

PROFILES OF SWE PIONEERS

ORAL HISTORY PROJECT

Irene Peden Interview

March 2, 2002

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Irene Peden

Irene Carswell Peden graduated in electrical engineering from the University of Colorado in 1947 and earned both a M.S. and Ph.D. from Stanford University. She joined the faculty of the University of Washington in 1962 and in addition to teaching and research served as associate chairman and later as professor emerita of the electrical engineering department, as well as associate dean of the College of Engineering. In 1970, Peden was the first woman engineer or scientist to conduct field research in the Antarctic interior. In the 1990s, Peden served two years as Director of the Division of Electrical and Communications Systems at the National Science Foundation. Her research interests cover several fields: applied electromagnetics, radio science, antennas and subsurface remote sensing. A Fellow of the Society of Women Engineers, Peden received the SWE Achievement Award in 1973. She is also Fellow in the IEEE and has received numerous IEEE awards, including the Haraden Pratt Award, the Centennial Medal, and the Distinguished Achievement Award of the IEEE Education Society. Peden was the National Science Foundation's 1993 Engineer of the Year and an inductee in the American Society for Engineering Education's Engineering Educators Hall of Fame.

In her 2002 Profiles of SWE Pioneers Oral History Project interview, Peden discusses her background and childhood; her undergraduate experiences at Kansas City Junior College and University of Colorado; her early work at a power and light company and at the antenna lab at the Stanford Research Institute; attending graduate school at Stanford and earning her Ph.D.; teaching at the University of Washington; performing

research in Antarctica; and her involvement with professional organizations, including SWE.

- July 2016

INTERVIEW WITH IRENE PEDEN BY LAUREN KATA, MARCH 2, 2002

LAUREN KATA: It is Saturday, March 2nd, 2002. This is an interview with Dr. Irene Peden. The interviewer is Lauren Kata for the Society of Women Engineers.

I'd like you to begin by describing your family background.

IRENE PEDEN: Oh, I'll be glad to do that. I am the oldest of three girls. My mother was the oldest in her family of four. And since my mother was important in the way I viewed life and decided what to do with my own, I'm going to start there.

My mother was the oldest child in a Swedish immigrant family. And her father, who was a very smart man with mathematical talent, became a self-taught architect, a building contractor, in a city in the Midwest. And he was very good at that and very successful. His older two children were girls, my mother and her sister, and the younger two were boys.

The two girls were very talented mathematically. The boys were not, as far as I know. The girls were. And my mother was the older, and she wanted to go to college. Well, her father had the "old school," northern-European attitude that even though he could well have afforded to send her, he wouldn't because he said, "Education is not for women." So my mother and her sister worked out what they thought was a good deal. Mother got a job. She earned enough money to go out into western Kansas and teach country school, which is the only kind of job that she could have had after going to college and majoring in mathematics. It was a

small teachers' college in Kansas. That was where they could afford to go. And the deal was: Mother would go for a year, and then she would work and put her sister through her first year, and then her sister would work, and Mother would go back. That was the agreement. Well, the way it really worked out is that Mother didn't finish, but her sister did. And her sister also went out and taught country school. But that's what my mother did. And it was very hard in those days. My mother, if she had lived, would be 103 or something now.

You can imagine. We're talking just about World War I time, maybe a little before. In those days, you did not have to have a degree to go out and teach. It was a different -- it was an agricultural environment and a totally different situation. They viewed themselves as lucky to have anybody come out and teach their children in western Kansas, which was very harsh climate, and all of that.

So what you did was go out and board with a family that had been selected for you by the school board, whatever geographic area had a school board. And you lived with a family and you taught country school. They were all in one room. You had to struggle out early, whatever the weather, and get the fire going in the -- all of this. And my mother, who was a very tiny little woman, she just did it. And so I grew up knowing that if you wanted to do something, no matter what kind of roadblocks they throw in your way, you just do it. And later on, when I

discovered science, which I was usually discouraged against by high school teachers and counselors -- I did discover chemistry as a high school senior. The only reason I did was that you had to have a science to graduate, and that was the one I took. People told me, "Don't take physics, it's very hard, and girls don't do that," so I took chemistry. And I really, really connected. I liked it a lot. And I started college to be a chemistry major. Then I took physics, and I loved physics. I just loved it. And I wanted to do that. I'm talking a time when they hadn't split the atom yet. There wasn't anything you could do with it in those days except teach it, and you had to get a Ph.D. to do that, teach in a college. And I was a teenager. I didn't want to do those things. I wanted to get a four-year degree, get out of school and have a life. That was my ambition.

