PROFILES OF SWE PIONEERS

ORAL HISTORY PROJECT

Naomi McAfee Interview

May 30, 2003

Linthicum, Maryland

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Naomi McAfee

Naomi McAfee received a bachelor's degree in physics from Western Kentucky University in 1956 and joined Westinghouse Defense and Electronic Systems Center as a mathematician in reliability engineering. She went on to work on a variety of airborne missile control and radar systems and communication satellites. She became the first woman to hold a supervisory engineer position at the company and was responsible for the reliability, maintainability, and safety engineering activities for all Defense and Space Center Programs, and headed the group responsible for developing the television camera system used on Skylab and other U.S. space programs. McAfee is a Fellow of the Society of Women Engineers and served as its national president from 1972 to 1974. She was the first woman elected to office in the American Society for Quality Control, served as the president of the Federation of Organizations for Professional Women from 1978 to 1979, served on the board of the Engineers Joint Council from 1975 to 1979, and was involved in IEEE. McAfee has been on the advisory council of engineering schools at Princeton University, Clarkson College of Technology, and Pennsylvania State University.

In her 2003 Profiles of SWE Pioneers Oral History Project interview, McAfee discussed her background and education; her interest in and introduction to physics and engineering; her career at Westinghouse as a reliability engineering working on defense and space program projects; her work on many important technological advancements;

and her involvement in SWE, particularly in relation to the women's movement, and sociopolitical issues such as the Equal Rights Amendment.

- July 2016

INTERVIEW WITH NAOMI MCAFEE (MAY 30, 2003)

LAUREN KATA: This is an interview with Naomi McAfee, past national president of the Society of Women Engineers. This is for the SWE Oral History Project. The interviewer is Lauren Kata. We're in Linthicum, Maryland.

First I want to start by thanking you for doing this interview.

NAOMI MCAFEE: Happy to be here.

LK: Can we establish your date of birth for the record?

NM: October the 27th, 1934.

LK: And can you talk a little bit about your early childhood, where you were born, and some family background?

NM: Okay. Well, I was born on a farm at home in Hart County, Kentucky. The largest town was a small town called Magnolia, which I think had six houses, so we were very rural. I spent the first year of my life on that farm, and then we moved to a big town, which was maybe fifteen houses, in another county about thirty miles away. I have two older brothers, an older sister and a younger sister. And I spent, well, the first fifteen years of my life -- the first year I spent in Hart County, the next fifteen I spent Hardin County, going to school.

I had a typical childhood, I think, as far as anybody who lived on a farm. As you grew up, you got assigned chores. First

it was feeding chickens, and then it was milking cows. And you progressed to increasingly more responsible things the older that you got.

My first school was a one-room schoolhouse. It had one through eight grades in that schoolhouse. And I think I probably learned more in that first year of school than I learned in the rest of my entire education all put together.

Anyone who talks about one-room schoolhouses not being good for you -- I just know that I was exposed to a greater breadth of knowledge during that one year than I was ever exposed to in any year after that. I graduated from Glendale High School in Glendale, Kentucky, another huge town. I think it had about 200 people. So as you can see, I'm a big city person from way back.

In high school I got interested in actually, chemistry, when we were doing a study on the atomic bomb, or atomic energy, in the beginning of the atomic age. And I was assigned to write a paper on the atomic bomb. And I had decided at that point in time that I wanted to be a chemist. And so I went off to college to study chemistry, even though my father thought I should either study home economics or elementary education.

But I went in to study chemistry, and then managed to have an altercation with a professor where I hit him in the head with a rubber stopper, which was not probably very smart on my part. And

he didn't kick me out of the department, but he told me that I could take that course twice a year for twenty years and I would not pass.

Of course, if I'd been hit in the head with a rubber stopper, I might have felt exactly the same way. Anyway, that day I became a physics major. And interestingly enough, when I went up to talk to the head of the physics department about being a physics major, I was the first woman who had shown interest in majoring in physics. And he had a very interesting answer. He told me, he said, "Okay, I'll let you try. But I don't think a woman can do it."

And he may have been more responsible for my success than he might have ever known, because that was a challenge that one just cannot pass up.

LK: What was his name?

NM: His name was Dr. George Page. Anyway, I went on to get my degree in physics. And I did not realize until years after I had been out of school and when other people were talking about they had problems -- or other women were talking about the fact that they had problems getting interviews when they were in college, that I didn't have any problems like that. And it turned out it was because he would not let any recruiter on campus unless they agreed to interview me.

And so as a result I had sixteen or seventeen job interviews. I had several job offers, but I decided to accept the one with Westinghouse Electric in Baltimore. And so that's how I came to be in Baltimore.

LK: Can we take a step back and go back to your childhood on the farm? As part of that experience, were you exposed to mechanical -- or any technology when you were young?

NM: Oh, yes. Growing up on a farm was one of those things where you didn't really think about calling a plumber or calling the electrician or whatever. When something went wrong, you were there and pretty much on your own, so you had to fix it. And with having two older brothers, that also helped, because they always wanted to have somebody that would be a gopher for them. You know, "Get this wrench for me, get that nut, hold that bolt, do this, do that."

So there was a lot of interaction with doing mechanical things, working with -- actually, with electricity, because my older brother turned out to be an electrician. And since he was thirteen years older than I am, he was always happy to let his little sister do something like hold a hot wire or -- he was great at playing practical jokes, but he was also very good to me.

I think the farm experience probably had as much to do with my interest in things mechanical or electrical as anything else.

Also, it had something to do with the attitude of my family. And basically, there were no such things as women's tasks or men's tasks, except my father would not cook and he would not wash dishes. Now, he would dry dishes, but he would not wash them. Other than that, everything was fair game.

LK: And they were encouraging about you going off to school?

NM: Well, yes. My father wanted all of his children to get college educations. He did have some ideas about what would be a good education for women. He felt that -- and he told me, he said that he wanted me to major in either home economics or elementary -- or education -- he didn't say elementary education -- because those were two fields in which a woman could always get a job. It turned out to be two fields that I could have been completely disinterested in. But when I went on to school, even though he didn't really support me financially, he never put anything verbally in my way to stop me from going on.

LK: So they did respond favorably when you became a physics major?

NM: He didn't know I was a physics major until I got my degree. In fact, I'm not sure he knew I was a physics major until he found out about my first job. And my first job, I was making the most money of anyone in my class. And that was a grand $95 a week. So that tells you how long ago that was. Of course, it was

1956. Good money at that point in time.

LK: So you were recruited by Westinghouse, and moved from Kentucky to Baltimore?

NM: Yes. I came from Bowling Green, Kentucky to Baltimore, and basically I've been in Baltimore ever since.

LK: Can you talk about your work history with Westinghouse? I mean, summarize for us.

NM: Well, I started out as a mathematician, because I have dual degrees in physics and in math. And after a year I was promoted into an engineering job. I started out in the reliability engineering area. It was a new field at that point in time. And I would recommend to anyone that if you're starting out, find yourself a new field and grow up with it, because that gives you a great step up whenever you're competing with anyone else. And if you can do it, help write the first books on that, which I was fortunate enough to be able to do.

I worked for Westinghouse Electric, and our total business was defense products. And primarily I worked in an area, which was airborne radar. The first program I worked on was a program called Aero 21B, which was a tail warning system. Now, if you want to know what a tail warning system is in an aircraft, if you remember stories about World War II, in the big planes you had a tail gunner and you had a wing gunner and a belly gunner, and so

forth. Well, the tail warning system replaced the rear gunner. It searched for aircraft coming in from the rear, and had a fire control system in it, where when they showed up in range, it shot them down.

From there I went on to bigger and better things through the years, more radar systems. One of the, I guess, most prolific was the F-16 radar, which we built over some 3,000 systems in that. That was a huge run for any program. There were offshoots from that. We worked on the AWACS [Airborne Warning and Control System] radar.

Now, AWACS, you surely have seen the strange plane that flies around with this huge saucer on top of it. That saucer contains the antenna for the AWACS radar. And I'm trying to think, I think at that point in time we had gone from radar systems that had something like three or four thousand components, to that particular system having over 166,000.

