in 1994, although he stayed on as a part-time consultant for an additional year.

In this interview, Plante discusses his long career and the various projects he worked on. He found entering electrical engineering during the 1950s highly interesting because of the many technological changes taking place at the time, including the introduction of transistors. Plante also talks about his involvement in countermeasures contracts, and his work with customers, including the military. Projects such as the ALQ-165 are discussed at length, the ALQ-165 posing challenges because of the multiple airplanes the model had to fit into, and working as a team with a competing firm, ITT. Plante's transition to supervisor and manager are also covered, as well as his decision to take a staff position when he became chief engineer. The atmosphere at Westinghouse Baltimore in the 1950s and 60s is also talked about, along with Plante's impressions of the evolution of both his career and Westinghouse Baltimore.

About the Interview

KENNETH PLANTE: An Interview Conducted by Sheldon Hochheiser, IEEE History Center, 13 April 2010

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Interview

Interview: Kenneth Plante

Interviewer: Sheldon Hochheiser

Date: 13 April 2010

Location: The National Electronics Museum, Baltimore, Maryland

Background and Education

Hochheiser:

This is Sheldon Hochheiser of the IEEE History Center, it's the 13th of April, 2010. I'm here at the National Electronics Museum in Baltimore with Ken Plante. Good afternoon.

Plante:

Good afternoon.

Hochheiser:

If we could start with a little bit of background. Where and when were you born?

Plante:

I was born August 29th, 1935, in New York City. And I grew up there and went to grammar school, high school, and college. And then I escaped to Baltimore.

Hochheiser:

Just a little bit more on that - what did your parents do?

Plante:

Well my father and his brother owned a delicatessen in Long Island City, and so that was how they made their living. My mother, before she was married, was a registered nurse, but she didn't continue in the nursing business, she was raising her family. So she was a stay at home mom.

Hochheiser:

Were you interested in technology and science growing up?

Plante:

Yes I was. Probably the thing that stimulated not only me but a lot of other young men and women - I grew up and experienced World War II.

Hochheiser:

Right.

Plante:

I developed an interest in following what was going on in the newspaper, the various campaigns, and how they did things and whatnot. I had an uncle who was a radio operator on an aircraft carrier, and so I began to get interested in the technology that was involved in this. And of course, when the atom bomb was dropped, that developed

a wider span of interest in the sciences. Everybody wanted to be a nuclear physicist at that point. We weren't quite sure what it was, but it was the new branch of the sciences. And I went through several changes of mind as to where in the sciences I wanted to go, and when I finally headed to college I registered in a course in electrical engineering, so that's probably the real start of my engineering career.

Hochheiser:

And what led you to Brooklyn Poly?

Plante:

Well at that time if you wanted to study engineering, there were only about two or three colleges in the New York City area that offered engineering as a program. And I applied to Manhattan College but they were already filled up at the time I applied, and then my advisor in high school advised me to go down and talk to Brooklyn Poly, and I did that. The next thing I knew I was registered. It was at that time, and it still is, a very fine engineering school.

Hochheiser:

Yes it is.

Plante:

And had an excellent curriculum and I came away, I think, with the right tools in my toolbox when I finished.

Hochheiser:

What was the curriculum in electrical engineering like there, when you were a student?

Plante:

Well, they had two majors in electrical engineering. One was a power major that focused on rotating machine and transformers and power generation. This equipped you to work for electric utilities or companies manufacturing equipment for the utilities. And the other one was called communications and electronics, where you took a few basic courses in rotating machinery and transformers and that kind of thing, but primarily the

coursework was in electronic circuit analysis and electromagnetic fields. At that time the common technology was vacuum tube circuits.

Hochheiser:

Right.

Plante:

Although, they were introducing circuit analysis of transistor circuits at that time. So when I graduated I was probably among one of the first few classes that ever saw a transistor. So in that respect it was a wonderful time to start. I started in the solid state electronics era in the mid-1950s that is still going on. This was a time of accelerated technology development and discoveries. The kind of work that I did when I first started, after graduation, compared to where I was even in the middle of my career was radically different because the technology had changed so much. It was a very interesting time to be in the electrical engineering business.

Going to Westinghouse, Bomber Defense Group

Hochheiser:

What led you to Westinghouse rather than some other opportunity, some other company, when you were finishing up your college?

Plante:

Well I talked to several companies prior to graduation, and I had a very good friend of mine who two years before had graduated and he had gone to work for Westinghouse, and he was located here in Baltimore.

Hochheiser:

Right.

Plante:

And so he said, "why don't you come on down and I'll get you an interview, and see what they have to offer you." In the end that was the job I selected because, to me at

least, [they] offered the broadest range of opportunities and different technologies in electrical engineering here at Westinghouse.

Hochheiser:

Did you start directly at Baltimore, or did you spend any time in Pittsburgh?

Plante:

No, I started directly at Baltimore.

Hochheiser:

What was your first assignment?

Plante:

Initially I was assigned to a group called the Bomber Defense Group and it was responsible for developing defensive electronics for bombers. And in particular I was working on a program that was building what we referred to as tail turret systems. The aft-mounted, radar controlled guns were intended to be installed [on] Navy bomber and patrol aircraft. More than 100 systems were installed in the Navy A3D. The ill-fated P6M, which was a jet-powered flying boat, was another candidate but only two or three of these were built. After two of these crashed during [the] flight test of these prototypes the program was cancelled. There were a couple of other candidate platforms. I was working on the computer for that system, which was an analog computer as opposed to today's digital computers. This interested me because I had taken courses in my undergraduate career in servo-mechanisms and analog computing, so it filled out my knowledge in that area as I got started.

Hochheiser:

Who did you report to?

Plante:

I reported to a fellow by the name of Joe Legin who went on to become kind of a legend in Westinghouse, Baltimore. George Towner was the department manager at the time. They were the folks that I reported to.

Hochheiser:

Did you start out as an assistant engineer?

Plante:

Yes.

Hochheiser:

Which is I guess the standard entry level.

Plante:

Yes, standard entry level position, and you worked your way up from there.