So I decided that there must be some aspect of physics in which there was a practical aspect that a four-year degree would do. And I, in retrospect, realized, that I had a physics prof. for that course who was very ahead of his time, because he was willing to sit down with me and talk over things like that. And together we reasoned that I enjoyed electricity and magnetism best. This was very basic physics I'm talking about, where they run you through mechanics and heat and light, you know, acoustics and all that of, in one course. But it was the electricity and magnetism that intrigued me. And it was he who suggested that there was a four-year degree - he didn't know of any women that

ever did it, but there was one, and it was electrical engineering. And gradually, I came to the realization that I wanted to try it.

LK: I don't mean to interrupt, but before we talk about how you continued on your engineering path, can we take a step back and talk about your early childhood.

IP: Early childhood, okay, sure.

LK: When were you born?

IP: I was born in 1925, in Topeka, Kansas. And I'm the oldest of three girls. My father was a businessman who didn't get to finish college. He got to start, but because of World War I and the death of his father in the big pneumonia or flu epidemic of 1919, he was not able to finish. He had to go to work and help support the family. And when he had gone to school, I think he had taken some introductory courses for civil engineering, but he never became an engineer. He was a businessman. My mother had taught country school.

And of the three girls, as I said, I was the oldest, and my mother had me targeted for music. They started me off (Laughs) -- she played the violin, not as well as she wanted to. But her ambition was that I would be a musician. And so they stuck a little tiny violin under my chin when I was almost too small to hold it up. And when I got big enough for it, they started giving me lessons. And I guess for a kid I probably wasn't bad, but it was very obvious to me by the time I was out of high school that I was not going to make any mark in the world of music. And I found

something I liked better, which I offered to my mother as a substitute. She didn't want me to become a teacher. She was very -- she never really told me why. She was very alarmed and negative when I finished my graduate work and said I wanted to go to a university and teach. She thought that was not a good idea. But my parents were very supportive of my choices while I was a student. I think they were completely mystified, but they were very supportive of it. And nobody said, "No, I'm not going to pay for you to take anything like that. Take nursing." In those days, nursing, librarianship and elementary school teaching were about it for women. That was it.

LK: Did the teacher that you spoke of, your physics teacher, that was in high school, who encouraged you?

IP: No, that was in Kansas City Junior College, where I started.

LK: Do you remember in high school any kind of guidance counseling program?

IP: You know, I don't. I don't think we had them in those days. I will say that in later years, when I started going out to high schools to talk to students in math classes, chemistry classes, what-have-you, about the possibilities of engineering, the most enthusiastic support I got was from the teachers of those subjects, not from the guidance counselors. They were uneasy with the idea of encouraging young women to go into the field. The teachers were simply delighted to know of the opportunities that

they hadn't realized were available to those students who were talented in those subjects.

LK: And where did you attend high school?

IP: Kansas City, Missouri, Central High School.

LK: And then you chose to go to Kansas City Junior College?

IP: Yes. I didn't have a choice. You know, we were just coming out of the Depression in those days. And in order for me to finish in a four-year college, it was really necessary to start that way. But many of my friends went there too, you know. And I have nothing but the highest praise for that level of education. The teachers did an excellent job. They didn't do research. They spent their time teaching and interacting with students, and so forth. It was a very valuable first two years for me.

LK: And so your physics instructor talked to you about electrical engineering?

IP: He did. Well, what he did was explore with me the possibilities, as he understood them, and as I could find out about them. He really acted as a guidance counselor.

LK: And why did you choose the University of Colorado?

IP: Well, I wanted out of Kansas, that's the first thing. And I didn't really know where I ought to go. The place to go in the Midwest at that time for engineering, and still is one of the biggest, most prestigious things you can do in the state university circle is the University of Illinois. And I thought I should go to the University of Illinois. And the family physician

said to me -- I was one of those kids who was terribly bothered with allergies at that age -- and he said to me, "If you think you have trouble in Kansas City, Irene, you just try Urbana, Illinois." He said, "It's going to be as bad or worse." So that was a new way of thinking about it to me. But my father had a friend who had gotten his engineering degree at the University of Colorado, which seemed manageable in all kinds of ways. And it was not a terribly long trip. When I started, it was World War II, and the only way to go was on the train. You know, you couldn't get on a flight. The whole world was different during World War II. So it was not a quick trip, the way it would be now, but it was doable, and it just seemed like a good idea. And I knew I was going to feel wonderful in Boulder, Colorado. And it was a great place to go. I'm still very proud of my degree from the University of Colorado. They have done wonderful things in engineering education.