And so keeping things reliable was a real challenge, because the more complex things are, the more opportunities you have for things to go wrong. And believe me, there were a lot of things that went wrong in that particular program. And we worked a lot of nights and days trying to solve those problems. But the problems were not the fact that we didn't know what we were doing, it was that the technology had not quite gotten to the point where

we really wanted to drive it with a design. And so we were really pushing the edge of the envelope. And when you push the edge of the envelope, things don't always work the way that your equations say they will. So it's a matter of trying to get theory and practicality to agree, and to resolve the differences.

Well, the program is very successful. It's been used in Desert Storm. It was used in Iraq. The British have it, the Israelis have it. There are any number of countries that we have sold that airborne warning and control system. It really acts like a big spy in the sky, where at the same time it can tell everybody in the sector what they should be doing at what time and when they should be doing it, so a tremendous step forward in technology.

Things that were not quite as big, and were, in many ways, possibly more difficult to do, was the space programs. Having worked on satellites -- and of course, a disadvantage of the space program is if something goes wrong, at that point in time, back in the '60s and the early '70s, you couldn't go fix them. So you had to design to be sure that things would work for years, or at least for the specified period of time that the government wanted it to.

One of the first programs I worked on was something called the Environmental Measurements Experiments. And what we were doing -- or what it was doing was measuring the bombardment of

micrometeorites on things in space so that later on when they were doing designs for things like Apollo, the Space Station, and so forth, they would have an idea about how much exposure one was going to get from those and what type of design shielding one needed to assure that one of those did not poke a hole in the hull of whatever you were doing. Well, that experiment was supposed to last for something like two years. And it was put up in 1965, and it's still working.

There's one minor problem, we forgot to put an off switch on it, because everyone knew it was not going to work for very long, or not longer than one or two years. But the design was so robust that it's still going to this day. Is it collecting useful information? I really don't know, but I would like to think it is.

Another activity was helping to do that and test the black and white TV camera that took the first -- the pictures of Neil Armstrong's first steps on the moon.

LK: That was a project you worked on with Westinghouse.

NM: With Westinghouse. And it's hard to describe the anticipation and the anxiety that one felt listening to them saying -- well, hearing them land on the moon, and then knowing that they were going to be coming out, and that when they did come down and land, or step off of the step onto the moon, that that

camera would take the pictures and transmit them back to the earth. And just trying to know that that would work created quite a bit of stress.

And of course, the other thing in the stress for that evening was that the commentators would say, "Okay. They're getting ready to come out." And then they would stop and say, "No. They're going to be there a few more minutes." And in my household, we were going to celebrate this landing with a glass of champagne. So we had the champagne bottle in the refrigerator. And of course, we were watching the TV set in another room. So they were coming out. So you'd jump up and run in and grab the champagne and the glasses. And no, they weren't coming out. So you'd run back into the other room and put the champagne and the glasses back in the refrigerator. And finally, after this had happened several times it was sort of like, this is ridiculous. So we took the wire cap off the cork and set the champagne on a coffee table, where we could -- it was there, and we were still watching the TV. And as things went along, the champagne, of course, warmed up and blew the cork out of the bottle. And when that pop went off, it was sort of like "What happened? What happened?" And even though they hadn't landed, we drank the champagne at that point in time.

LK: Oh, that's great.

NM: But we did see the pictures of them coming out -- well,

the TV camera worked perfectly, and we saw Neil Armstrong take the first steps on the moon.

LK: It's an aspect of the first landing that you don't think about, necessarily, the technology for televising the achievement.

NM: Yeah. Well, NASA was, I think, very farsighted when they came up with the requirement for that, that how many people are going to be the first to step on the moon? And so let's take those pictures and put them into an archive just like we're putting oral histories into an archive. Later on they went on and used color TV cameras, and somehow became blasé' of the fact that whenever anybody went out, everybody expected everything to work perfectly. It doesn't always happen that way, but it would be nice if it could. And that was what reliability engineering did, was to try to assure that whatever was done, it was done well and would work like it was supposed to.

I worked on many satellite programs. One was the Defense Meteorological Satellite Program. It's kind of lovingly called the DMSP, and it first was known as WAP5, which was set up to take the first pictures of storms from space and help with weather forecasting.

And Westinghouse built the radar system for that, and the transmission and television system that sent back the information. And that program has been in existence for thirty-five years, and

is still -- even though the satellites themselves have not worked for thirty-five years, the program has progressively grown, and it still working fine.

LK: It must be amazing to know that you worked on these technologies in the beginning, and now -- and they've really changed our lives so much. That must be exciting.

NM: Well, when you're doing it, you don't really think too much about it. It's sort of like, oh, yes, it's very challenging because we're pushing technology. We're learning new things. It's always great to do that. And that was one of the great challenges for the business that we were in, is that we I don't think ever did the same thing twice. Whereas if you were doing things like building toasters or refrigerators, yeah, you had a new model, but there really wasn't that much change. We did a satellite program, and the next satellite program, yes, there was some flow over from technology, but there was always newer and newer technology coming along.

And in fact, everything was getting smaller and smaller while we were doing that. And as things got smaller, it became more difficult to make them because the smaller things are, the easier it is to get things contaminated. A particle of dust could short out a circuit. A microscopic drop of water could wreak havoc on a circuit.

In one occasion, which I nearly became infamous, we were in a manufacturing area where they were making small silicon chips for uses in satellites and in cameras and so forth. And I managed to sneeze, and we lost a whole day's production because we couldn't find the chips because they went in all different areas.

They nearly banned me from the area. After that they said they were going to put me in a hood and tie a string around it so that if I sneezed it would never happen again. Fortunately, that only occurred once.

But as we got into the smaller and smaller activity, we went from chips that were a half-inch in size to a quarter-inch in size. We went to tracks for conducting circuits that were microns in size to something that was a half-micron. And in case you're interested in what a micron is, something that's the width of a micron is about a fifteenth of the diameter of the human hair.

LK: Oh, my goodness.

NM: And so if I told you that was a wavelength of light, you wouldn't really learn, but maybe the fifteenth of the diameter of a human hair means something. So we got to the point where we would laugh about stuff and tell people that we can make anything as small as you like. We may not always be able to find it when we get through, but we certainly can make it. So those were some of the highlights.

I think the greatest satisfaction of the career that I had with Westinghouse in Baltimore was the fact that we were always on the leading edge of technology. And we could see that what we did today, ten years in the future people would be doing things like putting it into cars, toasters, TV sets, those type of things.

So when people would say, "What are you doing, and what good is it?" it was very difficult to answer that question. You could answer what you were doing, and you could talk about it in terms of what it was doing for the national defense. But what it was doing as far as the average everyday person, it was very difficult to predict and see.

LK: Do you think that's true today?

NM: Oh, I think so. I think that we're on the beginning -- well, we're on the curve, and the curve for technology is increasing exponentially. And it's very difficult today to keep up with what's going on. So as a result, people have become very specialized, which is also quite dangerous, because as you become very specialized, technology changes. And unless you change with it, you can lose your usefulness very, very quickly.

LK: That's interesting, because engineering as a profession is divided into a whole bunch of subdisciplines. Can you talk you a little bit about the background of your team group and the interdisciplinary background, and along the line of

specialization, as you were just talking about?

NM: Well, of course, anytime you build a product you have to have mechanical engineers -- in our business, electrical engineers, microwave engineers, semiconductor specialists, quality reliability specialists. All of those have a basic activity of getting together. One of the things is that they use math, a lot of math, and they use physical principals to build things. So there is that common thread that goes through it.

But the mathematics that you use for designing an electronic circuit is entirely different from the mathematics you would use for building a package that would house that circuit once it's designed. It's also different than the mathematics that would look at how you would conduct heat away from that package as it generates electricity, or generates heat. And anything that has electricity with it does generate heat, and you have to carry that away. Each one of those areas has a different specialty -- well, a different set of special tools that goes with it. And even though there is a lot of it that overlaps, there is some of it that is very, very, very specific to the activity on which you're working.

In reliability engineering, my biggest thought was not how does it work, but how can it fail, and how can I prevent it from failing? Whereas, somebody who's doing electronics design says,

"Gee, how can I make this work," and very rarely is concerned with the fact that it will fail. So you find these two disciplines quite often banging heads against each other, because on one hand the individual is saying, "Well, this is how it has to work;" and on the other hand, there is this individual, "But this is how it can fail, and how can you prevent it from failing?"

