ORAL HISTORY: John Gregory

About John Gregory

John Gregory was born in Baltimore, Maryland and grew up with an interest in science and technology. He attended Johns Hopkins University in the 1940s, studying engineering and also taking part in ROTC. After graduating, Gregory went to GE, where he worked until he was drafted during the Korean War, going to the Army Ballistic Research Laboratory in the computer department. After his military service, Gregory stayed at the Army Computing Lab as a civilian, working in design and modification rather than maintenance, on projects such as EDVAC and BRLESC. In about 1962, Gregory went to Westinghouse, coming in as manager of the Digital Systems Group. Throughout his long career at Westinghouse, Gregory worked in various other groups - such as Control Data Systems, Computing and Data Systems and Strategic Operations and Business Development – and on many projects - such as AWAC, AN/AYK-8, millicomputers and BORAM. Gregory retired from Westinghouse in 1996, while continuing to remain professionally active for three years on the Open Systems Joint Task Force and with his own work on energy and the production of electricity. Gregory joined the IRE in 1949, and was involved with the Aerospace and Electronic Systems Society (AESS) throughout his career.

In this interview, Gregory talks about his career, both with the Army and at Westinghouse. He discusses the various projects he was a part of, as well as working in management. The atmosphere and organization of Westinghouse are also discussed, as well as the major changes Gregory saw over his career – analog to digital and Westinghouse from a 'Radar House' to an 'Electronic Systems House.' Gregory also talks about various colleagues he had at Westinghouse, including Harry Smith, George Axelby and Paul Pan.

Note: A long-time colleague of John Gregory's, Jim Ross, was off-camera during this interview, and his occasional comments are marked within the text.

About the Interview

JOHN GREGORY: An Interview Conducted by Sheldon Hochheiser, IEEE History Center, 17 February 2010.

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Copyright Statement

Interview

Interview: John Gregory

Interviewer: Sheldon Hochheiser

Date: 17 February 2010

Location: The National Electronics Museum, Baltimore, Maryland

Background, Education and GE

Hochheiser:

This is Sheldon Hochheiser. It is the 17th of February 2010. I'm here at the National Electronics Museum in Baltimore, Maryland with John Gregory, and he's accompanied off camera by his long-term colleague, Jim Ross. Did I get that right?

Ross:

Right.

Hochheiser:

Very good. Good morning.

Gregory:

Good morning.

Hochheiser:

If we could start at the beginning with a little background. When and where were you born?

Gregory:

Baltimore, Maryland. And educated at Johns Hopkins.

Hochheiser:

What did your parents do?

Gregory:

Immigrants. I got a scholarship to go to Hopkins.

Hochheiser:

Were you interested in technology and science growing up?

Gregory:

Oh, yes.

Hochheiser:

In what ways?

Gregory:

Reading books on science and talking to people educated in the field.

Hochheiser:

Did you go to Hopkins with a particular course of study in mind?

Gregory:

Engineering. I had offers of scholarships for the Naval Academy or Hopkins, and I chose Hopkins at that time.

Hochheiser:

What led you to choose Hopkins over the Naval Academy?

Gregory:

I went to Baltimore Polytechnic Institute, and that was their A course which is engineering oriented. And I figured I would continue Engineering at Hopkins.

Hochheiser:

What was the engineering curriculum like at Hopkins when you were there in the '40s?

Gregory:

Mostly power engineering and a few courses in electronics at that time. And, of course, that was all tube technology. It was a good course, especially if you were going to get into the power engineering field. I went through college in three years, including summer session school as well. In the process, I was taking ROTC. And the last year, they didn't have the ROTC so I had 3-1/2 years of ROTC and then got drafted. I went into the Army and the interviewer says, what about your background? I says, well, I had 3-1/2 years of ROTC. And he says, what's that? So I ended up a private in [the] Army Infantry.

Hochheiser:

So from Hopkins, you first went into the Army?

Gregory:

No. From Hopkins, I went to General Electric, Co.

Hochheiser:

Okay.

Gregory:

And there I went through their student program, a very efficient program. So I went through power engineering, items like motors, generators, transformers even their research labs. They're three- to six-months assignments to decide where you want to work permanently.

Hochheiser:

Did you go to someplace in GE after that?

Gregory:

I went to GE International division because I was interested in the steel mill and power generation. And, of course, they were selling and installing equipment for various different foreign nations so it was good engineering experience and availability of equipment and types and maintenance requirements.

Hochheiser:

Where were you based?

Gregory:

Schenectady, New York and Pittsfield, Massachusetts.

Hochheiser:

The two -

Gregory:

Their power transformer division was in Pittsfield for a three month session.

Joining IRE, Korean War and ENIAC

Hochheiser:

If the IEEE records are correct, you joined IEEE, or rather, one of its predecessors, back when you were in GE. Do you recall?

Gregory:

Don't remember when I joined. But yes, I guess, IRE.

Hochheiser:

You would've been either in IRE or AIEE. The old records aren't clear. They just say that he joined in 1949.

Gregory:

Oh, good, thank you for reminding me.

Hochheiser:

Do you recall any involvement with IRE back then?

Gregory:

Nothing significant.

Hochheiser:

Do I understand correctly that the reason you left General Electric is that you were drafted?

Gregory:

Yes.

Hochheiser:

So by now, this would've been during the Korean War?

Gregory:

Yes, it was.

Hochheiser:

So tell me a little bit about what you did.

Gregory:

I got drafted, went through infantry school.

Hochheiser:

Right.

Gregory:

And then I got assigned to the Army Ballistic Research Laboratory in their computer department. And that's when I started on the ENIAC, EDVAC and the ORDVAC and then did a lot of work on the BRLESC computer.

Hochheiser:

Okay. If I can back up a bit. So the reason you moved from things like power engineering and motors to computers was because that's where the Army put you?

Gregory:

That's where the Army put me.

Hochheiser:

It's very interesting to see how people's career paths develop and for what reasons.

Gregory:

Well, in the process of leaving GE, there were no other power places available to me. The Army got me started in the computer area. And by the way, the [Aberdeen] Proving Ground does not get, or the Army doesn't get, credit for their work in the computing field. ENIAC was the first electronic, we'll call it digital calculator and computer.

Hochheiser:

That's generally what people call it.

Gregory:

Yes.

Hochheiser:

So you arrive at Aberdeen as a -

Gregory:

Private, assigned to maintenance on the computers.

Hochheiser:

Maintenance on the - so this time was, was ENIAC still being started?

Gregory:

Oh, yes. It was just being converted, adding a lot more memory and features to it.

Hochheiser:

Right.

Gregory:

Because the original ENIAC was really a calculator and then got memory and functions added to it and it became a full-fledged computer.

Hochheiser:

Right.

Army Computing Lab, EDVAC

Hochheiser:

How long were you in the service?

Gregory:

The required minimum, whatever it was, two or four years. And then I had Reserve duty, and became a civilian at the Army Computing Lab.

Hochheiser:

So you went to Aberdeen because the military sent you there?

Gregory:

Right.

Hochheiser:

As where they wanted you to serve your obligation. And then when you completed your obligation, you stayed there, but now were a civilian employee. Is that correct?

Gregory:

Right.