LK: How did World War II impact the engineering program at University of Colorado?

IP: Very severely. Because of World War II, the only young men students, really, except for those who had disabilities of some kind, was the Navy V-12 Program, which they had at Boulder. And if it hadn't been for that, I think the professors would have had almost nobody to teach, so they were very welcoming to the small group of young women who entered the engineering college at that time. They had their own ideas about whether or not we would

ever succeed in the field, and so forth, but their jobs were on the line too. And we had each other, and even though we were pretty well spread out among the various departmental majors.

LK: Do you have a sense of how many women were at the University of Colorado at the time you were there?

IP: A dozen, which was unprecedented in 1944. (Laughs)

LK: In 1919, 1920, two women, Lou Alta Melton and Hilda Counts Edgecomb at the University of Colorado wanted to start a society of women engineers. And they conducted a survey by writing to various deans of engineering schools, asking, "Do you have any women engineers?" And those letters are part of the SWE Archives now. But from there I got a sense that the University of Colorado was very open to women in engineering.

IP: Deans always say the right thing. (Laughs) That's what they do. Some of them are giving you truth, and others are giving you the party line. That's my opinion, a very personal opinion.

LK: Okay. It seemed like there was, at that campus, at least a small network of women who were trying to make themselves visible to each other. And did you have any experience with a society of women engineers, quote, unquote, at the university while you were there?

IP: Yes, we had a small group. As far as I can remember, we formed it ourselves. There was no national SWE that I was aware of, to tap into. But we did. And we included some women who were taking architecture, I believe. And we were something like -- I'd

have to look at my old yearbook to tell you what our name was, but it was something like the Society of Women Engineers and Architects. And we were local, and we got to know each other, and do things together. And we were viewed, I think, as a club on campus, probably were. And I think we're in the yearbook that way, as a club.

LK: Were you involved in any other engineering organizations as a student?

IP: No. I did some work on the student engineering journal, you know. But no, in those days, women were not eligible for Tau Beta Phi.

LK: What about student chapters of the technical societies?

IP: I think I did join that. In those days, there was AIEE, the American Institute of Electrical Engineers, which later merged with the Institute of Radio Engineers, which we did not have on our campus, and became the IEEE [Institute of Electrical and Electronics Engineers]. But it was AIEE, and it was a very power oriented -- electric power oriented, as was the faculty at the University of Colorado at that time.

LK: Okay. And you joined it.

IP: I did.

LK: As a member or a student member or--

IP: A student member, yeah.

LK: What were some of your favorite courses, or the courses you enjoyed the most in your--

IP: As an undergraduate?

LK: As an undergraduate in electrical engineering.

IP: Okay, as an undergraduate, I remember being particularly attracted to a course in transmission lines, which I now understand from having gone through the whole higher education spectrum, was simply -- very simply related, although I didn't know it at the time, to electromagnetic propagation, which is the field I ended up actually doing research in, in a different context totally than transmission lines for power and for telephones. But I loved that course particularly. And things tend to coalesce sometimes.

LK: Did you have a good relationship with the professor in that course?

IP: Probably did. There were some -- and they were not in the electrical engineering department, mostly -- (Laughs) I think in the civil engineering department who were very hostile, and made really uncomplimentary and unsatisfactory remarks like -- I walked into some course, and I don't remember anymore what it was, but the professor just looked at me and he said, "Well, I guess I won't be able to tell my jokes to this class."

Yeah. And I had another one. He was in the same department. He had something to do -- his actual work was in highway construction or something. He never lost an opportunity to say something derogatory in front of the whole class. But in my own

department, I did not encounter that, did not. They did their best to be helpful.

LK: I can imagine how intimidating that might have been for a young person.

IP: Oh, yes, yes. And I would -- I really believe that because I knew my mother had done what she darn well wanted to do and did it anyway, I never felt that I had to back down. I think, you know, your mother can be a powerful role model. And even though she was not an engineer, I think she was probably mine.