And of course, when we did space work, it was very, very imperative that you put a lot of safety margin into your designs, a lot of redundancy, or whatever, to prevent that failure from occurring, or that if a failure occurred, its effects were minimum. And if you were dealing with a manned space program, with the fact that you could lose human lives, it became even more critical to do things that would prevent things from failing. So on many occasions there were a lot of -- I had a lot of differences of opinion with some excellent design engineers. And who won? Well, my head was probably harder than theirs.

LK: Were you the only woman working on these early projects?

NM: Well, when I came into Westinghouse Baltimore in 1956, they had hired two women prior to hiring me. One had gone back to graduate school, decided that she wanted to get a doctorate and teach. And the other one was from Florida, and the first winter here I think was so severe, she decided she would not stay. She went home. Well, Kentucky and Maryland aren't that much

different, so I didn't have that problem. And so for five years, there was just me.

And this was in a group of about -- well, my group was something like ten people. But in the whole complex, there was over 2,000 people, of which over 1,000 were engineers. So, yes, I was pretty much alone. Not that I disliked those odds. They were very nice. In '61, they hired another woman, and then in '64, '65, '66, '67, there were a number of them that came in. But for a long period of time, it was me.

LK: Do you feel that that impacted your work at all?

NM: Well, yes and no. The immediate group in which I worked was small, and we became a family. And as a result, family members know what family members can do, and so you rely on their strengths and try to take care of their weaknesses. So we worked it that way. Things I was good at, I got assigned. And things that other people were good at that I wasn't so good at, the assignments went to them. But we all worked together to try to learn.

I was also fortunate, in the group of people that I was working with all became very successful in what they were doing. And as they became successful, so did I. We went up the ladder kind of as a group, knowing each other, and we're still friends today. The composition of the group changed it, it grew, it got

bigger. As it got bigger, I became a supervisory engineer, the first female supervisory engineer in the history of the corporation, and then a manager, and then a bigger -- well, a manager of a bigger group, and so forth. So at one point in time, I had a group of 800 people working for me. But I don't recommend a group that size, that's too big to handle.

I didn't spend all of my time in Baltimore, though. I got a bug along the line that I wanted to work at corporate headquarters, to find out what really happened in the -- you know, the big picture of things.

LK: That would be in Pittsburgh?

NM: That was in Pittsburgh. And so I had a year assignment on the staff of the vice president for engineering, as the Director of Strategic Resources.

And we were doing things like looking at the strategic plans that came in from all of the operating segments of the corporation. And that included the commercial, appliance, big rotating industry, the nuclear side of the house -- everything. We got -- the strategic plans came in, and we reviewed them and commented on them, and so forth.

And there were, what, five directors of strategic resources for the corporation. And each of us had about fifteen different business units that we worked with. One of mine was

transportation, which included movable walkways, escalators, elevators, that type of thing. Another one was the defense group, with which I was extremely familiar. And we also owned some construction companies, which became one of my business units to look at and work with and so forth.

And construction companies were not used to having women show up on their sites and ask silly questions. And that's the first time I really ran into anything that was even blatant discrimination. First of all, it was hard for them to accept the fact that there was somebody that looked like me that had the title of a Director of Strategic Resources. And so they would set up small tests for me to pass, like the first site I went out was we were putting in the subways in the Washington DC Metro.

LK: Oh, really?

NM: So knowing that it was a construction job, I did go down with my hiking boots on and my jeans, and so forth. And I had a hard hat, so I took that along. But the first thing they wanted me to do was to follow this guy who went up an embankment, which was, I don't know, a hundred feet high, with nothing but a small steel ladder with small steel rungs on it. And of course, he was used to doing that, so it was lickety-split up. Well, fortunately, I made it to the top. I was breathing pretty hard when I got there, but I did make it. And he laughed at me and he

says, “You know, you just passed the first test.”

LK: Oh, my goodness.

NM: And he and I became very good friends at that point in time. And he kind of steered me out of trouble on other things. But it was interesting that, yes, it was a test, and I had to pass it.

LK: What do you think would have happened if you just didn’t make it up that ladder?

NM: Oh, I think that they would have been very polite and very nice, but any question I asked, if they felt like answering it they would, if they didn’t, they would have given me some answer that would have been meaningless. They would have recognized they couldn’t really run me off the site, that really was not something that was politically appropriate, but they could have made it to the point where my usefulness was absolutely nil. But those things you don’t worry about once you get past them. Now, if I hadn’t passed it, I don’t know what I would have done. But I think I would have figured out some way to get even.

LK: (Laughs) Well, it sounds like with the projects that you worked on there was a lot of long hours, or it could be long hours.

NM: It could be long hours. It was one of those things that whenever something came up, a deadline had to be met, that you

just fill in and did your share, you pulled your part of the load. If you were on a program, which was running into trouble and somebody called you at 3:00 a.m. in the morning, you got up and you came in and you worked on it. There were times when there was really a crunch on, and nobody seemed to go home for days.

I do know one program where one man stayed at work for four days and finally was sent home. But it was sort of like -- I didn't say he didn't sleep, I said he stayed at work. But he didn't sleep very much. But the dedication was there. And most of the people that I worked with had that same dedication. And it was sort of like it was a huge team pulling together. And you learned to either play as a member of the team or you didn't play.

LK: Well, it must have been a challenge for the entire team, all members of the team, to balance personal life with the long hours. Can you talk about how you personally managed that?

NM: Well, fortunately I'm married to another engineer who was working in the same company. So he had series of times when he had the same problem I did. So it wasn't a question of having to explain and not having somebody understand what you were doing, and so you learned to work around those type of things.

One of the things that happened was on the AWACS Program, when we were negotiating, I guess -- no, we were trying to win the fly-off for the contract. We were in a competitive situation with

Hughes. And it was my fourteenth wedding anniversary. And we had made big plans to go out and so forth. And at 2:00 o'clock in the afternoon I got a call from the West Coast that says, "We have a real problem out here. We need you out here tonight."

And I didn't tell the guy it was my anniversary. What I did say was, you know, "Does it really have to be tonight? Can I come out tomorrow morning?" He said, "No. Tomorrow morning we've got meeting that's going to be held. We need you out here tonight so we can plan strategy," and so forth. And I guess I reluctantly -- no, I just demurred. I said I just couldn't do it, and I hung up the phone. Well, within five minutes the president of our operation here called me and said, "It really would be nice if you could figure out a way to get out there tonight."

Whereupon I called my husband and said, "I'm leaving for Seattle at 4:00 o'clock, I'll see you when I get back," because I didn't know how long I was going to be gone. And his only comment was, "Ahh, honey, do you really have to go?" Whereas I think if someone who didn't understand those type of situations, if I'd been married to someone who didn't work in the same type of situations, it might have been a completely different reaction to the whole thing.

LK: Yeah, that's interesting.

NM: So, yeah, you trade things off. But then life's not

always perfect, either. Name one thing where -- even if you're just going to school -- that you don't give up stuff occasionally to cram for a test.

LK: Right, right. What was it like working in your industry during the time period where society was very excited about the space program?

NM: Oh, that was a tremendous time. It was -- everybody was upbeat about it. You know, it's sort of like, oh, there's a new challenge. We were in a race with the Russians to put the first man on the moon. What can we do new? What can we do different? What can we do that will be unique to get this program going? How can we solve these problems that are there that we've never looked at before or never worried about before of traveling in a vacuum? How do we keep people healthy for periods of days while you're having to recycle all of the atmosphere and everything that goes on?

But fortunately there we were helped with the submarine program, which where you had people who were on submarines for weeks or for days, or in some cases for months, underwater, that had solved a lot of those problems. But everything they did was huge, whereas everything we did was smaller and smaller and smaller. So we could take the technology that they had, but the question was, how do you take it and scale it down and make it

small enough to really fit into what has to be done? And that was a major challenge.

And of course, as a result of that, even though, yes, the technology was there for doing it, and you knew what the principles were, you had to invent new technology that was smaller to be able to do it. And that's sort of like how we went from vacuum tubes -- and probably a lot of people today don't know what a vacuum tube is -- to transistors, to integrated circuits, to microelectronics to the very high speed integrated circuits and so forth, everything getting smaller and smaller. So with those challenges out there, actually I don't think there was any idea that was too dumb to be listened to. And so it was a great opportunity to just be creative and toss out things to be thought about. And then once you did that, sometimes you wished you'd kept your mouth shut because somebody would say, "Hey, that's a great idea. Go build it." And it's easy to think, but it's sometimes very difficult to do.