Hochheiser:

Were you still doing the same things, computer maintenance?

Gregory:

Oh, no. Because of my engineering background I got into the design and modifications of the computers. For instance, the EDVAC computer was delivered there, non-operational, or let's say it was operational, but not productive. So we had to go through and increase its reliability and things of that sort, and add processes to maintenance to guarantee that it would be available 24 hours a day except for once every 7 days, an 8 hour shift for maintenance.

Hochheiser:

Is this the computer that was designed at the University of Illinois? Or is that the next one?

Gregory:

No. The original contract for ENIAC was given to University of Pennsylvania. EDVAC followed through at University of Pennsylvania. And then Professor [John] Von Neumann started the Institute of Advanced Studies Computer Work, and University of Illinois built their computer and University of Illinois built a copy for us called ORDVAC.

Hochheiser:

Ah.

Gregory:

So that's how they got into the computing field. In the meanwhile, while EDVAC was being put in operation, we had a lot of visits from the British, and they were interested enough to make themselves a copy of EDVAC called EDSAC.

Hochheiser:

Yes.

Gregory:

The British had it operating at half speed in full production. They were using it in their intelligence area. And we got ours going at full speed.

Hochheiser:

How large a group of people were working on this at Aberdeen?

Gregory:

Okay. It depends on the different departments.

Hochheiser:

Sure.

Gregory:

Of course, we had the mathematicians and programmers as one category. That was probably a couple dozen. And then about a dozen of technicians, and engineers on the computers. Total staff was probably more than 40. Jim, is that about right?

Ross:

I believe so.

Gregory:

Yes, I would say about that much. And by the way, that same staff, when it wasn't maintaining computers was designing the BRLESC computer, which was, at that time, the fastest computer in operation. It was a 64-bit computer with many additional instructions to facilitate trigonometric functions, things of that sort. And it went into operation about 1960.

Hochheiser:

What sort of tasks was EDVAC being used for?

Gregory:

ENIAC was used for firing and bombing tables and the Atomic Energy Commission did a lot of their bomb calculations on it. EDVAC took up those problems at much, much faster speed and expanding them. At that time, all the services needed their computing facilities. To get them started, we would do, for example, the Air Force bombing tables, which eventually moved to Eglin AFB. We facilitated the transition of programs from our computers to theirs and things of that sort. And, of course, the Atomic Energy Commission came along and got their own computers. They had to have the first of every super computer at that time. Also, we had a lot of commercial companies, like oil well companies coming in for calculations like what's the best way to get the oil product. If you drain too much, it collapses under the pressure. And if you drain too little, you're not getting enough money out of it. So in other words, what's [the] optimum way of getting the oil out of the wells.

Hochheiser:

That's interesting. I wasn't aware that the military's computers were being used part-time for civilian purposes.

Gregory:

Oh, yes.

Hochheiser:

That's very interesting.

Gregory:

Hopkins University was running programs. Their students were running programs. Oh, I don't know how many. A couple of ammunition companies, explosive type people used the computers. Aberdeen was the first major computing center for anyone to use. And if their demands exceeded our personnel capability they would have to pay for extra people that we would momentarily either hire or get transferred to help. These programs were running 24 hours a day.

Hochheiser:

Sure.

Gregory:

And you had to have someone there feeding inputs and outputs continuously. We did the first calculation of the Army's Redstone missile for Redstone Arsenal.

Hochheiser:

Redstone missile, yes.

Gregory:

Yes. I can't remember, but about 120 or 130 parameters were given to us from springs, for the ejection and all that. The goal was [to] reduce it to the minimum number of important elements in the launch and separation. I think it got reduced down to 14 or something of that sort. So an awful lot of scientific military and civilian work was done there.

Project Engineer

Hochheiser:

And I gather over the course of your decade at Aberdeen, you advanced to higher positions?

Gregory:

Well, typical government.

Hochheiser:

Yes.

Gregory:

You know, from an employee to a supervisor and then a project engineer. I became the project engineer on EDVAC and also on that BRLESC computer.

Hochheiser:

What did being the project engineer entail?

Gregory:

Specifying the parts that you would need. Helping the contractor, or the contracts man, to develop specifications, requirements, things of that sort. The staff and myself would design the architecture, the instructions and the circuitry and things of that sort including the input/output mechanisms. So it was a total design, develop, and operation effort. We actually, in the spare time of the technicians, built circuits and the cabinets and put BRLESC together. It was a minimum cost only because it was double usage of people. Instead of playing cards, they did assembly work.

Hochheiser:

Okay. And as the project engineer, who did you report up to?

Gregory:

We had the director of the computing lab, a supervisor, and I reported to that supervisor. The supervisor was for all the computers. And I was assigned to whatever computer required help at that time.

Hochheiser:

Do you recall the names of the main people you reported to?

Gregory:

The supervisor was Richard Bianco. The consultant was Richard Snyder, and the Director was Civil Smith, who came from the Atomic Energy Commission. Then he was followed by Dr. Warner Loitard, who got his doctorate at Switzerland.

Hochheiser:

Yeah.

Gregory:

And then Dr. John Giese. There is a Proceedings of 50 Years of Computing where they celebrated the 50 years of the ENIAC. And it's an interesting document because it really has one of the best collections of the history of computers that I've come ac**Ross**.

Hochheiser:

Were all or most of the people involved civilian employees, rather than military personnel, or what was the balance?

Gregory:

Most of them were civilians, but we got help, military help, which we welcomed because we didn't have to pay for it. So what was the ratio? I would say ten to one or something like that.

Hochheiser:

Ten to one, ten civilians per military or ten military -

Gregory:

One military to ten civilians.

Hochheiser:

For every ten civilians?

Gregory:

Yes, about that.

Hochheiser:

Anything else about your decade at Aberdeen before we move on to Westinghouse?

Gregory:

Well, we did get a lot of funds from organizations, while we were running their programs. And we used those funds to give contracts out for the first core memories, the first high-speed disks, the first drums. Especially a synchronous drum, which Aberdeen was the only place that had it. Also high-speed printers, chemical, and impact types. And the first transistors for computers. In fact, Philco at that time built a transistor computer for us. So Aberdeen did a lot in the early technology for memory work and storage work and so forth. By the way, when EDVAC was delivered, it had a magnetic wire I/O system. It was very bulky and very non-reliable so we changed that to paper tape first, and then to magnetic tape.

From Aberdeen to Westinghouse

Hochheiser:

Did you have much, if any, contact with Westinghouse while you were in Aberdeen?

Gregory:

No. The way I got into Westinghouse was through Professor Daniel Slotnick - there's a separate history of him in the IEEE files. Anyhow, when he was at Westinghouse, he toured our laboratory and was very impressed with the BRLESC computer. And he said if I ever wanted a job, see him. At that period of time, [Robert] McNamara was Secretary of Defense. And McNamara decided that government is wasting money in computers in the labs and in the universities. So he cut the funds in that area and that got me disturbed and I decided that I'd go to Westinghouse. At that time, the world was still analog. By the way, that's a very, very important transition era. Most of industry and universities were analog and using digital, they'd have nothing to do with it. So it was a hell of a selling job to convince people that you could do things better digitally, and faster. It was a hard sell. There were stories about ENIAC 18,000 tubes can never work, things of that sort. And the answer is, yes, they were right if you used statistics on 18,000 tubes. But if you introduced various different techniques to reduce potential errors like preheating the tubes, testing the tubes, during the maintenance period pull the tubes out and see where they stand life-wise. And through these maintenance techniques, we had, I'd say, 98% reliability of running 24 hours a day, 7 days a week except for that break period. So if that answers the question?