LK: Can you think of any other female role models in your life, as you were going through education?

IP: Only hypotheticals, like -- there weren't I know -- oh, well, there were, but I didn't know them. They were scattered all over the country, one here, one there, sort of a thing. The only thing I could do was have inspirational thoughts because somebody like Marie Curie had done what she had done. I never had any illusions about winning a Nobel Prize, I don't mean that, but just knowing that in the setting in which she lived and worked she was able to do something so spectacular made me feel that maybe I can do something that I wanted to do also.

LK: Do you remember where you first heard about her and her work?

IP: No. Probably in school.

LK: So when you graduated from the University of Colorado with your bachelor of science in electrical engineering, what did you do next?

IP: Well, the next thing I did, in fact, was get married. That didn't work out, so I don't want to go there. But I needed to get a job, because he wanted to go to graduate school. He had been in World War II, and didn't get a chance. He went straight from high school into the Navy. Young men didn't have a choice, and that's what they did in World War II. So he wanted to go to school, and I thought that was the right thing to do. So I would get a job, and he would go to school.

And I had a very difficult time getting a job. 1947, I think that was. But we moved to Wilmington, Delaware, where I knew no one. I feel very isolated. But I simply pounded the pavements until I wouldn't take -- I had to take no for an answer, I didn't have a choice. They would simply tell me, "We've never hired a woman before, and we're not going to talk to you," and shut the door. I had a lot of that to deal with.

But eventually, I did get a job at the local power and light company, where the job had been open a long time because it didn't pay very much, and the young men wouldn't take it, those who were there. So I took it, and I learned a lot on that job. Your first job -- I hardly think it matters what you do, you learn how to work. You learn how to be a part of a working group with a goal, and you learn how to fit into that and do what needs to be done.

And I think that's just as important as any technical work that you do, although I did that.

I had taken, fortunately, a course at the University of Colorado, which was very power related, electric power. And it had to do with a calculation method for three-phase circuits. And so they put me in the department where they were planning ten years ahead for these big networks, you know. The questions -- they had methodologies. I didn't have enough knowledge to create any. We didn't have digital computers in those days. I didn't have enough knowledge to create anything new in that sense, but they had ways of making calculations.

Like if this part of the state of Delaware, a tree falls over a couple of power lines and shorts them out, at this point in our whole network, what's the effect on all the other parts of the network. And I did those kinds of calculations. And I had an analog kind of a computer that I could set up various kinds of faults on this system, and take measurements on this board as well. And I got a lot of -- I enjoyed that.

Unfortunately, I learned how to do it in fairly short order, and then that was all there was to do. I got kind of bored eventually. But we did move from that state because he decided he wanted to go to Stanford. And I thought that was fine. I had family who had gone to Stanford, and I thought, great. And I loved California, so okay.

We were just kids. We didn't know how hard it was to get into Stanford. We just assumed that if he applied and said he could pay the tuition, that we could go. So we packed up everything we had, which wasn't much, in our little old car, and we drove to California. And fortunately, he had been admitted. But we didn't realize how unusual that was. (Laughs)

LK: So what were you doing when you were in California?

IP: Well, again, I had -- what year would that have been? I don't know. It would have been the early 50s by then. Again, I had to pound the pavement trying to get a job. And I ran into exactly the same kind of things I had before. Nothing had changed in that respect. In some ways, opportunities for women might have gone a little downhill, because after World War II, what happened was that jobs women had held during the war, which was unprecedented for women to hold, but they just went out and did it, it was their duty. And many of them needed the money, and so women were doing all the jobs that men typically did. But after the war, when the men came home, those doors closed.

And the society was very different. It was a very family oriented time, when people had four children, baked their own bread. The only meaningful kind of leadership position that would have been socially acceptable was to run the PTA. And here I was, you know, trying to get a job as an engineer, and to work as one.

I finally did, because SRI International, which in those days was Stanford Research Institute was just starting, brand new, what they called in those days the Antenna Lab. And they simply needed somebody -- the scientific staff, they all had Ph.D.s, and they were doing real research for money, but they needed people like me who would take measurements that they would teach you how to make, and do calculations on what were hand operated calculators. We still didn't have digital computers. Actually, one of the early ones was developed at SRI, but not by the group I was working with. I was in the Antenna Lab.