LK: Did you have any idea when you were young, maybe even when you were in school, that this was the type of thing that engineering involved?

NM: When I was young I had no idea what an engineer did. And in fact, even after I graduated from college I was not going to be an engineer. I knew I would not be a theoretical physicist,

because that wasn't my bag.

But being somebody who could do research in a lab and then build something, well, that was something that I could have done, to apply it. But when you look at it, applied physics and applied engineering, each one is just a little bit more remote than the other.

So they're very closely together. They use the same mathematical tools -- well, I don't say they use the same mathematical tools. They use the same basic mathematics and the same fundamentals in either application. The difference between most physicists and an engineer is a physicist does it once, and an engineer has to make it work many, many, many times.

LK: And that was something that you were familiar with in your teens?

NM: Oh, yes, I was familiar with that, but I had never thought about engineering. And in fact, when I came to Westinghouse, I still did not think of myself as an engineer. I was one of those applied physicists.

LK: Do you think of yourself as an engineer today?

NM: Of course. After thirty-eight years in that business, it's kind of hard not to.

LK: Right. I mean, since they're so similar, your educational background doesn't matter as much as actually what you

wind up working on in your career, or does it vary by industry?

NM: I think it varies by industry. You look at the various things in electrical engineering for example. You've got power, you've got electronics. There's, you know, several variables within that. And each one of those specialties uses a different set of tools. They've got the same basic fundamentals, but there are specialized tools that go with each one of them. So the main thing is to have a basic foundation that will allow you to develop the specialized set of tools that you need for whatever craft you're trying to pursue. And so with a broad base -- and I think physics gave me a broader base than engineering would have done -- I think I had more options available to me than I would have had, had I, say, been an electrical engineer or a mechanical engineer or a civil engineer or structural, or whatever.

LK: Right. Interesting. Can we shift gears and talk about the Society of Women Engineers?

NM: I guess that's permissible.

(Laughter)

LK: How did you first hear about SWE?

NM: Well, in 1961, we hired another woman. And she belonged to SWE.

LK: What was her name?

NM: Mary Lou Wolf. And when Mary Lou came to work, she

asked me if I belonged to the Society of Women Engineers. I had never heard of the Society of Women Engineers. I belonged to IEEE [Institute of Electrical and Electronics Engineers] and to the American Society for Quality Control, the ASQC, because those were two of my disciplines. She talked to me about it, I don't know, off and on for months, and then finally convinced me that I should fill out an application and join. And that was in '61, and I guess things just took their natural course after that. Looking at SWE I could see where it was useful in many areas. Having grown up in an active area where no one knew about SWE and had never heard anything about engineering or much about anything -- well, science wasn't really out of the question, because in high school I did have a basic course in chemistry. I had mathematics. You did not have any physics, because it was a small high school. I was in a graduating class of thirty-five.

But it was one of those things where all of those activities were things that should be pursued, and there was nothing that was looked down on. And really, there wasn't anything that said, "Gee, only boys do this or only girls do that," as far as studying math and science. Now, if you went into things like agriculture, that was a man's field, and home economics was a woman's field. And I want you to know that I never took a course in home economics in high school either. But as far as looking at

mathematics and science, history, English, all of those were fair game and anybody could pursue them. And if you were interested in that, that was fine.

I was one of the few people in my high school that took a course in solid geometry. And there were two of us in class. And sometimes I think there were three. I don't think the teacher knew much more than we knew, so we all were learning together. But it was very beneficial, just having that small number of people there. You could talk about different things, and if you didn't understand something you could spend time on working it out. Whereas, if you had had a class of fifty, you couldn't have done that, or even twenty.

And that was one of the advantages of my college, too. I was one of four physics majors graduating in '56. And there were many classes where four, six people were the norm. Now, it's tough on a student because there's no place to hide in those classes. But it has an advantage that the instructor knows your weak points and can work with you on overcoming those; whereas in a larger class you might be able to get by, but you would never be able to get the intense help that you might need. So good and bad points.

LK: So early on were you involved with working with students through SWE?

NM: In SWE the first thing that came up was that when I

joined that we were predominantly a group that was located in Washington, and we were known as the Washington Section. So the idea was, how do we develop people -- or develop enough membership in the Baltimore area? And originally our thought was to break into two sections. Well, it became obvious that that was never going to -- at that point in time, we were never going to be big enough to really do that.

So we became the Baltimore/Washington Section. But the first emphasis was on developing membership within the SWE area -- I mean, in the Baltimore area.

LK: Professional members.

NM: Professional members, right. Then we did look -- after that it was sort of like, how do we work with students? But even more so, how do we work with the other engineering societies, and how do we get recognition in the community that women actually make a very positive contribution in these areas?

LK: Can you expand on that a little bit?

NM: As to how we did that?

LK: Yes, for example.

NM: Well, for example, one of the things we did was to look at what other industries were in the Baltimore area. Glen L. Martin Company was a big company then. They were an airplane company. In fact, they were the biggest employer in the area. So

we contacted their human relations department and said we're trying to identify women in engineering. And they were very good about giving us names. They weren't very good about giving us ways that we could really contact them, but when we sent them information, they did pass it on. And they would leave it with the women, and they could contact us. There were architectural firms in the area, which we got in touch with. There were consulting firms.

And there was the media. And part of the media thought this was such a novel idea that they knew they had these freaks with two heads out there. So they were more than happy to come out and interview us, and were always amazed that, gee, we were almost normal people. And they gave us very good press. So the word went out that way.

So it was more of a matter of trying to figure out how to network, and looking at what the networking was. Now, the IEEE, I think maybe there were five other females in the organization when I joined -- locally. And they had no problem with giving me the names of the other members of IEEE. After all, I was a member of IEEE. The American Society for Quality Control, I was the only one. The ASME [American Society of Mechanical Engineers] has a group here, and all of them belonged to the Engineering Society of Baltimore, so it was sort of like with my IEEE connections, I

could get into that group and identify people. So we went out with talking about -- with selling the idea that you're there, you're making a positive contribution, what can we do to help? Are there lessons that we can learn from you? How can we encourage other women to join the profession? How can we get the word out to the high schools and to colleges?

And the thing that would really tweak most of the women was the fact that we were thinking about judging in science fairs in high schools. And yes, that was something they could do that was not making them look like they were joining a militant organization, or it was men versus women. So they went out to do that. And when they did that, they began to realize that there was a network there, that if they had questions or things came up, that they could call and say, "Gee, I'm running into this problem. Have you ever seen that before? And what did you do about it?"

So that's the way that that was developed. And I guess it was within two years, maybe a year, after really working on that that there became enough focus groups of people in the Baltimore area that we could go to the Washington group and say, "You know, yeah, you geographically have this whole area, but you are not really representing who we are by saying that you're the Washington Section of SWE." And so we changed the name to Baltimore/Washington.

LK: Why was it important to you, personally, to take some of your spare time and devote it to SWE on top of your technical commitments?

NM: Well, when you go out to dinner and you find that you're the only female that's talking to the men, after all, they would be over talking about, you know, what I'm doing with this car or how I'm going to fix -- and who wanted to figure out how to change diapers, you know? So we would go to parties, and there would be all these women, and there would be these men, and me. And it was sort of like, you know, we -- I really need to do something that can develop a group of people who at least think a little bit like I do.

And there were other people who did. I found that when I talked to doctors or lawyers who were other professional women that their concerns were different than if I had been someone who had just stayed at home. Now, I'm not going to denigrate what people who stayed home and raised children did, because it was very necessary, and if that's what they wanted to do, that was fine. But on the other hand, I sometimes felt when I went to social events, I must have felt like a mother does who has two small children at home feels when her husband comes home in the evening, that all of a sudden she's got an adult to talk to. And so that was part of it.

The other part of it was that we were really having a crunch at that point in time on getting talent in the engineering field. And so when you're neglecting half the population, that's a terrible amount of brains to ignore. So what can you do to encourage the people who are capable to come into the activity?

So it wasn't all altruistic. There was some selfish motives that went along with it. So as I say, SWE, to me, became a portion of things that could allow me to network, to get to know people in the field. And of course, as one moved on to a national level, it gave you a network of people across a huge group of industries.