Hochheiser:

Yes. So in '62 or so, you moved from Aberdeen

Gregory:

To Westinghouse.

Hochheiser:

Out of curiosity, did you move your home or did you commute from Aberdeen down to Baltimore?

Gregory:

I lived between Aberdeen and Baltimore at White Marsh.

Hochheiser:

I know where that is.

Gregory:

And stayed there, commuting to Westinghouse or to the Proving Grounds.

Hochheiser:

So you moved to Westinghouse.

Digital Systems Group

Your initial position, from what you gave me, was as manager of the Digital Systems Group?

Gregory:

Right.

Hochheiser:

Was this a new position or did you replace somebody else? Do you recall?

Gregory:

There was about a six people nucleus, mostly analog people that had the problem of how to get digital into the real-time computing of weapons systems and in radars. So I was made manager of a group to develop that capability. I had to get the software people, hardware people, and the needs from the military to militarize computers and digital electronics. An example of electronics use was the precise frequency and low noise timer for the Westinghouse Pulse Doppler AWG-10 Radar.

Hochheiser:

And digital was better suited to do this than analog?

Gregory:

At the frequencies they were working, yes.

Hochheiser:

So you initially had a group of about six people reporting to you?

Gregory:

Right. And then we built that staff up, introduced something very significant in the software area. Going back to Aberdeen, they produced the first compiler. Originally, the programmers had to - we called them coders - translate math requirements into the instruction set numbers. The first compiler, called Forest, was developed by Army BRL mathematician Floyd Campbell to simplify the programmers' task. In that time period, an IRE task force with members from BRL, IBM and others, had meetings on programmers simplification work. The Forest Language Compiler work was introduced as one possible solution. IBM then came out with Fortran Language Compiler for its computers. Forest was a lot more efficient, over Fortran, because we designed it for the BRL computers.

There are some things you can do to speed things up. So anyhow, with that background, coming back to Westinghouse, we set up our software engineering group. And the operating system for real-time computers is slightly different than for command-and-control computers. I guess the way to simplify it is, you need the ability to be able to sample all the input requirements and do the calculations and so forth in real-time. What I mean by that is, releasing a bomb, developing the trajectory points, it's a lot different in real time than in a command-and-control where you can say, well, I could wait a second before I get this input or a second before I can get that output out. In real time, you've got to keep that server loop going continuously. And if you fail, the loop breaks, and your calculations are gone. So because of that, we developed an operating system on the basis that the nucleus was a control unit, subcontrol units, sub-subcontrol units, in which we had a table that the analysts would give us the requirements for iterations of the different functions. And we were able to add binary bits to this table to decide how the computations go. Or maybe another way of looking at it, in the command-and-control, you could go through a loop like that and then repeat. And what we did jumped in and out of this loop, depending on the real-time requirements. And then by doing that, we would begin to standardize the interfaces of the sub-packages and eventually to the packages below that. So as a result, if you did the weapons software for F-4 aircraft and you wanted to use similar weapons in a F-16, we were able to lift the packages of software that would work into this master control and almost, with minimum changes, be able to go from aircraft to aircraft, provided you're doing the same modes. And also, we integrated that with the hardware building blocks. In other words, we had the computer, we had the various I/O analog-to-digital conversion units, all blocks so that you were able to collect these blocks according to requirements of your weapons system. We also developed an integrated and distributed avionics architecture in which aircraft control, weapons functions, display and pilot aids, navigation, were in computing centers and interconnected by a network to a central management computer. This architecture permitted modular hardware, and software blocks with standard interfaces using the modular operational program architecture to be used in other aircraft with similar avionic requirements. I called the architecture NECKS for New Common Avionics System. A paper was given at a NEACOM session.

Hochheiser:

How closely did you work with the other groups in Westinghouse developing specific projects, specific weapons systems?

Gregory:

Well, we were like their servants.

Hochheiser:

Okay.

Gregory:

They would come to us and say, here's what we've got to do. And we would say to them, well, here's what we could do for you. And in other words, they were the boss and we were the supplier for their requirements. So we didn't dictate what they had to do.

Hochheiser:

Right.

Gregory:

We just merely implemented what they wanted to do.

Hochheiser:

Right. And it was your job to figure out then how to do it so it would fit in with the overall project?

Gregory:

They would figure out how to do it mathematically. And we would translate that into the hardware and software in order to implement it.

Hochheiser:

Can you think of some particularly notable specific systems that that you did this for in the '60s?

Gregory:

Well, AWAC, I think is one of the best examples. We designed the computer–at that time, it was the fastest airborne computer in existence. We did the networking in order to get to the different inputs and outputs required for the computation. And then the software in order to implement it. AWAC was probably the first real command-and-control system in operation because, from the airplane, we were able to send the display information to, like, Navy ships to see what's going on, or ground control. And the computation for it was extremely complex from the standpoint of what you had to worry about - you're looking for missiles, you're looking for aircraft and ground targets. So you had multi targets to be concerned with, friendly, for things of that sort. It was quite a computation. So that computer really took a lot of work. We had the staff to do the implementing of that.

Hochheiser:

Now, in your role as someone who did things to the needs of the other groups in Westinghouse, did you also have occasion to work, in this period, with either the customer; that is, the military or with the prime contractor, Martin, Boeing, people like that?

Gregory:

Yes, yes. Again, similar to internal, they were the customers. We would go find out what they wanted to do, and we would give them a proposal on how we would solve it. Oh, yes, we interacted at that time with the Army, Navy, Air Force. Like, Navy at that time had four Navies: ship systems, their research, their aircraft systems, and sub systems. Air Force, the various Army places, the Intelligence Agency, NSA, a lot of others. So, yes, we interacted continuously with those people. And that's where working with the IEEE and AIAA facilitated the ability to meet customers, find out what their requirements were, or needs were, and develop relationships there.

Hochheiser:

So did you do this by attending conferences, local section meetings? Where did you interact under the IEEE umbrella?

Gregory:

Almost all conferences, being on various different, let's say, study groups. Each organization works with the government and has special committees set up in order to investigate and make recommendations to the government in those areas. And we had members from Westinghouse, and myself, on these different committees. So that was our main interaction with customers.

Working at Westinghouse in the 1960s

Hochheiser:

How did you find Westinghouse in Baltimore as a place to work in the ’60s? Particularly, in what ways might it have been different from working up at Aberdeen?

Gregory:

Oh, significant difference from the standpoint that Aberdeen was concentrated in one area - military problems solutions - and developing their master computing center with different computers. What was that called, Jim? MSRC – Major Shared Resource Center. I’ll show you the -

Hochheiser:

And that’s okay. We can, we can always add this later to the transcript so don’t worry about it.