So these exalted personalities taught me how to make the measurements they wanted made. And they gave me big equations, which in those days, were isotonic(astotic?) solutions to very complex problems. Those problems didn't get solved in any greater depth or near field terms until digital computers could do it. But they had developed isotonic(?) expressions: 'in the limit, this will happen,' and so forth. And so that was the kind of calculations that we did on these Frieden machines. And I did both of those.

LK: You were the computer.

IP: In a way, and the measurements person. Because at that age, I had very fine finger dexterity. I could do precision measurements. You know, I didn't understand what I was doing. But eventually I got bored with just doing it. I wanted to know why. And it turned out that what they knew academically was at a

level that I didn't have the background to understand, and eventually I developed a very strong feeling that I wanted more education. And also in those days, women -- you know, I could get the job because they were new, they needed people, but I wasn't going anywhere in that job, and it was perfectly obvious to me.

And a point came when I really had to decide, should I try to change fields, do something different or do I need to know more about this one? Which would I rather do? And I decided I would rather go to graduate school -- Stanford was right there -- and learn more about it. I only went to get a masters degree, but I figured the project level at which you could work with a masters degree was much higher, even though it's only a academic year time commitment, it's a great payoff. And that's all I meant to do.

And it was very difficult to get admitted to Stanford, but the mentors I had at SRI helped get me in. And so for a while I tried working part time and going to school part time. And that way it took six years to get a one-year masters degree, and you didn't have a life. You know, they're always trying to keep up. Stanford was very hard, very hard and very competitive. And to keep everything going and also have a life was just impossible. And the point came when it seemed better to disconnect, take a leave of absence and just finish the degree. So that's what I started to do. And by the time I finished I didn't want to quit. There were more things I wanted to know. And so my relationship

with SRI was just terminated, and I became a full-time graduate student. I got a research assistanceship.

LK: Towards your doctorate?

IP: Yes.

LK: And what year was that?

IP: Well, let's see, I sort of eased into it. It's hard to say. Exactly what year did I become a full-time graduate student? I imagine that it would have been the middle '50s, must have been '56, maybe.

LK: At that time were you still in contact with the women that you formed your club with at the University of Colorado? Do you recall still being in contact with them?

IP: I don't think so.

LK: Was there anything like that at Stanford at all?

IP: Not that I was aware of, but if there had been I wouldn't have had time. I was trying to imagine how to have a life. I had some very good friends that I had made at Stanford Research Institute who were very supportive. And I was always welcome in their homes, you know, as a guest, and always invited for Christmas dinner and Easter dinner and all those good things, so I never felt really isolated -- except as a graduate student in my classes, I was.

LK: You were isolated?

IP: You're darn right. I have the first Ph.D. that's in engineering that Stanford ever gave to a woman. And that was a

long, lonely path. When I got my masters degree in the EE [Electrical Engineering] department, there were two others, but they didn't go on. I was the only one who did. I have made many friends, and I was a lot older than they were. By the time I really went back to graduate school, I'd been out of school for ten years. And it's a field that changes very rapidly. Very little that I had learned as an undergraduate was any help to me. I had to just really learn things that other students knew because they hadn't been out of school very long. I had to learn those too, and parallel as I went, in order to survive in the graduate school. So it was a heavy duty -- I didn't have time for anything else.

LK: Right. What was your experience doing laboratory work as a graduate student, in terms of teams?

IP: Oh, no teaming. In those days you did it alone, or you were perceived as not being capable of doing research, really. I think a woman would always have been -- and maybe in some places this still is an attitude that's buried, but there: If you have worked with a group, they can never really be sure that you weren't just tagging along -- in some groups. It's not true of all anymore. Teaming is now a very important thing. Many management people understand that women team particularly well, and work in groups particularly well. But in those days, it was the lone ranger model.

LK: Do you feel like you were graded fairly, evaluated fairly for your work at Stanford?

IP: I was. What you earned was what you got. That was one of the first really important experiences I had had of feeling that treatment was absolutely fair. Judgments were pretty -- well, not very subjective. You take a test, you get a grade. And your final grade is based on how you performed, and that's it. There was very little subjective stuff to it. No, that was -- they were absolutely fair. And most of the professors I had as a graduate student were extremely supportive, let me know they were glad -- I can remember one who stood at the head of his class on my first day of this graduate course and said, "And we welcome Ms. Carswell." That was nice. It was, yeah.