Hochheiser:

When were you promoted to simply engineer?

Plante:

Well there were two grades - there was assistant engineer and associate engineer, which was the first grade where you were an exempt employee, and then there were a couple of grades of senior engineer, and it went on from there.

Hochheiser:

Right, and you gradually work your way up.

Plante:

Yes, but I guess the most significant step along the way was when I was promoted to a supervisor engineer.

Hochheiser:

We'll get to that. Okay so you're working, your initial assignments were on several tail turret radars.

Plante:

Yes. And the analog computer portion of it.

Hochheiser:

About how long were you working on those?

Plante:

About two or two and a half years. I got involved in flight test programs which employed Navy P2-V aircraft. We flew here locally over Chesapeake Bay, and then later on the aircraft were delivered to the Navy down at Patuxent Naval Air Station in St. Mary's County. I went down there several times to participate in flight tests. But then it was interesting, we were delivering tail turret systems towards the end of that program while they were taking them out of the airplanes that they already had them in, and they were putting counter measure systems in. They were converting a number of the A3Ds to jammer airplanes if you will. Fairly primitive technology at that time.

Hochheiser:

But I guess it was state of the art for that day.

Plante:

Right, and the thing that was driving that was again the technology changes; up until that point the primary threat to the bombers were interceptor fighters of various sorts. And prior to that point they were principally armed with machine guns, 50 caliber or 20 millimeter automatic weapons. But then they began to add to their armament mix missiles. Now the early ones were unguided missiles, they were 2.275 rockets and missiles of that sort, but the design of the tail turret systems and the guns that they employed were such that their effective range reached out to about 2,000 yards. Well, particularly with the rockets the interceptors could stand off outside of gun range and shoot at them, so they had to do something to deal with that. And that led to the eventual gradual removal of the tail turret, or the tail gunnery, capability on a number of the bomber aircrafts.

B70

Hochheiser:

So then I guess that if the tail turret radar is becoming technologically obsolete, you're going to need a new assignment.

Plante:

That's right, so it turned out that about that time, I guess it was around late-1958 to early-1959, North American Aircraft had been awarded a contract to develop the B70 which was a super duper bomber for that period. They conducted a competition to provide a countermeasure system for the B70, and I was part of a group of people that was working the proposal effort for that. It seemed to go on forever because - we used to kid about it - they put out the request for [a] proposal, containing a specification, supporting documentation, etc. We generated a response and then at least weekly and sometimes more frequently than that, we were getting telegrams and teletypes back from North American with questions that they wanted answered about our proposal. You never knew when these things were coming in so you'd be doing something and all of a sudden, "Oh, stop everything, we've got a bunch of questions and they've got to be in by Tuesday." That went on for months, and the questions got longer and longer, but then the basic bomber program experienced some difficulties and I think it was funding. I would characterize the B70 program as one that tried to advance the state of the art much faster than it was going to move. There were a lot of long technical reaches involved in the requirements for that program. Eventually they awarded a contract to us, and then not too long after, a matter of a few months, we got a stop work order. Not because of anything that we did or didn't do, but the whole program had difficulties and they said, "let's stop, we've got to regroup and figure out where we are and where we're going to go." Then they turned us back on again, and then during a fly-over one day, one of the prototypes - they only built two prototypes - one of the two prototypes crashed. One of the accompanying aircrafts collided with it, and it went down so they only had one airplane left. The Congress finally decided this is much too expensive and they're not going to put up with this anymore and terminated it, which ended it all. So we, at that point, had to go find other homes for all of the people who were working on that program.

Hochheiser:

About how many people were working on that here?

Plante:

I don't know exactly but it was a hundred or so.

Hochheiser:

That was a big project involving a substantial group of people and new homes have to be found.

Plante:

Attempting to do the impossible.

Countermeasures Contracts

But anyway, that killed the B70 but what it did for us was that in the portion of the time we were on the contract, the Air Force commissioned us to go out to all of the different vendors of countermeasure capabilities around the country and find out what they had to offer to potentially incorporate it into this system. So as a result of that we got a very valuable tutorial period to train people as to what was this countermeasures business all about. It was more than just chaff dumped out a window some place.

Hochheiser:

Right.

Plante:

We started pursuing other countermeasures efforts. Primarily at that time the only thing that was available, the B52 system, already had a contract with I guess it was Hallicrafters at the time for the equipment to go on the B52. There were one or two other efforts that were already off and running. What we pursued was primarily small development programs out of the avionics lab at Wright Field and some small programs out of the Navy. We had a couple of small contracts prior to the B70, one of which was with the Navy for a countermeasures pod for dispensing chaff, flares and decoys. We also had a passive interceptive tracking system, which was kind of an early version of a warning receiver, so we weren't totally without some credits in that field. So for a couple of years we were chasing contracts that would run typically about 50,000 to 100,000 dollars and we'd keep two and a half people busy for a year. It was how we acquired our education really. It was to start with those small things and work our way up.

Hochheiser:

So is this what you were doing after the B70 was cancelled?

Plante:

After the B70, yes.

Hochheiser:

You were out chasing those small contracts?

Plante:

Right. And periodically we would catch one.

Hochheiser:

This sounds almost like sales work then.

Plante:

Well it was. We were out there, the technical guys were supporting the marketing guys. We went out as a team, so yes it was. There was a lot of sales work involved in it, and so many interesting experiences out of that. One of the fellows had won a contract from Wright Field and I forget what it was. After the contract had been awarded, they went out for a kick-off meeting to sit down with the customer to make sure we were in agreement as to what the task was and so on. They went all the way through that, and at the end of it they concluded, yes, that covers everything and they are about to wrap up and head back home, and one of the Air Force fellows says to him, "yeah, but Joe Legin promised me…" and then we had an unfunded task in our lap. But it was challenging and it was a lot of fun.

Hochheiser:

And how long did this go on?

Plante:

A couple of years, well it went on longer than that because it became a part of the whole business. You had to keep working the technology to keep the pipeline filled up

because there weren't that many production programs around, and you had to earn your way into those.

ULCER

Hochheiser:

So you were doing this sort of thing for a couple of years?