Gregory:

So in other words, Westinghouse was the breadth of space, ships, aircraft, ground systems versus Aberdeen was in their Army scientific area. So a significant difference there. Also Aberdeen isn’t concerned with real-time embedded systems.

Hochheiser:

Sure.

Gregory:

Whereas that’s the main item at Westinghouse here. We also had a Westinghouse computing facility that the company used, of course, for their payrolls and all that stuff or we used to do design work but that’s a different department.

Airborne System Space Constraints, NASA

Hochheiser:

When you’re dealing with airborne systems in particular, there are real space constraints. I mean, there’s so much room in an airplane.

Gregory:

Right, and weight and center of gravity for the vehicle.

Hochheiser:

And weight, yes. How much of a challenge was it to meet those sorts of requirements?

Gregory:

Okay. Initially, it was a significant problem because the only thing we had to work with was individual transistors, resisters and so forth. Of course, that requires huge space, volume, and power and so forth. Westinghouse was lucky. The commercial portion, non-defense portion of Westinghouse, set up right on the Baltimore-Washington Parkway a division for commercial circuitry. And since they were so close and we reacted with them quite a bit, we got them to build for us the beginnings of integrated circuits. The government gave out contracts for the first true integrated circuits, and Westinghouse was one of the players in that area. And because it was so divided between commercial, military, and research jobs, Westinghouse never got credit for starting that whole area. We took that integrated circuit area and applied it to our computers and were able to shrink them to the point where we developed for NASA Goddard the first space computers that eventually became their NSS1 (NASA Standard Space Computer) their standard computers - for all of the unmanned missions there. And we developed a class that we called the millicomputer, which was very significant because it had a lot of computational base and were very small because they used, at that time, the best integrated circuits that we had. And it had our software so it was easy to apply it in areas. And by the way, we gave NASA Goddard our support software package, which was the compilers, assemblers, and all that, and maintenance systems. We introduced the ability to do off-board maintenance through our network onboard. We were able to collect all the parameters onboard using a wireless network to bring it back to ground center in order to do the equivalent of going up to the plane and connecting equipment to it, to do your maintenance.

Hochheiser:

About when was this?

Gregory:

Well, we developed the software and the approach doing that and NASA used it for their updating of their unmanned space probes.

Hochheiser:

Okay. Now, is this still in the 1960s or is this later?

Gregory:

From the ’60s to the ’80s.

Hochheiser:

So these were long term projects rather than something more specific like AWACs?

Gregory:

Well, I wouldn't call them long term. It was bursts of activity with them over long term. You get this project accomplished, what's the next one. So long term from that standpoint. Westinghouse developed - and I'm sure they probably had separate programs going - a class of modular radars, taking different bits and pieces and putting it together for different applications. It used principles of standard hardware and software and interfaces. Westinghouse ECM was way ahead of competitors because they were able to make pods where, depending on a threat, you would change the different blocks in it to jam or receive or confuse the enemies.

AN/AYK-8 and F-16 Radar

Hochheiser:

One or two specific projects that I noticed you had mentioned. One is the computer, the AN/AYK-8 computer for the B-57G.

Gregory:

Yes.

Hochheiser:

Could you talk a little about that project?

Gregory:

Okay. What that program was, the Vietnam War came about and a significant requirement of trying to detect and attack the night activity - because those guys advanced either through tunnels or underground, under the shrubbery - they would be able to move around and operate clandestinely. So the requirement came up, we'd like to be able to see, using radar, night vision, infrared, and low light level TV. So the B-57 was a contract that we won in which Glenn L. Martin, at that time, or Martin Company, would do the aircraft modifications and we would supply the electronics package. They'd strip the whole airplane and put in our integrated system that did the navigation, all the weapons sensing and the necessary controls to do the bombing or whatever. And, in fact, that program is the one that - I don't know how to say it - the first infrared missile pointing weapons systems; you'd point a laser and then home in on the beam. The planes were having a hell of a problem making the missile work. Because of our integrated system, we were able to test one of those laser-guided bombs and determine that the cone of the laser was too small to hit the target. The B-57G had to speed up or, in other words, lop the missile to hit the target. What was happening, it was losing the lasing coming back. So that gave the bomb designers the parameters to change, to make it work. And then a Gatling gun, a General Electric Gatling gun, the same one that was used in the A-10 tank buster, it was added to the B-57G. So it did a lot of the bombing along the Hồ Chí Minh trail and things of that sort. And it competed, foolishly, with the Air Force's, Gunship Program. So you had both the Gunship and the B-57G were both at Vietnam at the same time. And when I say it competed, because one was an Air Force project and we were subcontractor.

Hochheiser:

Right.

Gregory:

You know how those relationships can develop. But they both worked out very efficiently. Again, there was a big report and a commendation on the B-57G. So just to go back to that B-57G. I don't know if it was the first, but it was the integrated system, first in terms of the three different sensors, the navigation and controls. It had three navigation modes. All of that integrated into one system, with the modular controls so that you can see targets at night and deliver weapons to targets.

Hochheiser:

Can you tell me about the F-15 fly-off radar?

Gregory:

We lost that, Westinghouse did, to Hughes Aircraft Co.

Hochheiser:

I see.

Gregory:

But we won the F-16. Now, in the F-15, we had a system, a radar system, much more efficient than a Hughes system at that time.

Hochheiser:

Who you were competing against for the contract?

Gregory:

Yes.

Hochheiser:

Right.

Gregory:

Yes. And Hughes won it. And folklore, the reason they won it is, our radar we bid was a package for high development cost and low-cost production cost because it was a very integrated, good system. Hughes, on the other hand, bid low development, high production costs. The customer only had one pot of money for development so unfortunately, that's how we lost that one, but that's how we also gained the F-16 radar. And the F-16 radar proved to be very, very reliable and efficient. Thousands were produced, including for our allies.

Manager of Control Data Systems

Hochheiser:

In 1970, you had a new position now, the manager of Control Data Systems. Is this a promotion?

Gregory:

It's a promotion. Because eventually, our group got built up to 186 people or something like that, for hardware and software, and interface packages.

Hochheiser:

Which is quite a lot when you start with six.

Gregory:

Right. And different functions got added to it. The data systems came about where the networking and integrating, for platforms and the command and control areas. In that period of time - and it's still probably true today - the Defense Department was divided up into I'll call it real-time platform department and command-and-control departments. They didn't talk to each other. So as a consequence, it was very difficult to get good integrated total electronic systems. I wrote a paper to Noel Longuemare at that time, when he was Principal Deputy Under Secretary of Defense, Acquisition, Technology and Logistics, (PDUSD ATL). At that time I was selected to be chairman of the IEEE/AESS Electronics Integration Committee (EIC) after becoming a senior member of IEEE. The paper to Noel Longuemare was through the EIC.

We got so many hundreds of them. But in the Defense Department, you've got the Deputy Secretary of Defense and then the guy responsible for procuring all of the weapons systems.

Hochheiser:

Okay. So you wrote a letter to this person? I mean, a paper to this person.