LK: Well, can you describe the situation of trying to find-- once you received your Ph.D., looking for an academic job?

IP: Yes, oh, yes. Well, I had my degree from the Stanford Microwave Lab, which was very prestigious at that time, very ahead of its time. And I had kind of been imprinted by the whole faculty with the idea that the highest-level thing you could do was go to a university and teach. The Stanford faculty, at least in the engineering, felt that their mission was to educate and prepare the next generation of faculty for engineering. So I felt that too, and that's what I decided I wanted to do. And I did some teaching as a graduate student. You had to pay Stanford and get credit for it, they didn't pay you. But we felt -- those of

us who were able to do it and chosen felt very privileged, even though it would be, you know, 101.

But it was a wonderful experience for learning how to teach, which so many engineering faculty have no instruction in that. You know, you feel that if you know the subject, that's all you need to know. And I don't really think that's true. And so learning how to do it was important. But I enjoyed it. I really liked it, and I felt that this is what I really want to do. But when the time came to get a job, deans came to interview candidates, and the AT&T Bell Labs came -- because that was a very prestigious place at that time. And many of the graduate students who didn't want to teach wanted to go there, and so they were big on the hiring scene. But many of the deans who came wouldn't even talk to me. And I remember the day that I was interviewed by the dean from the University of Washington. And apparently, he was reluctant about it, but he had been essentially instructed by the EE Department at the University of Washington to interview me. And the dean of engineering at Stanford at that time was Joe Petit, who later became the president of Georgia Tech, and he was a very supportive guy, too. And before I went in for the interview, he sat me down and he said, "Now, Irene, I have been talking with Dean Westman, and he's a little upset. I took him to lunch. And no matter what happens in the next hour, I want you to remember that you are an opportunity for them."

And I didn't really know what he was talking about, but I sure found out. I mean, he asked me the kinds of questions that they're not allowed to ask anymore, like suggesting that possibly I was in engineering looking for a husband. Well, that was ridiculous. There are lots of easier ways than that. (Laughs) But you know, really I forget all the things because I would rather forget, but it was outrageous. It was absolutely outrageous. And when it was over, I said, "I'm not going to go there. This would be terrible."

But one of the Stanford faculty members from whom I'd had several courses and who I sort of felt like I could go talk to him about things, he had gone to the University of Washington as an undergraduate, and he knew the faculty. So I told him about it. And I said, "I really don't think that's a place for me to go." And he said, "Well, he's only going to be there another couple of years and then he will retire." He said, "There are many good possible things about it, and I think if they invite you for an interview, you ought to at least go up and talk to them, and don't let this one thing make your decision for you." So I thought, well, I guess I could do that.

And when I was getting close to the end of my graduate work - there were several other small schools with maybe only six people in their EE department who couldn't get anybody to come, and they would invite me, you know. There were several of those. I went on a very short tour. I wasn't willing to go east of the

Mississippi ever again. I had not enjoyed the East Coast. They're kind of culturally different from West, you know. I wanted to be in the West. I went on a short tour, and went to several different places, and ended up at the University of Washington.

And it was one of those perfect Seattle days. It was. Oh, I stepped off the airplane and it was like fairyland. There were chains of mountains on both sides. There was salt water. There was clear water lakes, fresh water lakes, and Mt. Rainier was out. It was simply unbelievable. It was an April day. And I thought, "Wow," you know. And I spent the day with the department, and I met many people who I really liked, and who were very welcoming, you know. And I went from office to office with some of the ones in the area in which I would work, and they would say, "I really do hope you come. We'd really like to have you." So when I got home I had decided that maybe that would be okay.

The only downside to it was they offered me assistant professor, and I felt like I was too old and had done too much for that. But the other small schools had offered me associate professor. And I sort of said -- and I went back and I talked to my mentor friend at Stanford, and he said, "Well, you know, the important thing is, where do you want to be in five or six years. It isn't how they're going to start you." And the chairman at that time of the University of Washington, he said, "We're offering you a beginning associate professor's salary, but it's a

policy thing. We can't offer you associate professor to start, but we'll do it as fast as we can, if you're able to do the things that you need to do in order to be one here." And so that was only four years.

LK: Before you were--

IP: Before I was tenured as an associate professor. Getting to be a full professor was very much harder than getting tenure -- for me, because I had some papers all ready, I had some background, and I was older.