Plante:

Oh yes, but there was a bit of a detour. In 1959 I was 'temporarily' assigned to the ULCER program. The Westinghouse Marine Division in Sunnyvale, California was involved in the Fleet Ballistic Missile Submarine program. They were responsible for the missile launching system. Electric Boat Corp in New London, Connecticut was the prime contractor. There was a concern that if a launch was ordered under high sea state conditions the surface waves might cause the missile to tip beyond the recovery angle limit as it passed through the air/water interface. A couple of approaches were considered. The one selected was the Underwater Launch Condition EvaluatoR otherwise known as ULCER. This system employed an array of high frequency sonar transducers aimed upward along the deck of the submarine. In addition to these it had an array of water velocity meters to measure water flow at the mouths of the launch tubes. The system was installed in the missile launch control compartment. The displays showed the operator the water velocity in the launch tube areas as well as wave profile above the launch tube area. This allowed the operator to select the optimum launch condition. Initially my responsibility was the design of the transmitter and the receiver. Later I was sent to support the initial test cruises conducted by Electric Boat off New England. I sailed on the George Washington, SSBN-598 and the Patrick Henry, SSBN-599 the first two Polaris missile subs in the U.S. Navy. During these cruises lasting several days each and virtually all of the systems on each boat were exercised. The launch tubes were exercised using instrumented dummy missiles containing water ballast to simulate the weight of a real missile. When these were fired they dumped their water load and floated on the surface and were picked [up] by support boats. For some shots they fired water slugs from the launch tubes. After the first two boats the field engineers took over the test support. My last contacts with the submarines included a cruise on the Patrick Henry out of Port Canaveral in Florida and a visit to the George Washington in New London on the occasion of its return from its first 'War Patrol.' The Patrick Henry adventure in Florida was the final element in its qualification which involved the submerged launch of two live missiles, without warheads of course.

Pod Programs

Hochheiser:

And then.

Plante:

After this "temporary" assignment which lasted about a year and a half, I returned to Electronic Warfare Programs. About this time we started getting some larger, very significant programs. The Air Force recognized that in the tactical aircraft they had made provisions for installing a radar and some radios and some navigation gear, and one or two other things, and that kind of filled up the airplane. So now when this countermeasures stuff came along and they decided that they might need some of that one day, there was no room in the airplane. So they started looking at alternative approaches, and one of those was to hang pods from the bomb racks on the wings. We won a contract out of Wright Field for what was then known as I think the modular ECM pod. It was a ten inch diameter cylinder with a nose cone and a tail cone, a ram air turbine generator, and a structure inside of it that provided cooling. That was interesting because we had no conditioned air, we were stuck with ram air. So some of our clever mechanical engineers came up with a cooling approach in which you had - imagine a slab that ran a length of the pod, and it could slide in and out and you mounted the electronics on either side of the slab. This slab was hollow, and it had water in it, and the way that we dumped the heat was let the water boil. The electronics would dump the heat into that, quote, 'heat sink' and you could carry enough water to match the mission time. Later on we got a little bit smarter about that kind of thing, and I'll talk about that later, that's the ALQ131. We wound up being the guys who had developed a standard structure, so from there on even for little develop programs we could offer something to them that they could put on the airplane they intended to defend, not some big airplane that you could walk around in. We could put the product there and fly it as they intended to fly it, so it gives a competitive edge in that regard. Now, there are other pod programs in both the Air Force and the Navy, but this quickly became the Air Force standard for its structure. And the other thing that we got involved in was using that pod structure. We had a development program that pre-dated the B70 again, or a series of those for ECM against Pulse Doppler radars. Now at that time there were no Pulse Doppler radars deployed anywhere. The only ones that existed were the ones in this country that Westinghouse had built which were prototypes and experimental models. But the Air Force wanted to have a concurrent development for countermeasures against this kind of technology. We had some early programs for things called Pulse Doppler repeaters. We put one of those, or something like that, in a pod which became

later on the QRC249 which was a repeater jammer, a coherent repeater jammer, which was a very different animal than all of the other ECM transmitters up to that point. The ECM transmitters up until then, for example in the B52, were predominantly noise jammers, and they weren't very smart. They were barrage jammers or maybe swept spot jammers. And the Navy had a few pulse repeaters but they weren't coherent, so this was kind of a unique animal. It was interesting, the Air Force liked the idea, and in fact, we added noise jamming capability using the same transmitter as we went down the road, They were very interested in the pod structure, that repeater capability and so on. There were a few guys over in Navy Air who had countermeasure programs with these non-coherent repeaters, and they didn't want to hear about coherent jamming. They thought that was the worst thing in the world you could do. And secondly, they didn't want to hear about pods because they felt that they'd be rolling around on the deck of the aircraft carrier, which was kind of odd since they don't worry about the bombs rolling around. [Laughter] Same shape, and they fit [in] the same rack.

Hochheiser:

Right.

Plante:

Primarily the business that we'd get was the Air Force business and we kept trying to get into the Navy but it was a long time before we did that. There were a whole series of these pod programs that involved developments of pods with varying capabilities, increasing frequency coverage, higher power, and so on, and as a matter of fact I brought a picture with me. That kind of summarizes some of those early pods. I wasn't full time involved in the pod developments, I was working primarily on the receiver side of things, but I did participate in all those proposal efforts and in a lot of the selling efforts, so it wasn't totally unknown to me by any means. Let me see. Yes here it is. Now these are the early pods, and they started down at the bottom with the, well these were the ones that eventually got into production and QRC 335, ALQ 101s and on up to the ALQ 119. We built several hundred. I probably could go look it up, but we built a whole lot of these. And there's another family beyond, that's the ALQ 131, which is still flying as a matter of fact. It's been through various updates and improvements. But that was the active countermeasures side of things. On the passive side, we built some special purpose receivers for a variety of applications.

Hochheiser:

So were these the receivers you said a minute ago you were spending most of your time with?

Plante:

Yes, most of my time. In fact ultimately I was responsible for that side of the product line.

Hochheiser:

Okay.