Gregory:

Yes. Noel Longuemare was acting at that time (USD ATL), which the goal of the paper was to develop, which we did at Westinghouse, a digital communications system - and the goal here was use AWAC or equivalent, or platforms to be translators. Take the Navy communication equipment and the Army communications equipment, make them intercommunicate in the platforms translator equipment with predetermined programs. Take testing equipment in the services and make them intercommunicate by the platform. So if you set up the system right, using existing radio communication systems, they can talk to each other by the translator platforms. Also, using language translators, we can get foreign language to English language translators and vice versa. So anyhow, set up a total integrated command-and-control system so that we can integrate space activities, the Air Force activities, Navy, Army facilities into an integrated system. And bits and pieces of that were developed at various different places. The Army went into their battlefield management systems where the communications aspect of it is one part of it. And instead of using relay translator platforms, they did develop a digital radio that had the ability for all of these different requirements of communications of the services. So it was like a general purpose communications set. But that's a lot different of one thing doing what the relay was doing. So government spent a lot of money in that area and I don't think that they have it fully operational yet. If you use this integrated communications radio, you would have to strip what's onboard aircraft and substitute it. Huge expenses.

Hochheiser:

About when was this attempted, building this?

Gregory:

'80s to the '90s.

Hochheiser:

So we've jumped ahead a good bit in time.

Gregory:

Yes.

Millicomputer, Remote Maintenance

Hochheiser:

Can we circle back around to the '70s? Could you tell me a bit about the Westinghouse millicomputer family in the'70s?

Gregory:

Here's how it started. Professor Dan Slotnick, when he was there -

Hochheiser:

There at Westinghouse?

Gregory:

Yes.

He hired me and he was my boss while he was there. He said, let's develop a real low-cost computer so we can have these in the homes. And at that time, you know, taking something like EDVAC and reducing it to some practical small thing without integrated circuits was not possible.

Hochheiser:

Right.

Gregory:

Anyhow, it set the goal. So our goal was to develop a millicomputer, based on his concept, small as we can get it, with the most integrated circuits that we can get, and militarize it and use it in all our different products and we used it in space. So we called it the millicomputer because it was the smallest, least consumed power, but yet powerful computer of its time. And again, we built thousands of them. It was used in every launch platform for the harpoon missile program. And eventually, that got improved and speeded up and all of that for the AWACS program as the AN/AYK-8 computer.

Hochheiser:

Okay. So this development was under your direction in your group

Gregory:

Yes, in our computing group. Especially the software, because the software package for these computers was really a secret of why they were able to be applied quickly and efficiently. We also developed the remote maintenance of software programs, as an example, when McDonnell Douglas would be running their program on our computer ran into difficulty they would call us. Our programmer would get on the line and be able to remotely work with their programmer to see where we or they had problems.

Hochheiser:

It was something new at the time, being able to do this remote work.

Gregory:

Oh, yes. Let me give you an example.

Hochheiser:

Please.

Gregory:

In the F-4, McDonnell Douglas had a huge analog pod that would record the various different, let's call it sensors, taking place during flight so that when they land, they will be able to check what was going on in the airplane to find out where their problems were. Well, that's where we introduced this remote onboard maintenance with the relay so that instead of this huge pod, we were able to record the instantaneous calculations at the time so that, well, you could see the answers that the onboard computer was getting for various sensor inputs, which we had on the ground and we could verify, it's doing the right thing. So, yes, that was a new technique so that big pod that weighed I don't know how many pounds, got eliminated.

Hochheiser:

And any time you can save weight on an aircraft, that's a very good thing.

Gregory:

Definitely. And also another important thing is the balance. In other words, you've got to make sure that with all the stuff that you've put on the airplane, the center of gravity doesn't shift. So you've got to work then in your development work very closely with, in this case, McDonnell Douglas, the prime contractor, to make sure that what you do fits in with the overall project center of gravity.

Hochheiser:

So did you then have to spend a fair amount of time at Martin or McDonnell Douglas' facilities or was this largely done remotely?

Gregory:

Remotely, as much as possible, but definitely visits, meetings and things of that sort.

Hochheiser:

I've heard from other people of working on projects where they picked up and moved out to Boeing in Seattle for months to get stuff done.

Gregory:

Well, AWAC, when doing a flight test fly-off we took all the radar equipment out to Boeing and worked with them on the fly-offs with Hughes. We tried to reduce the cost to a minimum by using space relay communications to do things remotely.

Computing and Data Systems, Organization in 1970s

Hochheiser:

Okay. Now, by 1975, when projects that you already talked about, the F-4, the F-16 radar happened, you again had another title, Manager of Computing and Data Systems. Is this something new or is this again a recognition of the growth of your group?

Gregory:

Well, I guess it was just building up staff. And the data systems came about when we tried to get the services to implement onboard data systems. Let me tell you a funny one.

Hochheiser:

Please.

Gregory:

In the process of selling the networks and busses and so forth to the ship Navy, we wanted to tell them that on their aircraft carriers and ships that if they put on a good network system, they could get information transmitted around much more efficiently and introduce automation of controls of the boat such as directions and navigation. And in the process of explaining how these networks work, an attendee had so many stripes on him that I didn't know his rank - he was way up there. And he gets up and says, do you mean to tell me you're trying to eliminate that thing that I talk down to the engine room? I don't like it. And he walks out. But that's an indication of the analog-to-digital mentality. And by the way, that was at all levels, from universities down.

Hochheiser:

It was a struggle to convince people of the advantages of digital?

Gregory:

Exactly.

Hochheiser:

But, of course, eventually, the whole world went digital.

Gregory:

You ought to have a separate program like this on IBM's story because IBM always was the first at everything so they really rewrote a lot of history on introducing digital.

Hochheiser:

Yes. Going along in the '70s, where are you in the organization? Who are you reporting to?

Gregory:

Well, let's see. You had the guy running the operation, then you had a division manager and then some engineering managers reporting to a division manager, and section manager. I reported to a section manager.

Hochheiser:

Who was the division manager that your boss reported to?

Gregory:

Oh, let me try to think now. At one time, John Stuntz. At another time, it was Ben Vester. There was a lot of shifting.

Hochheiser:

Ah.

Gregory:

Maurice Oni another time. My main interaction, because [of] the way we operated, was to the engineering manager, which was Johnny Pierson. So in other words, the money came from the division manager but work was assigned through the engineering manager. Westinghouse had a matrix operation.

Winning Air Force Contracts, BORAM

Hochheiser:

Can you talk a bit about winning the Air Force standard military computer development contracts, the AN/AYK-8, that sort of thing?

Gregory:

Yes. In that period of time, we worked and worked and worked with NAVAIR, then in Washington, about standardizing on computers. And they were very much embedded with Grumman Corporation, worked with them, you know. And we sold them on the advantages of having a standard computer. So eventually, they went off and - I don't know who built, I guess IBM - their AYK-14. So we built for the Air Force the AN/AYK-8.

Hochheiser:

Yeah.

Gregory:

So we built the AYK-15 standard computer that the Air Force considered a standard, but the standard is only as good as to who will use it.

Hochheiser:

Right.

Gregory:

So inside of a company, standards work very well, but outside of a company, people have always got better ideas. So how far did the AYK-15 go? Oh, I don't know. We used it a lot. AWAC was a variation of it and [a] couple other applications. And a subset of it was the millicomputer. So it's just the Air Force liked it and the Navy liked their 14. The trouble with the Navy was their support software package was inadequate. When I say inadequate, I mean by our standards. By their standards, it was fine. But we had all these extra features that reduced the integration time.