LK: Is that why you continued to go -- to become active nationally instead of just remain--

NM: That was one of the reasons. The other reason was that, I guess, if you've got a modicum of ambition, then when you join an organization you like to see how far up the ladder you can progress. But the networking and the development of the contacts was very important.

For example, on company trips, when one would travel, almost all the guys, if you were on a trip with the guys, knew somebody in the city that they could call and go out and have a beer or have dinner with. And it was also very nice to be able to call and said, "Hey, I'm going to be in town. Can we get together for

a drink," or whatever, and not have the problem of just tagging along with what the boys did. So there was that aspect of it, too.

And it was great, also, on vacation, when you were on vacation, to be able to hit a -- drive into an area, pick up the phone and say, "Hey, I'm here for a couple of days. What should I see?"

LK: Sure. Do you recall that your coworkers supported the idea of a separate Society of Women Engineers, or did that ever come up?

NM: I don't think my coworkers really cared. I do know that my superiors were not against it. Some of them very actively supported it. I don't know of any of them who were actively against it.

LK: That's wonderful.

NM: And as a result, when I was trying to go up in the organization, I got a lot of management support to go ahead and progress, that I'd do that, because they felt it gave Westinghouse a good name in the community, as being somebody who would do good works, or whatever, create goodwill. And so that's very important whenever you have a business.

(INTERRUPTION IN RECORDING)

LK: This is tape two for our interview with Naomi McAfee.

In your national role within SWE, that brought you in contact with networking with other women's organizations. Can you talk about that a little bit, how you got involved in that, and the outreach between SWE and other women's organizations in the early '70s?

NM: Well, in the early '70s, SWE, initially, was a very insular organization. It looked at doing everything within itself instead of looking outside and seeing how it could communicate and work actively with other groups, whether they be professional engineering groups or whether they be women's organizations.

To me, it became painfully obvious that if SWE was really ever going to become a 'dynamic national voice for women in engineering' that we had to cut across several layers of things. One, we had to do outreach to the other professional societies, professional technical societies. And so one of the things we did was set up a memo of agreement with the National – NSPE [National Society of Professional Engineers].

LK: Oh, that's right.

NM: Which there was some opposition within SWE, too, because I guess at some point in time NSPE did not take women members. But that was, you know, a slight ripple on the water. It wasn't anything that was really strong. Looking at the other women's professional organizations, there was a large concern within the leadership of SWE that if one became affiliated with those groups

that we would, one, endanger our nonprofit status.

And the question was, if we do these things, how can we do that and keep our educational nonprofit status so that we will maintain the same status within the engineering communities that we have had before? Very valid concern. But there were any number of ways of doing that. You could sign memorandums of agreement as we had with NSPE. That didn't mean we were advocating everything NSPE did, but we had agreed that we would work together to further the 'tenets of engineering', and make it known for everybody, each one.

To look at other women's professional groups, the idea was, how can we cut across those groups? And some of them like AWIS, the Association for Women in Science, were women who had technical backgrounds like people in SWE. And so obviously, if we could entice those people to become part of our organization, we could further our goals of getting the word out about engineering being a good career for women.

LK: Right. Can you give some examples of other women's associations that you're speaking about or talking about?

NM: Well, we even looked at doing things like -- there was a subgroup within the American Medical Association, the doctors. When we actually looked at that group and they looked at us, it was sort of like, well, we are so far apart in what we are trying

to do, with us being the social side -- this type of thing -- and your being the hard people -- not the hard people -- the hard scientists, that it didn't seem like a workable match, even though we had goals in common. And we agreed to continue talking.

For many of the others, like the Association of Women in Geology -- and I can't remember what all of these groups were, but most of them were in the physical sciences, social sciences area, that had women's organizations. I remember there were several groups like that. And the idea was that if we could bring those groups of people together and talking as one unit rather than each of us going off and spinning our small portion of the pie, trying to 'ping', we could consolidate our efforts and make a bigger impact.

So at the time we were looking at that, there was a lot of changes that were going on in society in general. For example, the Equal Rights Amendment had just been passed out of Congress at that point in time. And so people were becoming more and more aware of those type of activities. Title IX was passed along about that time, too. So it was a question of how can we concentrate our efforts in such a way as to create the greatest impact?

And many of those things were the same. Even though SWE wouldn't really admit that, they were interested in how can we get

jobs and how can we get better pay for the jobs that we're in, or at least equal pay to men, type of thing. How can we encourage more people, particularly women, to come into this field and see it as a strong career move?

And the Federation of Organizations for Professional Women [FOPW] was founded on that tenet: Let's bring all these diverse groups together and see if we can come up with one voice that can go out and say that we've got 50,000 members supporting this rather than having a group of -- like SWE at that point in time -- 1,200.

LK: Do you have any thoughts on how that type of organization compares with like AAUW [American Association of University Women], or even NOW, National Organization for Women?

NM: Well, AAUW and FOPW -- AAUW was a member of FOPW, by the way--

LK: That's right, okay.

NM: -- were all looking at this as, you know, how do we get the women's professional groups to concentrate and bring their weight to bear on 'an issue', or two issues, or whatever? Now, FOPW was interested in making sure that this was an educational effort that was out there and would not be perceived 'as a lobbying group' because of its educational tax-exempt -- well, educational status, primarily. And you couldn't keep your

educational status without having a tax-exempt status of some type, whether it was a 501C3 or a 501C5.

Now, if you look at NOW, NOW had this whole broad group of activities that it wanted done, and they wanted them 'now'. And they were going across the board. SWE was not interested anything like the legalization of abortion, for example.

They weren't interested in lesbian rights. NOW was interested in all those things, and they actively went out and lobbied for all that stuff. Well, I don't really mean to refer to it as 'stuff'. They went out and lobbied for those issues. There was no way SWE was going to get into any of those arguments, because it did not fit the charter that we were looking at, and it was outside everything that we had laid down.

Now, the right for equality was not something that was outside our charter. But how you went about proposing that or actively selling that point was completely different than how somebody like NOW could go about it. So if you looked at the professional women's organizations, they had a lot of common goals. A common goal of: How can we entice more women to come into these professions? How can we convince the public as a whole that it's an honorable profession for them and it's a good thing to do? How can we upgrade our status in the community? And I can go on and on about that, but it was in that genre of activity to

get things done.

Now, there is always a conservative group, and there's always a liberal group, and there's always somebody like me who's a radical. The radicals go out and shake the trees and the liberals come along and really make things happen. Conservatives like to go back to cave age -- Stone Age days. But anyway, you have those different approaches. Some people are conservative by nature; other people are, "Let's go out and embrace new ideas and get out with it and see, and hey, if it doesn't work, let's go try something else." Whereas there are people who says, "Okay, let's take a small step here, and if that works, then let's take another step and another step, and in about 400,000 years you'll get where you want to go.

But at that point in time in the '70s there was a huge social change sweeping the whole country. The Equal Rights Amendment thing just being passed out of Congress was something that was basically unheard of. And immediately, you know, several states approved it. And in fact, the night that it was passed out of Congress, the Maryland legislature set their clock back so that they would still be in session when it was passed so they could be among the first states to ratify it.

So that was some of the tenor that was happening then. And on college campuses there was this huge push for women to be

accepted in all the scientific organizations, its members and so forth. And colleges were making that happen. They were forcing the male organizations to accept women as full members -- either that or losing their charters. And they were turning around and saying to SWE in return that, "If you don't change your requirements so that men can become members, we are not going to allow you a charter."

Well, it was sort of like if you're demanding this of the men, the men have the same right to demand that of you -- members, you know, of equal status.

LK: Right. Prior to the early '70s, how did men -- how could they become involved in SWE?

NM: Well, in the -- I'm trying to think -- '66, '67, somewhere in that time period, there were a group of men who were spouses, basically, of members of SWE, who got together and formed a men's auxiliary. And it was lovingly known as MASWE. That was the way they were showing their support. After all, men's groups had women's auxiliaries and did the same thing, so was in that way. And the members in MASWE, except for one or two, never really wanted to push it further than becoming just an auxiliary.

But there was a couple who were saying, "Well, gee, if we're going to -- if everything else is changing to the point where women can be full members of everything else, why can't we be full

members of SWE?" Which to me made an eminent amount of sense, but didn't make a lot of sense to -- well, I don't say it didn't make a lot of sense -- it was an argument a lot of other people were not willing to buy within SWE -- or within SWE were not willing to buy.