Plante:

But this was the break out, if you would, of the pod business. During the Vietnam War we were shipping those things as fast as we can run them out the door. I mean we were building, delivering them almost daily. It was really going.

RWRs, Project THALO

Hochheiser:

Can you tell me something more about the receiver end of things?

Plante:

Yes, well we did a lot. The primary receiver business that both services, Air Force and Navy, employed was the so-called radar warning receivers, or RWRs. Early on there were a bunch of people who were building those, including ourselves, but when this business started to boom, the pod business, then we focused primarily on the smaller parts of the receiver world because we were looking forward to - and the customers were looking forward to - incorporating receivers into these kinds of transmitters to make them smarter so that they would respond with the right thing at the right time. That was where our vector was pointed, but we did make some receivers. For example there was a program called a QRC 402 in which we incorporated a receiver in the F4 series of aircraft. By the way, we were building the radar for that airplane at the time, so we were very familiar with it. What we did was to try to demonstrate a capability to integrate a receiver [that] would track outside the radar band, and accurately locate air-to-ground threats on the ground so they could accurately deliver smart bombs on it because at that time the typical warning receiver gave you a rough idea of where the thing was, it

was over in that quadrant somewhere. And that wasn't very good for delivering any kind of munitions on the target.

Hochheiser:

Right.

Plante:

We had a development program to do that and we built several versions of that warning receiver, the Air Force elected in the end not to equip all of the aircraft with that kind of capability. We also built some functionally similar receivers for the Navy to supplement the defensive systems they had for missiles targeted at ships, the low flyers. We built a couple of sample receivers for cueing the radar that pointed the guns onto those signals so that they could accurately track it. There was one other case where we had a special purpose warning receiver that we built, it was - I think I mentioned it - Project THALO.

Hochheiser:

Right, and that was?

Plante:

That was a special purpose warning receiver for an airplane that didn't exist at the time, at least that was the cover story, but ultimately became the SR71. In fact, Westinghouse built some other sensors for their aircraft that I can't talk about. We built about ten of those, which for the fleet that they had at that time pretty well armed them all. Later on those were replaced by more sophisticated receivers because initially they were only concerned about missile systems like the one that shot down Gary Powers in the U2. They had other sensors for collecting intelligence on the broader range of radar systems, but there were only one or two threats that could reach that thing when it was flying at altitude. So those were examples of some of the things that we were doing. In the early 1970s the concept of integrated ECM systems with receiver processors for identifying the threats and controlling the responses and so on became more and more of a hard requirement. In the end the Navy and the Air Force and the Marine Corp and the Army actually got together for a while and sponsored a program called - well initially it was a bunch of development programs so it masqueraded under the names of light weight, low cost, design to cost, and so on. But those were development programs that developed some critical capabilities that they wanted incorporated in this next generation system, and that was a system beyond the ALQ131. I don't think I have a

picture with me of that. Let me pause for just a moment just to keep the chronology running in the right direction.

Hochheiser:

Right. I know you've jumped over a number of things, but as long as we go back and catch them.

Peanut Pod, Arc 63

Plante:

Yes, one of the things that I jumped over was the QRC272 or the Peanut Pod.

Hochheiser:

Right, and is this the point when you become a supervisor?

Plante:

Yes, I think so, that was probably about that time. It might have been a little earlier. The Peanut Pod was an interesting concept; let me show you a picture of it. I'll tell you the last couple of days I've been rummaging through some files I haven't been in in 15 years or more.

Hochheiser:

Yes, but I'm asking you to probably talk about things you haven't given much thought to in a long time.

Plante:

Right. [Holding up a picture] That's a good picture of it right there. Okay, it's that ten inch diameter circular pod structure, and it has this big long nose that sticks out, and this side of the nose is flat, and basically what it is is a side looking passive radar if you would. It's looking out to the side, and intercepting signals and trying to determine the angle of those signals. It had in it a modulator that would allow it to modulate the onboard aircraft radio and in real time transmit the intercepts back to the ground. We were the prime contractor. Clifton was doing some - we needed some information on pitch and roll and whatnot, the aircraft dynamics, they did that part of it, Hughes built a

modulator for the aircraft radio. For a while we had Melpar down in Falls Church, Virginia as a subcontractor for the primary receiver on this thing. Later on we had to terminate that contract and do it ourselves because they weren't getting anywhere. The concept was this would fly along parallel to the front or whatever the separating boundary was, and look across the air and determine the radar order of battle and the location of those radars on the enemy side. It was a very challenging thing to do because, as you can see, this thing is sitting underneath the wing of the aircraft, and what you get when you do that is you get a lot of reflection off this wing. Needless to say, its accuracy never really achieved what we thought we needed. Eventually it went through flight tests but the Air Force decided that they're going to have to find another way to do this. And ultimately they did two things - the next version of this kind of a machine was installed internally in the aircraft, above the wing. And it used a phase comparison approach as opposed to an amplitude comparison, which was what this was.

Hochheiser:

What aircraft?

Plante:

That's the F4. Here's another shot. [Holds up picture]

Hochheiser:

Okay.

Plante:

We built two of those, but that was as far as that particular program went. Just to fill in the background, there were a couple of other programs that we did for the Air Force out of Wright Field in the countermeasures area. The Arc 63 was the first example of spread spectrum communications in the Air Force inventory. They were going to spread spectrum transmission for communications to make them less detectible. They let a couple of development contracts, several of which we got, to pursue techniques for A) detecting these noise like signals that were literally down in the noise, and B) to develop some techniques for describing the parameters. The typical radio of that type employed phase shift keying with a bit stream that was a pseudo-random sequence. Then you would transmit that signal, and the receiving station would use the same sequence to collapse to spectrum and read the information in it. So, things such as the clock rate of

that bit stream w[ere] important for exploiting the signal, and determining exactly what kind of modulation they were using and so on. We did those kinds of things. As I recall it, at that time in the services there was a kind of a debate going on, if you would, about whether or not they really ought to jam communication signals at all. Because the good guys and bad guys were using the same frequency bands - how do I make sure I'm not stepping on my own traffic, and so on. They never really took it that far. The Army did a lot more in that area. The Air Force seemed to have decided not to fool with that stuff, at least as far as I could tell. And of course, as far as intercepting our signals and describing them, the guys down the road at Fort Meade were very interested in that. And they pursued that on a pretty much in-house basis at that time. But they were interesting programs, and a lot of fun.