Hochheiser:

But ultimately, it's the customer [that] decides what they want.

Gregory:

Absolutely. Absolutely.

Hochheiser:

Can you talk a little bit about BORAM?

Gregory:

Okay. That commercial integrated circuit facility had financial problems so our corporate, Pittsburgh, came to Harry Smith, who then ran Baltimore.

Hochheiser:

Right.

Gregory:

And said, "can you help us?" and Harry got his staff together and said, how can we use it? My God, it's a Godsend 'cause we can use it to develop all the integrated circuits and shrink everything that we have and substitute semiconductor transmitters for tubes and all that kind of stuff for the radars. So Harry Smith took it over and that's where we were able to have a tremendous advantage over other companies, by going to our own division to build the various different circuits, and radar people used them to increase the transmitter reliability by using semiconductor transmitters. So they played a very important part in us reducing all our systems sizes and increasing reliability.

Gregory as Manager, Staff

Hochheiser:

When I hear you talk, I [see] in some sense two different types of developments - one type is more product oriented, like millicomputers. But then there are some things, like the work with the B-57, that seemed more specifically project oriented.

Gregory:

In my position, I had to supervise, manage a staff of hardware, software and system designers to be able to service all these different people. So as an example, on AWAC, how do you integrate all these different sensors, navigation and so forth, to be able to get all that information collected into the computer? Using networks to do it was a very important - that's the data processing portion of it - a very important function. So as manager, I had two jobs: keep a very efficient staff and move them according to different project needs as well as work with customers and other divisions in getting business, while building products needed for the task. Selling customers on what's possible and hope that you get the contract for the item.

Hochheiser:

Yeah. How would you characterize your management style? How did you manage people to achieve the goals?

Gregory:

Well, in order to be successful, you've got to develop all the people that work for you into proficient areas. So you've got to help them come along. Maybe a better way of saying it, train them to become your replacement. If you advance, you want to know your replacement is capable. In the process of doing that, all the people's morales go up, they sort of know what's going on, and that way, maintain interest in their jobs 'cause they're continuously expanding, and you're expanding. A lot of managers do the reverse. They consider people who know what's going on as threats to them so they limit their activities. Maybe one answer to your question is, build up a staff so that they advance to make your life easier.

Hochheiser:

Who were some of the key people on your staff?

Gregory:

Jim Ross, Oscar Cromer, a guy that was able to be the data information flow, from sensors to computer requirements. Jon Squire, who was our software brains in developing the operational system programs. Vicki Moseley, developing the software tool sets. When I use that term, I mean the necessary software to help programmers, software engineers (it changed from coders to programmers to software engineers) get their programs running more efficiently. There were so many people. Karl Avelar a possible replacement for me.

Hochheiser:

Sure.

Gregory:

Dr. James Farrell, our navigation expert, he did an awful lot in developing, in space, onboard self-contained navigation, and helping the Security Agency in a lot of their type of problems. George Axelby, very active in the IEEE. The developer of fly-by-wire, because he's the one who did all the math associated with expanding the bandwidth with digital control over analog systems on control airplanes that could only go six to ten cycles, the fastest that everything reacted. And his idea was, hey, we'll just maintain the last mechanical power unit and make everything electronic. So electronic actuators to increase the bandwidth of control up to 100 and eventually to 1,000 cycles. So people of that type. One named Gwen Hays, who was our representative to introduce Ada, Ada language. Ada, unfortunately, seems to be getting lost. The difference between the commercial C, C3 and all that kind of stuff, is they're easy to use, easy for program to generate their requirements, but has no control over recording what they are doing. The Ada language does what these other languages do and adds the burden on the programmer to record what he does. And that's extremely important if you're going to have a system for 20 years. The new guy coming onboard would want to know what functions the software packages were doing. I don't know if that answers the question.

Hochheiser:

That does. And incidentally, I will be interviewing Gwen Hays later today.

Gregory:

Oh, very good.

Signal and Data Processing Systems

Hochheiser:

In '79, you have another new position, new title: Manager [of] Product for Signal and Data Processing Systems. Is this is this a change?

Gregory:

Yes.

Hochheiser:

It sounded like one.

Gregory:

What happened is our system or group got extremely big and some of our top management decided, let's break it up into different systems. So they separated software off, things of that sort. And we went more into system applications and design. And we introduced at that time, and that's where Jim Ross comes in as another one of his designs, because he was one of the chief designers of the BRLESC at BRL with me. He designed what we call a programmable signal processor. What that was, instead of using a general purpose computer to do various complex functions, FFTs and things of that sort using hundreds of instructions in order to accomplish [it], instead, put those instructions into hardware circuitry so that you had one instruction to do an FFT and things of that sort. Jim was the prime designer of that element. And what we did was, by integrating a programmable signal processor with a GP computer, which the Security Agency used very efficiently in a lot of their applications with the general purpose computer. The computer does the management and sends out requests to signal processor, do this, do that. And otherwise, that computer would need to be 1,000 times faster to do those functions in-between. So we integrated a real-time control computer with a programmable signal processor to implement systems.

Hochheiser:

This would be in the 1980s?

Gregory:

Yes, the '80s. Eventually I left the group and joined the group under Dr. Paul Pan that did our basic research and development. And in that area, responsible for getting new business by developing the requirements and designing systems concepts to be able to implement it, and sell it to customers. And in that period is where I had to interact a lot with outside IEEE and things of that sort.

IEEE Participation, Paul Pan

Hochheiser:

Could you tell me a little bit about the way you used IEEE during that period?

Gregory:

I was active in a number of the organizations.

Hochheiser:

Right.

Gregory:

Mostly getting on committees to solve problems that the Defense Department would give them. Even standardization of computers was one of them, or communications was another. Working with the AESS portion of IEEE, their integrated systems, to develop integrated concepts. I wrote a report in that area for them. Those organizations are very important for the infusion of ideas between the various participants - government and industry - in order to take ideas from one and give it to others for use. That way, we build up knowledge, instead of holding it in our little corners. So using IEEE or many committees of the AIAA and so forth.

Hochheiser:

What can you tell me about Dr. Pan? I've heard his name mentioned by several people. And, of course, he's not here for us to talk to.

Gregory:

Okay. He was probably the best R&D manager that we had from this standpoint. You're given a certain amount of permissible IR&D funds when you win contracts, you know, get a certain portion devoted to an area. Some of Dr. Pan's predecessors controlling that and deciding where the money goes for helping our internal research, they were biased occasionally because they came out of a product section, so naturally, they would give them more funds because they knew more of the areas. Whereas Paul Pan divided the stuff very evenly, required people to come and give him presentations on why we should spend it, how, where, what it will do. So he was extremely good in that area because he wasn't biased in any particular area. So perhaps that might give you an idea of that.

Selling Programs, BORAM Revisited

Hochheiser:

Yes, it does. How did you go out and sell ideas and programs to customers in the 1990s, and what customers were these?