So as these things went along, it became a tug-of-war among those people who said, "Gee, let's go full out for equal rights and the whole thing, pass the ERA," and for those who were saying, "Well, gee, what's going to happen if we allow this change -- and it's a major change -- when all of this influx of men come in, what's going to happen to the organization?" And that would have been a valid concern, except that there wasn't this huge influx of men who really wanted to come in.

On the other hand, the feeling that this huge influx of men -- or these men who were going to come in were going to come in and immediately take over, to my mind was something that was ridiculous. You had a group of people who knew –had shown they could be leaders, and if they let that happen it was their own fault. So that was the difference in the way of thinking.

Also within SWE there was a feeling that if you really went out and pushed for 'equality', you were going to be thought of as this bra burning, hatchet bearing militant who was fighting -- was killing the image of SWE as being rational professional women who

were really looking for change in a reasonable way. So you had all these factions that were fighting against each other.

LK: Sure. In '73, SWE's Council passed a resolution in support of the Equal Rights Amendment, correct?

NM: Yes. It came -- the motion was made and it was duly seconded and passed. And I'm not sure, but I think it was unanimous for that.

But at the point in time when that happened in '73, a lot of the issues that became very divisive later had never been brought up. As I say, the tide was, at that point in time, it looked like this was going to be a sure thing, it was going to pass in (snaps fingers) the next couple of years. And no one had thought about the divisive battles that came up later about, "Gee, this would mean that women want to use men's restrooms," which was one of the dumbest arguments that I ever heard. But it was brought up as a valid type of thing. In spite of the fact that on hundreds of airplane flights every day everybody used the same restroom, and there was never any fight. What do you do in your home? Do you have a male restroom and a female restroom? The answer to that is no. So it was one of those red herrings that was thrown out there to stir the pot.

There were other things like: "What makes women think they have the rights to demand all this stuff? After all, a woman's

place is in the home," and et cetera, which is... But those issues were not on the table at the time in '73 when that resolution was endorsed by the Council -- well, by the Executive Committee and I guess by the Council at that point. Really, at that point in time, there wasn't really that fight about men becoming full members of SWE. That came a couple years later. And the argument on campuses about if women are going to be full members of whatever campus group there happens to be, except for fraternities then professional women's groups have to accept men on the same level. Those arguments had not come up. And if arguments haven't occurred, then you don't have a lot of fight about them. It's only later when those issues are brought up that they become divisive.

There was a group that said, you know, "If we really go out in our endorsement of the Equal Rights Amendment, then we were 'lobbying', and therefore we are endangering our tax status."

LK: What did you think about that?

NM: I don't think I can say what I think about that on this.

LK: Okay.

NM: Well, it's a specious argument, because there are many ways that you can advocate your point of view without lobbying. And one of the ways you do that is by getting up and saying, "Gee, I'm for this," without putting a ton of money behind it.

LK: Oh, okay.

NM: Everybody said, "Well, you can do that as an individual." But it helps more if I can go out and say, "As a group, an X-number of women engineers, we feel that we have a right to be treated as equals." Now, I'm not in Congress trying to get a vote even though I'm hoping they vote my way. I'm not down at the statehouse actively haranguing somebody about "Do this," whatever. And that's really the definition of lobbying. But to answer a question like you just asked me and say, "Gee, I am for this," and so forth, "and my group of SWE is for it," doesn't count for lobbying. That's an opinion that has been stated out there.

But there were many people who were afraid of doing anything because of the status quo. They wanted to keep the status quo. And as a result, it ended up in the Society kind of splitting -- I won't say down the middle, but because of they're being a group of advocates who said, "We've got to go out and do something about this," and those others who were on the other side saying, "Oh, no, we can't do this because we're going to do whatever."

LK: How was that split manifested? Was it people just didn't talk to each other as much, or were there actual votes that went -- or--

NM: Well, the difference was manifested in such votes as

male membership. And male membership, that did not pass by a huge majority. I'm not sure what the vote was on the Executive Committee, because I was not on the Executive Committee at that point in time. I was past president. But it was at least a majority that got voted out to present it to the Council. And in the Council there was a long debate on it, and it passed, but it was not by a significant amount.

LK: This was in 1975?

NM: 1975. There were other issues that came up at the same time that were in the same category, like letting student representations on the Council. Their feeling -- there was a lot of people who said, "Well, gee, students, they do not pay the same dues as full members," and so forth, "so as a result they shouldn't have the same rights." Well, the students weren't coming out and saying, "Gee, we want one vote for one member. What they were saying was, "We would like representation on the Council." And I think at that point in time they were asking for two people.

Well, if you look at the number of students versus the number of professional members at that point in time, it was about five to one for students, and what they were asking was sort of like, so what? But it was sort of like -- you know, again, this is upsetting the rules of order or the rules of the day. And even

though it passed, in either ‘74 or ‘75 -- it must have been ‘75, because I chaired the committee that came up with that recommendation, so I couldn’t have been president, so it would have had to have been after that. But even though it passed, it was, again, a long a serious and hard debate. And there were people who went away saying, “Well, if that’s the way you’re going to do business, I’m going to take my toys and go home.”

Now, I don’t think on the Council, the student thing, that there was anybody who really left the Society. On the male membership vote, there were people who left the Society.

LK: Interesting.

NM: And the question is whether that was for male membership or whether that was because of the push that was being put forth on ERA.

LK: Because it was in the spirit of ERA that male membership became an issue.

NM: Right. And there was a group that was very vocal about, “We can’t do this, because if we do that, then we have violated all of our tenets. We’re not longer staying true to what our charter was and what our initial goals were.” And there was another group that was saying, “Well, gee, our initial goals is to advocate the position of women in the profession. How do you do that without advocating the position of women in society?” And so

it was a -- you know, night and day. And there was this huge gulf in between. And there were people who were ambivalent. But there was this huge gulf where these two groups -- nobody made the attempt to get them together to talk.

And I felt that that was a lapse in SWE's leadership, that even though this leadership had taken a mode of neutrality -- and there was nothing wrong with taking a neutrality role -- when you're neutral, the thing you have to do is get the two warring parties together. And they may agree to disagree, or they may find some common ground, but at least to get them together and talk, because if you get them together and talk, maybe you can make some progress. If you leave them out there, just ignoring it and saying, "Maybe it will go away," it only gets worse.

LK: So what were the venues of getting people together primarily, the annual conference and then the magazine, or--

NM: Well, the annual conference would have been the easiest place to have done it, because typically your most vocal people show up at that conference. And even though there is a tremendous number of things that go on at the annual conference, to set aside an hour or two hours for something that was looming that big would have made a certain amount of sense.

Now, it might have been a difficult negotiating ploy to get people to agree to sit down in the same room, because as I say,

the tempers were running pretty high -- well, emotions were running pretty high at that point. I won't say that tempers were really flaring, but people felt very, very strongly about their position. And it was sort of like, "Well, if you don't do this my way, I'm going to leave."

And even though I do not know -- that's not true -- I can think of two people who were on the very pro side that left because didn't think enough had been done. And I can think of about ten on the other side that left because they thought far too much was happening.

LK: Interesting.

NM: So it was a fun and volatile time.

LK: Right, right. I can think of a couple things that happened related to this in the late '70s, when it wasn't so obvious -- or it didn't seem too obvious the ERA was a sure thing. And that was SWE asserting, once again, its support for ratification, and then the resolution not to hold conventions in states that had not ratified. Can you talk about that a little bit?

NM: Well, I think that by the time '76 -- there was a conference -- or a convention in Cincinnati, where it was -- at that point in time it was saying ways to get the point across that we really are serious about this is to vote to not hold meetings

in unratified states, in those states we're not spending our money. And that would be one way of tacitly supporting. Not lobbying, but you're just saying, "Okay, you can do whatever you want, but we're not going to come to your state to hold a meeting." And that passed at that convention. These days we have a conference and then we had conventions, so I have to...

LK: That's okay.

NM: I think it intensified in '77 in San Francisco, where San Francisco then, like San Francisco today is a very liberal, outspoken group.

Well, I don't know about the -- I won't say the SWE Section is, but San Francisco as a total, the city, the territory, or so forth, they're thought of as the liberty section of California.