Westinghouse in the 50s and 60s, Becoming Supervisor

Hochheiser:

What in general was Westinghouse here in Baltimore like as a place to work in the '50s and '60s?

Plante:

Oh it was great, it was great. The corporate culture was wonderful. As far as I'm concerned I would characterize the corporation as one with a lot of ethics, a lot of concern for the people that work for them, very interested in developing the technology, and very different than it became in the mid '90s where, effectively, they sold everything out and had jumped into the media business. But right here in Baltimore we had clustered probably 80 or 90% of the technology work in the corporation, and we were always pressing forward. We had our own - and it's still here - solid state laboratory for building integrated circuits and for the solid state microwave kind of stuff going on. From a technology standpoint it was right up there. And I think that they treated the employees very fairly, so as far as I was concerned it was a great place to work.

Hochheiser:

How did you find the transition to being a supervisor and having people report to you?

Plante:

I liked it. [Laughter] No, I enjoyed it, and I guess the thing I enjoyed most of all is that the guys that I was working with were a bunch of smart guys, and if you sat down and laid out the problem, they'd go off and find a way to do it - they would cooperate with each other. It wasn't a big competition going on, so it was very enjoyable.

Hochheiser:

Did you find that you were spending much of your time in the second half of the '60s doing supervisory work more than actually doing the engineering yourself?

Plante:

Well I was doing less of the engineering myself, but I was still responsible for reviewing their work, and I was deeply involved in the technical problem, and it remained that way pretty much throughout my career. I had later on increasing administrative responsibilities but I still had my fingers in the technical pie if you will.

QRC402, ALQ-165

Hochheiser:

Are we up to the QRC402 in the late 1960s?

Plante:

Yes, the QRC402. We're in the late '60s and we built a couple of those systems. I think I've got a picture of the receiver here someplace. It fit in a modular package that hooked right onto the radar package, and it allowed it to get our RF pipes into the receiver chain of the radar and so on. Also, as a part of that effort, we had put a digital computer in the aircraft that provided some very major advances in being able to drop bombs accurately.

Hochheiser:

So is this replacing an analog computer at this point?

Plante:

No, no, no - this was in addition to.

Hochheiser:

Oh, so this was not replacing an older component, this was a new additional component.

Plante:

No, a new component.

Hochheiser:

That's what I was asking.

Plante:

Yes. It involved a very accurate bombing system. Ultimately it went through flight tests, and the flight test was not handled very well by the Air Force. The other thing probably that was a negative was that they were in the process of going through the last of the F4 models, this one was a - D, and I think they went up to the E and the only one beyond that was a Navy F4 version and that one was a little later. So the Air Force was looking at replacing these airplanes, and I think from an economic standpoint it wasn't considered all that great. So it got through development and stopped there, but it was an example of another special purpose receiver that was integrated.

Hochheiser:

Right. One of a whole series that you were involved with in this period of time.

Plante:

Yes. As I began to say, at that point the services got together and came out with these small development programs. Through these programs they had us build some demonstration models for some of these key capabilities that they wanted. They eventually came out with the specification that was very complete in terms of the required capabilities and performance. The program was known as the Advanced Self Protection Jammer (ASPJ), later known as the ALQ-165. Without that roughly two years of focused development effort it could never have been achieved. It required a whole new approach to the system development and design. The other challenge in that program was that the same set of hardware had to fit about a half a dozen different airplanes, all of which had different cooling systems, different hole shapes, etcetera.

Originally they were looking at one of the Army's fixed wing aircraft, a twin Beach, this airplane was primarily a surveillance aircraft. The Navy had the F14, the F18, the EA-6B, while the Marines had Harrier and the V-22. The Air Force candidate was F16 that they wanted. So the first challenge was [to] find some set of boxes that you could configure to fit all of these different slots, and that was a challenge. It was highly modular system. The basic system, as it was known, consisted of five boxes - there was a high band, a low band transmitter, a high band and a low band receiver, and a processor. But for the F14, which was a bigger airplane than the F18, for example, and also had a bigger radar cross section, we had what was known as a common system, which added an additional high band transmitter aft that was driven by the forward system, so it had six boxes. And we had to develop the racks for each one of these to hold it. The cooling ranged from a relatively small amount of conditioned air on one platform up to systems that were fully ram air cooled, as well as hybrids of cooled and ram air. And of course, those that had conditioned air, the conditioned airflow and inlet temperature was different on each platform, so there were some very, very challenging thermodynamic problems involved in doing that. The other thing that was a critical requirement was they wanted a highly reliable system with MTBF's well in excess of 100 hours, which at that time was unheard of. Consider that we had nasty things like high powered microwave transmitters in it, high powered travelling wave tubes, which up to that point weren't the best things in the world from an MTBF standpoint. And then this great collection of electronics including digital assemblies employing state of the art high density gate arrays as well as a completely new approach to solid state integrated microwave plug-in assemblies. We did a couple of things. Number one, we said, "well let's start with the MTBF requirement, how are we going to get that to work?" One of the things that we were required to do was to build a set of thermal mock-ups of the system to verify that we could cool the system. What that allowed us to do was to get temperatures in various parts of the different boxes. The next thing we did is we built a computer model that would allow us to do the MTBF predictions, and crank into that prediction the actual component temperature as opposed to an average temperature for the whole box, or for the whole system, which, up until then, was a typical approach. So we had a prediction that was tailored to the exact heat distribution in the system. The third thing that we did was that we looked at the system and with an eye towards shortening the heat path between where the heat was generated and whatever the cooling stream was.