Gregory:

Our biggest customers at that time were McDonnell Douglas, Boeing, General Dynamics. When I say big customers, people that we continuously try to sell ideas to. Grumman was another but we never got contracts from them. And then the Air Force anywhere from Dayton to Electronic Systems (ES) and their research group to Rome, New York.

Hochheiser:

Right.

Gregory:

Also, at that time, Army Fort Monmouth. By giving presentations to them on solutions in areas that they had problems.

Hochheiser:

Any particularly notable wins, contracts that you, through these efforts, were able to gain?

Gregory:

The AYK-8, DAIS Computer, NASA Space Computer, Shuttle Master Timer Unit and programs for NASA.

Hochheiser:

Which we've talked about already.

Gregory:

One of them was, one of the earliest information integrating, have a mass information center. And that's before the kind of mass storage available today.

Hochheiser:

Right.

Gregory:

And then going back to BORAM, because we had that facility - Dr. Joe Brewer was our chief investigator in that area. And he developed a block-oriented-BO-random access memory. In other words, it's a memory that you can change and then it's permanent. So it's electrically alterable. Before that, we only had memories that you cast a pattern or would lose their data because they're registers with power. So this block-oriented was that type. And by the way, that whole concept of BORAM was - not the name, but the technology - was developed at IBM. And they were worried about another kind of problem so they rejected it because it didn't do that problem.

Hochheiser:

But it did your problem.

Gregory:

Yes. And we recognized that, holy mackerel, and Joe Brewer's the guy who recognized that and developed that. And then we tried to sell that - I don't know if we were fully successful - to replace the crash recorders in aircraft. You know, you've got the black boxes.

Hochheiser:

Right.

Gregory:

So we built a few for them, but it never went into production because, again, you had to sell to the primes.

Hochheiser:

Yes.

Gregory: And we were in a very difficult position on systems because you had to sell a prime, and they had their own ideas. I'll give one example.

Well, anyhow, at that time, it was a lot of - without mentioning names - people who were in high positions, retired [from] Department of Defense that were consultants. We would hire them to listen to our ideas to see where we should sell them. So a lot of them would infuse the ideas between their different constituents so it was a touchy area. Paul Pan used to hire the people in that area. And the example I was going to give, we gave a big presentation to the Security Agency on integrating databases and using the programmable signal processor. And we gave this big presentation. And afterwards, their consultant was there and he says, "we got better ideas." So in other words, we were rejected. Well, that is a normal story in selling.

Hochheiser:

Well, sure, sure. You make many more pitches than there are sales.

Gregory:

Exactly.

Hochheiser:

As long as you make some sales.

Gregory:

Exactly.

Hochheiser:

And I assume that you did.

Gregory:

Yes. We stayed alive and expanded.

Hochheiser:

Any particularly notable sales that come to your mind from the 1980s?

Gregory:

Oh, God. I think in my résumé, I might have some of them. Other than the ones I mentioned.

Hochheiser:

Well, that's okay. Then in anything else on the '80s before we move into the '90s?

Gregory:

No, I guess that's about it, other than that software development that I mentioned and that programmable signal processor.

Early 1990s, AESS

Hochheiser:

Okay. I'm not entirely clear from your résumé what you were doing in the early '90s.

Gregory:

Well, that's where I tried to sell our integrated systems approach and the computers and networks, the software, the digital communication, digital radar, digital communications, and integrated electro-optical systems into various different primes and government agencies. And an awful lot of work in the IEEE and so forth. I was on the Board of Directors of AESS for a number of years. So what I did in the '90s was basically selling.

AWAC is used today because it's such an important command-and-control system. And along came our division chiefs, saying, hey, we would like to get recognition for the developers of AWAC - Bob Cowdry, Bill Skillman the chief engineer. Cowdry was the program manager. So in recognition of that, I wrote up the qualifications of these people that met all the time, requirements for the Pioneer Award of the IEEE.

Hochheiser:

Right.

Gregory:

The 20 years and this and that, put all these requirements together. And the package was accepted by Erwin Gangle, who's still the chief Pioneer Committee guy. I did a lot of work, by helping or managing different sessions for NECON, the Northeast Electronic Conference.

Hochheiser:

Right.

Gregory:

And anyhow, there was a big, big special session at Dayton to give the Pioneer Awards to Cowdry and Skillman. I did the selling of that, if you want to put it in those terms, by writing up the paperwork.

Hochheiser:

It's different than selling a system to the Air Force, but certainly it is selling in the sense of making a case for something.

Gregory:

That's true. And the biggest problem for AWAC award was [that] I had to unofficially interview about 100 different people that worked on the project, to pick who were the key people. And that in itself was a job.

Hochheiser:

I suspect so.

Gregory:

But I think we got the key people from Boeing, the Air Force and from Westinghouse in this Pioneer Award package.

Strategic Operations and Business Development

Hochheiser:

Now, the final position on your résumé is as Manager of Information Technology in the Strategic Operations and Business Development?

Gregory:

Yes.

Hochheiser:

Now, what did you do in this position?

Gregory:

Under Paul Pan, of course -

Hochheiser:

So this is still under Paul Pan?

Gregory:

Yes, but eventually, he retired. Shapiro took over and I worked for him.

Hochheiser:

Okay.

Gregory:

My job was to sell these various strategic integrated electronic systems, both military and commercial. Commercial field definitely could use it. We did a lot of work on integrating the information for the Social Security Administration because at that time it took weeks for them to get information on various people because they had to go to tapes and warehouses to get updated. So we tried to sell this integrated system. And we did, by the way. But it turned out that at the last minute, the funds got lost or something of that sort. But that took a lot of work.

Hochheiser:

So you made the sale and then the funds were no longer available for Social Security to implement the project?

Gregory:

Yes. Just like we did work way back in the '60s on the first parallel computers and stealth aircraft. And when I say parallel, its multi processors working on a common objective.

Hochheiser:

Right.

Gregory:

Instead of parallel computers or serial computers. So we sold the Solomon computer concept. And at that time, the Atomic Energy Commission (AEC), were willing to give us money to develop it, but wanted to rent the production stuff. And we sold a contract, but then it turned out we didn't have the money to go into the computer rental business. And that's when Slotnick left and went and built it at Illinois. That's the Iliac IV computer.

Hochheiser:

So were the commercial customers you were dealing with in this last position all government agencies like Social Security or were there some in the private sector?

Gregory:

Well, the primes. Oh, and the police department. I didn't do a lot of the selling, but helped give the right information to people selling to automate the different police records and things of that sort. That was aiding other people to sell. Well, that was the function.

Retiring from Westinghouse

Hochheiser:

Then am I correct that you retired in 1996?

Gregory:

Right.

Hochheiser:

Now, is there any relation between your retirement and the sale of the division to Northrop Grumman or is it that just coincidence?

Gregory:

Yes.