LK: Was it a departmental policy that all new employees had to begin as assistant professor?

IP: It was the practice. Whether it was an absolute policy, I no longer remember. We're talking about 1962. I don't remember. But it was normal practice, at least. I think they could break any rule they wanted to get a superstar, but I was not that. I think that's probably still true.

LK: Are you a member of the American Association of University Women?

IP: No. That's another thing that wrangled -- when I first got out of school I wanted to be. I wanted to join, and they wouldn't let me in because I had an engineering degree.

LK: Oh, you're kidding.

IP: I'm not kidding. That was the way that was then. I could have been an associate member or something, and I wasn't

satisfied with that. And later I was just too busy with other things to think about doing that too.

LK: During the time when you were teaching and then, you know, creating your record for your tenure track, were you active in IEEE?

IP: Yes. I was because I started going to major conferences to give a paper and that kind of thing. And somewhere along the line I met a very distinguished electrical engineering educator, very well known internationally, who had daughters. By gosh, it makes a difference if they have daughters. And he somehow decided to sponsor me for various kinds of things. We got to be good friends. And I only ever saw him at these conferences, but he began to open doors in the IEEE for me. And we'd cross paths at a conference, you know, and he'd talk to me in a roomful of people where I knew no one else. And engineers, being the sort of not extroverted people they are, didn't all come up to talk to me, because they didn't know me. No, huh-uh, it wasn't like that. I'd sort of stand against the wall, you know.

LK: He sought you out.

IP: He would seek me out and talk to me, and he'd walk me around the room, and he would tell me who people were and what they did, and how they made their mark in the field, and that kind of thing.

LK: What was his name?

IP: Mac VanValkenburg, a wonderful man. And he had held high-level positions in the IEEE, and he opened those doors for me. I also worked from its inception with what started as the group on Antennas and Propagation, and is now the Antennas and Propagation Society. I've been a member of that as long as it's existed. It's one of a number of technical societies within IEEE. And I also was a member of that, and eventually I was president of it some years ago.

So those things were -- Mac was not related -- but I had another mentor who is now Emeritus from the University of Michigan, very distinguished antenna researcher. And he had been at SRI when I was, and he went into academe. And he's been -- I probably did a lot of calculations for him in those early days when I was calculating. And he was a theorist. And he would have been one of the people who produced those equations that had to be calculated, you know, from recipes, and so forth. And he became a mentor in the discipline for me.

LK: Do you remember what the process was in your early career when you applied to present a paper at a conference?

IP: Well, I think I applied as my initials, not as Irene. That was the way it was in those days. Same thing with getting a grant, you used initials.

LK: What happened when you arrived at the conference?

IP: I don't know. It's hard to be sure. (Laughs) But you know, when you're young, and you aren't used to giving papers,

you're so nervous and so focused on, "Will my voice crack," or you know, that you don't think about noticing those things in the environment.

LK: But you were permitted, obviously, to present your papers.

IP: Oh, yes, absolutely, yeah. And it wasn't very long, since there weren't any other women at that time that I can remember, in Antennas and Propagation, that just using initials didn't do it anymore. They knew perfectly well who I was.

LK: Because it was such a small specialization.

IP: (Laughs) That's right, that's right.

LK: So when did you hear about the Society of Women Engineers?

IP: Well, I think I was always aware of something like that, even when I was in school and we were not part of a national organization, I was aware that that was something that was important, and that there must be something going on somewhere, but I just didn't know about it. I think I must have come to the University of Washington before I found out about it.

LK: About the national?

IP: Yes, about the national. Now, we didn't have a student chapter at the UW at that time because there weren't enough women for that. That happened later, and they connected with the Pacific Northwest Section, which was proper. But I think it was

after I came to the University of Washington. And I can't really remember what the first contact was.

I know that I went to the 1964 International Conference in New York. I know that I met women from the Pacific Northwest Section there, met a lot of women, and really enjoyed the comradery of it, because in the IEEE, it was different. I made many friends, and I had a circle of people that I knew and all that, but the instant connection that you make with women in the field, even though they may be civil engineers or MEs [mechanical engineers] or something, there's a connection. And I thought that was important.