[Holding up a picture] Here is the common system. Those are the boxes that made it up, so there's two extra WRA's or LRU's, there's an augmentation transmitter and an augmentation receiver, and then the boxes here for the forward system, and this high band transmitter is the same as the forward high band transmitter. And you could also support this one, an extra one of these in the back. It was highly modular. Here's a transmitter disassembled, and a high voltage power supply, the low voltage power

supply and the travelling wave tubes went in this compartment. This unit was split apart so you had a high voltage power supply on one side, and the TWTs and the other portions of it on that side. This is the processor, which included the low voltage power supply; it provided all of the DC for the low level circuits. Then here is a processor - actually there's two computers in there, one which dealt with the system control, so it had the jamming programs, and the other was the one that dealt with the receiver that intercepted and recognized the various signals that we wanted to respond to, and also generated time markers and frequency markers for when and where in the spectrum the response should happen. And then let's see if I got one of the typical board. Yes, I see it, here's one. [Holding up another picture] We went to gate array technology and hybrid technology to get the packaging density that we needed.

Hochheiser:

Now, when you say we went to - is this a later development?

Plante:

No, this is part of this development.

Hochheiser:

Okay.

Plante:

There had been some hybrid circuits used prior to this, but not on the scale that we did it here, and you can see them here. This was new technology in general gate arrays. We modularized the RF components. This is one of the receivers, and one of the first ones we put together we used conventional wiring in. And then we went to a first level of printed wiring, but the critical thing was how do we deal with all of the RF interconnections that had to be made, and there were a multitude of them. So, you can see the final version here with the rigid cable, going to these plug-in units. Another novelty in this system was, and let me find one… [Selects another picture] This is a typical digital package, There are two cards that make up this package that are back to back, and then there's fin stock in between, so in effect, it has a plenum in it, and we would flow the air through that plenum and there were fins that stuck out into the air stream. The distance between the junctions in that chip and the airstream is a quarter of an inch at the most. That allowed us to get the minimum temperature drop between airstream and the components to be cooled. You see these things here are blind mating

plug-in RF connectors. Up until now typically if you had an RF cable then you had it connected to something, you need a little wrench to hook it up. This would allow this unit to slide in just like a circuit card and plug into the back plane and make all of the RF connections at the same time. That was a major step in applying the technology. All of these things plus a rigorous failure analysis program, and corrective action program, allowed us to demonstrate the required MTBF for this system, which was unheard of in that day. The other thing too is that by modularizing the system the way we did, you had a system where everything was readily accessible and the mean time to repair was almost nothing. These advances in reliability and modular design made the system maintainability and support cost dramatically better than any other system in the inventory.

Hochheiser:

Yes, if you've got pullout boards like that, that's a lot quicker.

Plante:

Well yes. And if you're careful about how you partition this stuff, each board hopefully contains one or two or three functions, rather than having them spread out over four or five different boards. So features were the things that we did in order to satisfy those system requirements. The thing is that the shape and the total volume (2.3 cubic feet) of the basic system had been defined by the predecessor system, the ALQ-126 by Sanders. That was the space we had to fit into. The ALQ-126 didn't cover as much frequency range, nor did it have the power output, and it didn't have the technique suite that this provided. So this was a major, major step.

Working with ITT, Operational Tests

Hochheiser:

Then I assume this went into production?

Plante:

Yes. There's at least one very novel aspect of this program, and that is that the services, and the Navy in particular, w[ere] concerned because every time they would develop a system like this, or a radar system, they'd select a contractor - he'd build a system, he'd produce a system, and nobody else could make it. They wanted competition in the

production phase, so they insisted in our original proposal that we form a joint venture with another company equally capable of producing it. And in our case that was ITT.

Hochheiser:

Okay.

Plante:

And [for] the competing team, they went through a couple selections, but there were three proposals originally, then they got it down to two. The other team was Sanders and Northrop. Finally Westinghouse/ITT became the winning team.

Hochheiser:

Was this joint venture for the development or just for the production?

Plante:

Both.

Hochheiser:

Then were all of these things you just were going through developed by a joint team from Westinghouse and ITT?

Plante:

Yes, yes. You talk about supervising people - when I told my engineers to prepare for the first time we got together with the ITT engineers, on a technical exchange, they were shocked. I said, "now here's what I want you to do, I want you to talk about all of the development efforts we conducted in preparation for this program." And they look at me and they say, "we're going to tell them about that? That's our best stuff!" They were concerned about revealing our proprietary data and trade secrets. The mantra on the program became, "you've got[to] remember this is a joint venture." I wound up being the joint venture engineering manager, so I used to have to tell that to both sides as we went along. But we managed to do it, and it was very interesting.

Hochheiser:

Where was ITT located?

Plante:

It was up in Nutley, New Jersey.

Hochheiser:

Okay, so I imagine there was an awful lot of back and forth between Baltimore and Nutley.

Plante:

Oh yes, even before the contract was awarded because we were producing the proposal. We had a charter airplane that we'd take up there, we'd go up a couple of days a week, and they'd come down here a couple of days a week, and switch back and forth. That went on for months. I got really tired of flying in little puddle jumper airplanes. [Laughter]

Hochheiser:

I bet, I bet.

Plante:

Eventually we went through a step where we built some prototype systems and production design systems, and then finally the final configuration until they were done. The system went to operational test eventually out at China Lake.

Hochheiser:

About when?

Plante:

Let me see if I have it here. Well the test program overall started in '84 but it lasted a lot longer than that. The final operational test was probably '90 - you know I'd have to look it up.

Hochheiser:

Well that's okay and you can always fill it back in later. So this is quite a long process, you're starting this back in the '70s.

Plante:

Yes, the first whispers were in the '70s, and the final system - now, needless to say, we didn't finish this program on schedule, not the original schedule, which was extremely optimistic. So we went through some extensions on the program in order to allow us to get everything done. The early part of the program was a very expensive part for the contractors involved because in effect we were under a fixed price situation.

Hochheiser:

Ah, and as it proved to be a big and more complex problem -

Plante:

It got more expensive.

Hochheiser:

Yes, and since it was a fixed price there was no more money coming in.

Plante:

Right, it started out as a cost incentive program, but that didn't last long They finally capped it. But as far as this was concerned it went to operational tests.