One of the functions that we had was to help our marketing division, give them the technical information and solutions to sell things. For years, we tried to sell Northrop, at that time, I don't know if it had merged with Grumman yet, for aradar to go on their F-5 aircraft. So at that time, their CEO asked to come to get a summary of our capabilities to put radars on his airplanes. So this developed a little internal problem where the marketing people say, we're wasting our time. This guy never bought anything in 15 years. The whole damn arrangements got dumped on me and a Judy Beck. So we set up the program and gave him a summary of all the different areas that applied to his F-5, I think it was called at that time, because that was the airplane that they sold to NATO and was used around the world. And we set up a beautiful program for him and it went extremely well. He was so interested that we even missed lunch. Had to have sandwiches sent in instead of a big organized dinner in our executive cafeteria. So in that process, his top man told me that in going to the airport, he was so enthused, he was saying, man, we need an electronics branch in our company in order to integrate our aircraft better. And that's when he decided he'd buy the Westinghouse defense portion. And that's another major story in itself, how the breakup of Westinghouse came about. That's historical. And by the way, my concern is it's liable to be happening in GE right now. The guy running GE doesn't have any engineers on his board of directors. He's not an engineer.

Hochheiser:

Yes.

Gregory:

So as a consequence, all his efforts concentrated on the real estate business.

Hochheiser:

Yes. Though GE's big problems these days really come from the financial division.

Gregory:

Because, instead of him concentrating on his database of power and nuclear energy and all that, he concentrated on that losing area. It was a winning area until the crash came.

Hochheiser:

Yes.

Gregory:

And when Westinghouse broke up, their nuclear power was up for sale. Instead of him buying it, the Japanese bought it

Hochheiser:

Right.

Gregory:

Terrible decision on his part there. They need some engineering top management.

Hochheiser:

That's not irrelevant to why Westinghouse broke up; you had the character of the top management of Westinghouse in the '90s.

Gregory:

Yes. Definitely a relationship is there.

Hochheiser:

So what led you to retire in 1996?

Gregory:

Well, I was 3 years beyond 65.

Hochheiser:

So you, you stayed past the common normal retirement age?

Gregory:

Exactly. And along came the sale of us.

Hochheiser:

Right.

Gregory:

And I liked the Westinghouse retirement policy so I figured I'll get out under the Westinghouse policy because the Northrop Grumman policy was unknown to us at that time.

Hochheiser:

Makes sense.

Gregory:

So I figured, well, shucks, I'm happy with what they have. And one of the beauties of Westinghouse was, instead of taking retirement pay we had the option of taking the full money value at that time (lump sum).

Hochheiser:

Right.

Gregory:

And I decided to go that way. Because, again, I was worried about what's going to happen to the Westinghouse retirement system.

Hochheiser:

Sure, sure.

Gregory:

So those kinds of things got me to retire.

Westinghouse Over Gregory's Career

Hochheiser:

Looking back, how would you characterize your overall long career with first Aberdeen and then Westinghouse?

Gregory:

Well, I figured I contributed, like Jim Ross and all of our people, to the computer development and use of computers in the scientific area at the Army BRL and to the real-time weapons systems area at Westinghouse. That programmable signal processor is a very, very important development. We took a problem, as an example, that would run on our programmable signal processor versus the same thing running on the Iliac IV - I think it had 256 processors at that time - and we were able to do it faster. It's very simple reason. These things are manipulating information more than the solution, whereas the signal processor is a direct function of accomplishing a mission function. So in simple problems, it beat the big guy. And parallel processing, to my knowledge, never developed the full operational toolset needed to take advantage of it. Oh, one other thing, going back to Aberdeen that you mentioned. In the early stages, because we were fairly successful in the computing field as we finished BRLESC, the Department of

Defense came to our director and said, hey, we would like you guys to become the Army imbedded computer center as well as the present functions. The Director said, fine. Just give us the money because we're going to require additional people. And they said, oh, no, do it on your own present funds. So that's when Fort Monmouth got the charter to do the Army imbedded computer developments.

Hochheiser:

In what ways, if any, did Westinghouse Baltimore evolve or change over your 30 or so years here?

Gregory:

Well, from analog to digital and from a Radar House to an Electronic Systems House. The software group, when I was running it, helped sell the DOD to fund the University of Pittsburgh-Software Engineering Institute (SEI) as consultants to DOD software Developments and Evaluations.

Hochheiser:

Sure.

Gregory:

The SEI at U of PA is still in operation as DOD software consultants. And in that process all these computer proficiency standards got developed. They're one to five. Gwen Hayes will give a good rundown of that area.

Hochheiser:

I'll certainly ask her.

Gregory:

And when I ran that software, we were almost number one in the country in real-time software development because we had the whole coverage of tools and operational stuff.

Remaining Professionally Active

Hochheiser:

In what ways, if any, have you remained professionally active since your retirement?

Gregory:

Right after my retirement, Noel Longuemare set up in the DOD a group to help the rest of the services develop integrated avionics, especially what we call open systems, Open Systems Joint Task Force (OSJTF). I was a paid consultant to OSJTF for three years. Contracts given to different companies had proprietary stuff in the products. So if the government had to modify these things, they'd get out proposals and whoever was the original prime had all kind of proprietary advantages because of their interface circuit. So what the Open Systems Joint Task Force was between services was to try to break that barrier down and introduce open systems in hardware and software interfaces. And also, on my own side, doing a lot of work on energy in terms of what's our best kind or type of energies for producing electricity. By generators, by chemical reactions, by fuel cells, etc. I'll have to write a paper on some fundamental properties there. Like why do we have super conducting? Think I got an answer. Also, if you'll notice, we're talking about Earth warming without including Sun activity factors as causes.

Hochheiser:

Yes.

Gregory:

But never a single item about what's the sun been doing in terms of delivering energy to the universe. And one of the things that happened, when [Al] Gore was Vice President, he was given the function to reengineer the government - I don't know if you remember that -

Hochheiser:

I recall.

Gregory:

Okay. In that period, he was to look at all government agencies. He developed and inserted different little groups that he would stack his people in at agencies to help facilitate integrating the requirements and their successes with the White House key by the flow of information. For monitoring the sun, we've got a couple of space platforms out there - one of them monitored the sun for sunspots because when that happens pointing to Earth all of that energy causes our Northern Lights and causing all kinds of blackouts because it induces huge voltages in power transition lines and knocks out communications and power distribution and our satellites, if they're not protected. The function for space sun activity was transferred to NOA, and NOA didn't have the staff at that time so we lost three or four years of knowledge in that area while that stuff was being transferred. That was very unfortunate. Like I said, nowhere in this weather stuff is the sun activity taken into consideration. So it's assumed to be constant. And we know it's not constant because Mars had some of its ice caps melt. One of NASAs early probes that we had a computer on showed pictures of Mars ice caps changing over time. Earth's ice caps are yearly cycles.

Okay. So basically, we lost a number of years in getting sun activity. We know now for sure, from pictures that we're getting from our NASA satellite, that the eruptions on the sun are down to a minimum. Where there used to be hundreds of them, there might be one or two. And that reduction has been going on for probably ten years. And the studies of why that's occurring concludes internal shifting in the sun. Unfortunately, there's no study on how energy that we're receiving from the sun is changing. And that rover that's stuck by soft ground on Mars is getting low sun energy indicating sun energy is down.

Hochheiser:

Right.

Well, my cards are all facedown so I -

Gregory:

Okay.

Hochheiser:

I think we've certainly covered everything I thought of and unless you think of anything that we've missed, I'd say we're finished.

Gregory:

No, I think we covered the field, without going into detail of each project so forth.

Hochheiser:

Thanks.