LK: And I think the Golden Gate Section was very outspoken about ERA at that time.

NM: Right. And so at the '77 convention, they invited Bella Abzug to be the keynote speaker. And not only did they invite her, but they paid her, which was one of the first times that any speaker had been paid.

And people were very upset about the fact, "Okay, we're not only paying this speaker, but we're bringing in this outspoken foul-mouthed liberal." And she was pretty foul-mouthed -- not in public, but boy, if you were just around her, she was New York

street, that was the way it went. Anyway, Bella came to the conference, our convention, and wowed everybody.

LK: This was in '77 or '79?

NM: Well, '78 was in Atlanta where we had the big showdown. And in '77, at the San Francisco convention, there was a big debate on should we go ahead and hold the conference in Atlanta.

LK: What were the issues pro and con?

NM: Well, the issue there was that, okay, we have passed this resolution in Cincinnati not to do this, so having passed that, what does this say if we go ahead and hold it? On the other hand there was the argument that, gee, we made this commitment to Atlanta three years before, and what does this say if we're not willing to keep our commitments? So that was the argument. And so the upshot was that the Society, SWE, voted to honor its commitment. And so that's when we went to Atlanta.

LK: Where you were the keynote speaker?

NM: Where I was keynote speaker at the banquet. I actually went into that conference -- or convention with two speeches for that banquet. One was the one I gave, and one was a light fun type thing that would just celebrate the activities of the week. And when I got there I had no idea which one I was going to give. And I still, up until Friday evening, had not made up my mind which one I was going to give.

But one of the agreements that we had in San Francisco was that the Atlanta Section would not go out and say, "Gee, we're meeting here in spite of all this ERA stuff." Now, the question is: What did Atlanta do or what didn't the newspaper guys do? A news reporter on TV, he came out and he said, "Would like to report that we have this group of highly qualified professional women, the Society of Women Engineers, who are meeting in this state in spite of their resolution to not meet in unratified states."

LK: So they highlighted that contradiction.

NM: Well, they said no. Now, who's going to know? I don't know. But I do know that cemented my decision to give the speech I gave, because at that point in time I thought we had an agreement that, yeah, we came, and we kept our commitment, but that doesn't mean that we still don't feel strongly about what we said we would do.

LK: Right, right. What were some of the main themes of your speech?

NM: Well, my main theme of the speech was -- actually, I think I retraced the history of women in the workforce, when you come right down to it. But I started out with thirty-nine E's for equality, because that's how many states we needed to -- well, that's how many states we had ratified at that time, and we were

three short. And I don't know whether I got the other three E's in somewhere along the line, but I do know I had to look a long time to get thirty-nine.

And then I talked about the status of women, starting back in, I don't know, 1200 and coming through. Looked at what women were making in 1960, which was something like fifty-nine cents on the dollar for every dollar a man made, and that we had gotten up to -- it's been a long time, so I don't remember the exact numbers, but we gained a couple cents along the line. And then in 1978 we were back to fifty-nine cents. For every dollar a man made, a woman made fifty-nine cents. And looking at that, my reaction was that if we kept going at that rate, eventually we would be paying people to allow us to work, which is a little bit far out, but you can draw those... And I talked about the things that we needed to do, emphasized what some of those were, and then ended up with the fact that we were the people who were the educated people, the ones who had really made it, but we were unwilling to support our sisters who hadn't.

LK: How did people respond to that?

NM: Well, about half the group stood up and cheered and about half sat at the table. So anyway, it was an interesting evening. It was probably more interesting the next day because of the people that you had known for years that just froze you as you

walk past them.

And it was interesting, also, when I got back, I got some anonymous letters that were really great, some of them threatening. I got some that were very positive. And some of the anonymous letters were hilarious because they were handwritten, and you could recognize the handwriting. So anyway...

LK: What would you say about the fact that as a member of FOPW -- I mean, SWE, indirectly was vocal even when there was a debate within the organization to directly -- to speak out for women?

NM: Well, FOPW was one step removed 'from SWE'.

LK: Right. But SWE was a member, correct?

NM: Well, yes. But the people who were against this could say, "Well, gee, that's just that faction that's for it." So you could keep yourself away from it. You could say, "Okay, I'm at arms length from that." And even though 'one didn't particularly like it', you had a valid argument for it happening and still being a member of the group.

But there was a group within SWE who did not even want to do the reaching out across the area to other women's groups, even though that wasn't as strong -- it wasn't a real strong fight. But there were people who were concerned about that.

LK: Do you remember what their reasoning was?

NM: Well, again, we're affiliating with a group of people whose goals are not the same as ours, whose ways of advocating things may be stronger than we would like, who may be saying things we don't really believe. But as I say, again, we had this wall, where that was one step removed, and so you could say, "Well, I'm on this side of the wall, and those people on the other side, yeah, they're there, but I'm not really part of that group."

LK: Yeah. Do you think it's important that SWE was represented at the National Women's Conference in 1977?

NM: Oh, definitely. I think not being there would have been a gross omission. Basically what it would have been saying is that -- one of two things -- either that, "The Women's Conference was totally irrelevant," or that, "We're above all of this." And I don't think SWE could afforded to have said either one of those things.

LK: Do you think some of those issues are valid today?

NM: Of course. I still feel as strongly today about ERA as I did then, to the point where there are certain states that I almost refuse to go to. And you may find this interesting, but every year my family has a pool on the men's basketball NCAA tournament. And it's one of those things that everybody draws up their picks and throws them in, and then whoever wins, everybody else takes that person to dinner, wherever that person wants to go

to dinner. But when I go through to make my picks, the first thing I do is I go through and I eliminate all teams that are from unratified states.

Then I go through and I eliminate all schools that have any religious affiliation, and see who wins. And then I go back and I pick who I think really will win, discarding all that first nonsense.

LK: Have you ever got a winner?

NM: Five times.

(Laughter)

NM: But not -- only once -- that's not true. When Duke won, when Kentucky won, those all fit my criteria. But I don't think they won when I went through and just said, "Okay, these are the teams I throw out," for whatever reason. But my husband thinks that's absolutely hilarious when he watches me go through and make that pick. Then he comes back and he says, "Okay, now, what are you rationally going to do?"

LK: How did you feel when the statute ran out for ERA?

NM: Well, very bad. First of all, I never thought there should have been a limitation put on it to start with, especially when several years later an amendment that had been around for 123 years finally got passed. But on the other hand, with looking at all the controversy that was going on and how it was dividing

things it might have been just as well that it did, because it could have only gotten more divisive. It wasn't going to get any better.

Even though if you pushed it long enough, we might have gotten the three states to ratify, the additional states that were needed. But it might have been a case of winning the battle and losing the war, from just the backlash that might have gone onto it. So it's a moot point. It did lose. It will be back again at some point in time, and hopefully at that point in time it will pass.

LK: Other than SWE, you have been involved in other organizations or even committees or organizations focused on promoting women in engineering or studying women **in** engineering. Can you talk about those a little bit? Like the IEEE committee, I think, was one of them, or--

NM: Well, actually, in IEEE, even though I was a member of the women's committee, it was Thelma Estrin who was a member from Los Angeles, and Irene Peden, who headed up that. And of course, their being there actively, of course, had my support. At the point when that was going on, I was very active in the IEEE Reliability Society, and was an officer in the Reliability Society, and ended up being president in 1984. So, yes, I was active there. And when I was working with the group -- this

Reliability Society, I was active in trying to bring women into the group and promoting them. And in fact, I had a lot of support from the guys in the IEEE Reliability Society doing the same thing. So from that viewpoint, yes, I was pushing and trying to have some influence. But the people who really had the main influence were Irene Peden and Thelma Estrin, who were doing all the really hard work with the board of directors.

LK: What is the difference -- or maybe that's not the right way to put it -- as someone who has been involved in SWE for so many years, what do you have to say about new types of women in engineering committees that are being formed or were formed later, and do they have common goals with SWE, or are they different, or--

NM: Well, if you look at the women's organizations in the other groups, I think they have come up with a cause that is specific to the society to which they belong. On the other hand, in many ways, because they felt that they had to do that, I feel that SWE has lost a battle, or missed an opportunity, because if SWE could do the reaching out -- and I tried this and other people have tried it, and no one has been successful, so I'm not throwing in any rocks at this point in time. But the person who can figure out how to take SWE and cut across all that and have those people joining SWE will be the person who has really done the most for

women in engineering.