Hochheiser:

This is in '84.

Plante:

Well, yes that was not OT, that was the first flight test out of China Lake.

Hochheiser:

I'm sorry, I skipped a couple steps.

Plante:

Yes, but eventually we got to operational test, and the DOD people for OT&E were cleaning house and changing the way they did business. The requirements that the Navy had laid down at the beginning of the program, against which the equipment in the program would be evaluated, some of them were fine, we didn't have any problem with meeting those. But the performance requirement against the threat they didn't know how to express it, and so basically they said, "alright you've got to improve the effectiveness against threat by X%." The no ECM condition versus the ECM condition. That muddied that whole operational test environment. In addition to which, at that point there were competing viewpoints as to what their requirements were. To make a long story short, we wound up with an unfavorable OT report and everybody's wondering "oh my gosh what do we do now?" They did continue the program for a while. We were allowed to also get the FMS sales plus a couple of the early production lots. We sold the system to Korea, to Switzerland and to Finland, and we did deliver all of their systems. Korea and Finland w[ere] flying the F16, and Switzerland was flying the F18, so we satisfied those requirements. But ultimately, I think we finished maybe two production lots and the Navy stopped the program there. At that point, the threat included and had included for some years a coherent capability on a part of the bad guys. The Navy effectively had little if any deployed capability against those systems. When things got hot in the Balkans, they had to put the system in some airplanes there to protect them because some of those coherent systems on the ground were in use at that point. Ultimately they started a new program called IDECM. Basically it was a towed decoy type program.

Hochheiser:

But this wasn't something you were involved in? You're just telling the general story of this.

Plante:

No, the general story. The initial concept was they were going to use parts of this system, the ASPJ, and add a decoy to it. They went through a procurement process and finally the team headed by Sanders won that contract, and if we had problems on the ASPJ program, they beat us out on problems in the next program. To this day I don't think they have a decoy that they can safely fly.

Hochheiser:

I guess that says something about the difficulty of the task itself.

Plante:

Yes, it had difficulty but there were people difficulties too. Management problems. Severe management problems. So anyways, where are we?

Hochheiser:

Let's see, so you - according to what you sent me, you managed this joint venture program until about 1985.

Engineering Manager

And at that point you became engineering manager for the EW division?

Plante:

Right. Up to that point, as far as Westinghouse was concerned, I was responsible for a portion of the EW engineering department that was working on the ASPJ project. And when I escaped from that project, they gave me the whole thing.

Hochheiser:

So, was that a reward?

Plante:

I think so. [Laughter] So I continued to be involved in ASPJ.

Hochheiser:

Right, because this now reported to you.

Plante:

Right, that was only one part of my responsibilities.

Hochheiser:

So what were the other major things?

Plante:

Well, the ALQ131 pod program and there was still some ALQ119 effort going as well as some development programs, and improvement programs on those things. We were probably shipping three to four hundred million dollars a year in EW products.

Hochheiser:

Would these largely have been the pods?

Plante:

The pods, the ASPJ, and the smaller stuff. We were pretty prosperous at that point.

Hochheiser:

As the engineering manager, what part of the total EW effort was under you?

Plante:

From an engineering standpoint? Almost all of it. There was a portion of development activity that reported to another manager, but other than that, I owned probably, I don't know 75% to 80% of the systems engineering assets.

Hochheiser:

And who, in turn, did you report to?

Plante:

Westinghouse had a matrix organization, and if you're not accustomed to that it's difficult to understand.

Hochheiser:

Well, I've had some experience myself, and also I've been listening to other people from Westinghouse.

Plante:

Technically I belonged to the division that was responsible for advanced development. At this time I reported administratively to the Engineering Manager of the Systems Development Division.

Hochheiser:

Okay. And who was he?

Plante:

He was a fellow named Bob Hughes. Now, some time later that position was eliminated and at that point I reported directly to the general manager of the development division.

Hochheiser:

Who were?

Plante:

After the organization change I reported to Kelly Overman who became General Manager of the Development Division. On the program or product line side I reported to the General Manager of the EW Division Jim Holman and then Bill Jones and later Sal Cuomo.

Hochheiser:

So, I gather as the engineering manager, this pod project took a lot of your time.

Plante:

Oh yes, yes. The pod project and other things. We were doing work for the intelligence community, primarily in analysis of some of the signal collection and some other intelligence related tasks. I had some of that activity reporting to me and some other related development programs.

Hochheiser:

How was your time allocated between internal things like managing these groups, and customer contacts - did you do much of the latter?

Plante:

Oh yes, I did. I still did a lot of customer contact, not customer contact in the nature of just kind of wandering around calling on our customers.

Hochheiser:

Right, you're not in the sales position, right.

Plante:

Yes, but I was right in the thick of things anytime there was a major design review. Then periodically we'd have to go out and visit the customer on some issue or new project or something like that and I'd be involved in that. I was on a committee for an analysis of defining measures of effectiveness for EW systems. That's one of those items where your position description says "and other tasks as assigned." So I was working with the DOD on some of those.

Hochheiser:

So you were assigned as Westinghouse representative to this DOD committee.

Plante:

Yes. There wasn't just this one. These things would pop up periodically and I'd get that. They would just look around and say, "you're it."

Hochheiser:

And so would the members of the committee be people from various contractors?

Plante:

Yes, from other companies who were working the field, plus consultants, various beltway bandits and government employees.

Hochheiser:

I know it's a hard question since it's a matrix management system, but about how many people did you have in your organization?

Plante:

When I stepped in as engineering manager I had about 125 engineers. As the business changed and some other things happened, that probably moved down to around 80 or 90, so it was a pretty good stable of people.

Hochheiser:

How do you manage a group of 100 people for both success of the programs and success of the individuals?

Plante:

Well, I had a staff of intermediate managers that reported to me. That helps a whole lot, supervisors and managers. I didn't bring an organization chart with me, but there [were] several guys that reported to me that took care of the care, feeding, and encouragement of the staff.

Hochheiser:

Anything else about this position before we move onto your last position?

Plante:

Well it sure kept me busy.

Hochheiser:

I bet.

Plante:

And again it was enjoyable work because I was getting out and meeting the customer, and maintaining relationships that I developed over many years with the customer community and we were doing interesting work, so it was enjoyable.

Chief Engineer, Retirement

Hochheiser:

Then your final position in ’93 was as chief engineer reporting to the division manager?

Plante:

Right.

Hochheiser:

Now, is this a staff rather than a line position now?

Plante:

It is. I thought hard about making that step.

Hochheiser:

How did that come about and what did you think of it?

Plante:

Well, they were doing a major shuffle of the organization, not just in EW but across the Defense Center. The management was implementing the philosophy of broad organizations with minimum reporting distances between levels and a minimum number of levels type of thing. There had been a chief engineer slot from time to time for the division, and so one day my boss said to me, my boss being the EW division manager.

Hochheiser:

Who was?

Plante:

Sal Cuomo. He said, “we’re going to do a shuffle here and I’d like you [to] take the position of chief engineer. I want you to be responsible for all the R&D effort, and also

oversee the other technology elements in the development and production programs, and help us plan how to lay out our R&D thrusts for the future." After I thought about it I said, "okay, let's do it." To a significant extent I didn't mind getting rid of the administrative issues. They were a whole lot less fun than the other side of it, so I agreed to take the position. They did the reorganization and we went on from there. I expected to be around a few more years than I wound up staying, but in '94 they came out with an offer for any employee who had at least 25 years service. My plan was to retire when I was 60, because at that age I would not take a pension reduction for retiring early. I looked at the offer and when I sat down and ran the numbers I said if I stick around until I'm 60, which was less than two years, it's going to cost me money. [Laughter] Where do I sign? So I bailed out at that point.

Hochheiser:

And then I see that you had a consulting contract with Westinghouse for a year after that?

Plante:

Yes. I worked about half time for another year.

Hochheiser:

Doing what?

Plante:

Well, primarily what I was doing was helping out with preparations for and writing the proposal for that next generation EW system, the towed decoy program. It involved not only in-house work, but also going out and meeting with the customer and discussing requirements and making sure that we understood what they wanted us to do and what approaches they were interested in and so on. So, I was keeping an eye on things to make sure that what we were doing made sense, and customer contact.

Hochheiser:

And then at the end of that one year, then you in a sense really retired?

Plante:

I said, "I'm off."

Hochheiser:

Right, since you really retired instead of officially retired.

Plante:

I found that working for a living was interfering with my fun too much, so I decided to give it up.

Hochheiser:

In what ways have you kept yourself active since retirement?

Plante:

I've done a lot of traveling, and I have some hobbies, one of which is making sawdust. I have a workshop in my basement and I build furniture. I'm involved in a number of volunteer efforts, and so on. I don't have any trouble keeping busy.

Career as Whole, Evolution of Westinghouse Baltimore

Hochheiser:

Looking back, how would you characterize your career as a whole?

Plante:

I think it was successful. I enjoyed it, I had some fun, in fact a lot of fun, and there w[ere] some times that were extremely difficult, but you know it's part of life.

Hochheiser:

Yes.

Plante:

So I enjoyed what I did, I'm proud of the work I did and the company I worked for, and I think there's still a lot of new technology to create and to use in electrical engineering.

As a matter of fact, two of my children are electrical engineers, and in fact four out of five are in the sciences, so they must have inherited something. [Laughter]

Hochheiser:

In what ways did Defense Center, Westinghouse Baltimore evolve over the course of your years here?

Plante:

Well it got a lot bigger. When I started in 1956 there was one building here at the airport, it was then called the Air Arm Division. It's the one closest to the instrument runway here, at the airport. And within about two years they built what was called the West Building or the electronics division, and later on they plunked another building in between them and connected them. They kept building all over the place, and they also opened up a number of places, College Station, Texas for a manufacturing place and we had an operation in Florida, and we had the Sunnyvale division out in California, and so it grew tremendously in the 39 years that I was involved. There's a little book, two books as a matter of fact I think - both of these are in the library here at the museum, this is one by Dr. Gene Strull.

Hochheiser:

I went through that to help me prepare to do these interviews.

Plante:

It's got a lot of good information in it.

Hochheiser:

An enormous amount of great information. I would have had a much more difficult time preparing for these interviews if Gene hadn't written that.

Plante:

And there's another one, John McCarty was the principal author, it's his fault. [Laughter] I think Gene's of course is much broader, John's one only deals with the EW. I think Gene's is a bit more accurate. I know there's a bunch of mistakes in this one, but those are two good resources.

IEEE

Hochheiser:

As you know, I am from IEEE, so one thing I'll ask you - were you ever a member of IEEE or its predecessor IRE?

Plante:

Yes to both.

Hochheiser:

And what was the extent of your involvement with the IRE and IEEE over the years?

Plante:

From a practical standpoint, not much. I used to get the magazines, and even read them from time to time, but I was not active in any of the committees or whatever.

Hochheiser:

Well, for either conferences or the local section, you were not at all engaged.

Plante:

No.

Hochheiser:

Did you find the publications useful in your work?

Plante:

Oh yes, particularly early in my career - you know the IRE publication was excellent, and I used that on a number of occasions. But particularly when I got more involved in the management side of things, that wasn't the kind of information that I really needed to get things done.

Hochheiser:

So did you let your membership lapse at that point?

Plante:

Yes.

Hochheiser:

Well, I had this whole stack of cards, they are now face down, so is there anything that you would like to add or talk about that we didn't cover, that I neglected to ask?

Plante:

No. I guess I just would in closing say that it was an excellent time from the standpoint of technology development to be in this business, and I was in a part of the business that I think, as I said before, with a company that had a strong ethical sense, strong technology sense, and that they cared about their employees.

Hochheiser:

Well, in that case, we're finished, I think you for coming here and sharing your story of your career here.

Plante:

You're welcome.

Hochheiser:

And thank you very much.

Plante:

Okay, I'm free to escape huh?

Hochheiser:

Well, you know we've got one last thing - we have to get the microphone back.
[Laughter]