LK: Why is that so difficult? Or is it just not one answer?

NM: Well, I think there's several answers. One, a lot of these people have never heard of SWE. Second, there are those people who would rather be a big duck in a small pond rather than a small duck in a big pond. There are others who feel that what they're trying to get done in their own society does not agree with what SWE is doing, or that if they join SWE they would lose some of the focus on what they're trying to do there, because, again, it would be splitting energies. So there are any number of reasons, none of which are easy to overcome.

But the greatest one, I think, is the lack of communication across the whole activities. Even though at the top all those people who head up those major societies will tell you that, "Yes, indeed, we're for that," they don't do a lot about pushing the message down through the organization. And in many cases, when you need to get that message across, regardless of what people say about things coming from the bottom up, from the top down carries a lot of weight.

So there isn't 'a reason,' because if there was 'a reason,' it would have been attacked and overcome. But there are just so many reasons that it seems that if you hit one and overcome it, there's a dozen others that pop up someplace else. So it's a very

difficult situation.

LK: We talked a lot about SWE. Is there anything you'd like to talk about as far as contributions in your other professional organizations?

NM: Well, I like to think that I made some of those organizations. Like for American Society for Quality Control, I was the first chairperson -- or chairwoman -- or chairman, I guess at that point in time, of the Baltimore Section, the first woman who was. I was the first female president of the Electronics Division. And I went from that position to be the first woman who served on the board of directors in ASQC. Since then there have been several, and there has even been a female president, which is -- I didn't get there, but I like to think I helped pave the way.

In IEEE, I think my contributions were more in a technical vein, of working within my own profession, doing things like education, developing educational materials for that profession, for that particular discipline of engineering.

LK: Reliability?

NM: Reliability, right. It was really my major contribution. I worked with the first people -- there were four of us who wrote the first textbook on reliability engineering. That group, as a result, were able to go out and get that discipline -- at least its courses -- introduced in several

engineering schools. And so from that viewpoint, what we were trying to do was further the profession, the technical discipline of reliability engineering, to cut across -- and I think in that we were quite successful. I think in my own corporation, Westinghouse Electric, I was quite successful in making it at least a legitimate discipline. And that had some impact that made a lot of difference as we went along. So a lot of things that go on.

I think one thing we didn't talk about was mentors within the profession. And at every step of my success within Westinghouse I had at least one mentor, and many times, two. And they were very seldom the same people over a long period of time. As I went up, the people who were my mentors, as I progressed from one level to the other, at that level, became friends, and we're still friends. And they in turn helped me develop other mentors.

And that was one of the reasons why I was selected to go to headquarters, was because of the mentors and the sponsors that I developed as I went up. And the mentors are important, and it's important to recognize, as you advance, that you need to get different mentors because of the different perspectives and so forth that come along.

But what people don't realize is that as you go up the ladder, you also need to have people who are sponsors. And

sponsors are particularly people who come in and tell you, "Hey, you know" -- or when you go to and ask for advice they said, "Well, gee, you ought to do A, B, C, D," or, "Have you thought about" -- or when you go in and say, "I'm going to do something, and they said, "Well, maybe you should rethink that," rather than telling you it's a stupid idea. But sponsors are those people who will stand up and say, "I think the person for this job is Naomi, and I think it's for this reasons," and they say this over and over and over again, while those other people who are sponsoring other people are making their comments, but your sponsors are better at selling their point. And if you don't have a sponsor -- you have can all the mentors in the world, but if you don't have a sponsor...

LK: How do you get a sponsor?

NM: Quite often you don't even know when that sponsor shows up. And when I came up and the chance for the promotion to Pittsburgh -- I knew my boss was very much for it. He was, and his boss, they were my mentors. What I didn't realize was that my sponsor was the president of the sector in Pittsburgh.

And he had been down, and he had heard me speak, and he had done this and that. And when he came up and they were picking people, his comment was, "I think Naomi is the person for the job." And I found that out after I came back from Pittsburgh. And

of course, the idea for doing that rotation out of a job peer into one looking at the corporate activity was to broaden my perspective, give me an aspect -- a view of what the other aspects of the corporation were, to look at how things were handled financially. But when I left, the idea was that I'd rotate back to this sector into a different job. And I came back as executive assistant to one of the vice presidents that was here. And I was on his staff for a year and a half, and he decided I really ought to go to work. He put me back into a functioning activity within the engineering department.

But it was a learning experience. But along those lines, I had a lot of freedom in my headquarters assignment, because unlike most people who went, I knew I had a job if anything went wrong. Now it might not have been the job I really wanted, but at least it was a job at a high enough level with enough responsibility that I wouldn't be ashamed to take it.

And that allows you to take a lot of risks you wouldn't do otherwise. So get a mentor, hope with that somebody decides they will sponsor you, or maybe you can figure out some reasons or something to convince somebody to sponsor you that they wouldn't have thought otherwise, but recognize that you need all of that. And also recognize that you don't get ahead by not taking risks. And of course, you do have one problem when you do that, you can

get your head chopped off.

But people tend to look at people who are willing to take risk, and if they have a reputation for being able to get things done when they do that, to look at that and say, "Okay, you've had that failure, now what did you learn from it?" And if you can answer that question, they'll say, "Well, let's go on to something else."

LK: Do you think that the public understands what engineering is?

NM: Oh, absolutely not. If they did, we wouldn't have things like sanitation engineers. You know, engineering has been -- I hate to use the word 'bastardized,' but the term has been that it applies to everything. And so when you say you're an engineer, people are sort of like, "Well, are you somebody that hangs doors someplace or drives a nail?" They don't think about the intellectual activity that has to go with really being 'an engineer'.

LK: Right. Or drive a train.

NM: Well, driving a train might not be a bad idea.

(Laughter)

NM: But, no, I think the public as a whole has no concept as to what goes into engineering versus what a scientist does. And they look at everything that happened on the space program and so

forth as scientific achievements rather than engineering achievements. And it's true, if the scientists hadn't come up with those ideas to start with, it probably never would have happened. But if there hadn't been engineers that were there to practically apply those ideas and make them work, it definitely wouldn't have happened. So you need both, but one gets credit and the other one doesn't.

LK: Yeah. In the last few minutes that we have, can you comment on why or if there's a need for a SWE today?

NM: Well, it's no different than when I was coming into SWE. There's still a need for women to be able to get together and share their experiences, because their experiences will be different than men. The roadblocks that are thrown at them are different than from men, so they need to have a network of people that they can talk to that at least understand the language and the perspective.

The other thing is that even though women who are successful, eminently successful, all have a pretty much common set of traits, they're ambitious, they're hard-working, they tend to be honest, they tend to be team players, they're willing to take risk, and most of them play golf. Well, if I'd have played golf, maybe I'd have gotten further than I did, but I got pretty far without it.

But anyway, it's still there is that need to be there.

There's a need to set examples for young women coming up, that, gee, it is an honorable profession. It's a good living. You can make a decent wage. And as an engineer, you have all kinds of opportunities do a lot of other things.

One of the best educations in the world you can get is to be either a physics or an engineering major, because once you get a degree in that, you can go into medicine, you can go into law, you can do all kinds of things. Whereas if you go into pre-med and pre-law and then get to be a graduate and you decide you want to be an engineer, you've got to go back to square one and take all those math and science classes. Not true in medicine and law. You take anatomy and so forth. But that is med school, not pre-med. So there are a lot of advantages there. And engineering is something where you're taught to apply knowledge and solve problems. And everything we do uses those techniques, and so what better way to get there? So, yep, engineering is a great field, but we ought to do something on our PR.

LK: Do you have any final thoughts?

NM: Well, I want to thank you. It's been an interesting afternoon.

LK: Oh, you're welcome.

NM: You made me think about a lot of things that I hadn't thought of for a long period of time, most of them fond memories.

LK: Good.

NM: Would I do it again? Yes. It was a rewarding career. I won't say I enjoyed every minute of it, but I would say in my thirty-eight years at Westinghouse, thirty-seven of them were outstanding. And those few days that were in between was sort of like, oh, well, those have to happen to anybody. You know? So it was a good career, a great life, and I'd do it again.

LK: Excellent. Well, thank you very much.

NM: Okay.

END OF INTERVIEW