And I had been made aware -- the law librarian at the UW was a friend. She was a much older woman than I was at that time. But she was quite unique in her own field. When I first came to the university there was a lot of publicity about it. And she made a point of contacting me and taking me to lunch, you know. And she was sort of a campus wise counselor for me, even though the fields were different. Being a law librarian was probably not so different in a certain way from what I was trying to do. And she had impressed on me the importance of giving back as part of the responsibility that we have. And I believe that. And I thought that -- I enjoyed the local women whom I met, and knew that I would like to be a part of their organization. And it was a two-way street, and both sides of that were important.

LK: How did you balance your personal family life during that time period, the late 1960s, and then your work life, and then this 'giving back'?

IP: Yes, well, by that time, I had met and married Leo Peden, in Seattle. He was a lawyer in private practice, no relationship to the university. But he had seen all this publicity when I arrived. And he was divorced -- single at that time with the two teenage daughters, young teenage daughters, who actually lived with their mother. But he had them on alternate Christmases and in the summertime -- or something like that. And Leo is a trial lawyer, now retired. But they don't move. You get licensed to practice law, if licensing is what it is, and you build a practice, and you stay there. So when I married Leo, I understood that I was staying in Seattle, and he wasn't going anyplace -- any geographically different place. I understood that, and I thought that was okay. You know, Seattle was fine, the marriage was wonderful, and I wouldn't have had it any other way.

But how I balanced it, it's a juggling act. Now, the children were not mine, and we didn't have them all the time, until the older girl was ready to -- she was going to be a senior in high school, which is an important time in a kid's life. You've built your friendships, you've got your activities. And her mother and her mother's second husband moved to another state. And she decided all by herself that since she wanted to go to the

University of Washington anyway, and she had to change high schools anyway, that she wanted to come and live with us.

LK: Do you remember what year that was?

IP: Yeah, it would have been '65. And I remember thinking, you know -- I got along with her beautifully. I wasn't worried about that, but I really wasn't sure myself how you balance everything, but I figured one day a time we'll figure this thing out. Because she and I enjoyed each other. She now refers to that period as 'Breaking in a new mother.' (Laughs) And I'm sure was stressful for her too.

But I did what I could. Every day I'd get up at 5:30 in the morning and write my lectures, when the house was quiet, for the day. And I'd spend the day at school. And she now says, remembering the days -- and then she did go to the University of Washington, although she only lived with us for a while, and then she moved on campus. But she remembers, and she laughs about it, she says that I left in the house in the morning, "Like a new golf ball, all wound tightly and, you know, no hair out of place, and smooth." And "She'd come home at night," she said, "like an old golf ball, with strings all loose," (Laughs) "and the surface marred." And I've always enjoyed that model. But that's what she said about it. But maybe it's a little bit of luster, too. I did what I could every day. I did not do any housework, we hired that done. Leo hired the help, and if somebody else had to be replaced, he took care of that. If we had a period when there was

nobody, he would run the vacuum cleaner, whatever he had to do to relieve me, so I didn't do that. All I did was cook the meals, which is something I thoroughly enjoyed. He did all the dishes, and just did everything to take the load off, because he knew I was under a lot of pressure. And with that kind of support, you know, it's possible to manage.

LK: Well, why don't we shift and talk a little bit about the research that you were doing. Well, I'm interested in the research that you were doing at the University of Washington that led you to your research in the interior.

IP: Okay. Well, when I first came, it was apparent to me that although I had wonderful training in microwave work, that I needed to make a shift of some kind. And that's not an easy -- you don't go on doing the research you did as a Ph.D. student. I had to do something that used it, but would be different. And I wasn't really sure for a little while what it would be. You have to get started by learning what students know when they come into your classrooms, so you can teach effectively. But I sort of talked to people. And the area that I worked in at Stanford was an area for which they had nothing at the University of Washington. There was no equipment, nobody else working quite in that field.

But I discovered that two guys in the department, senior people -- one being the one who had been at SRI with me all those years ago -- had an NSF [National Science Foundation] grant to do

polar research -- polar -- upper atmosphere research in the Antarctic. And it's work at the Geophysics Electrical Engineering Interface is what it is. And they had designed a twenty-one mile dipole antenna to be stretched out on the ice to send very low frequency signals up to the ionosphere to be bounced back, and bounced along the propagation path, which is the way that works at very low frequencies, for the ionized layer above the atmosphere.

And I thought that was pretty fascinating. I was just interested in it. And the context in which they were working I thought was pretty exotic, but that was kind of neat, too.

And I didn't have any thoughts at that time of becoming an Antarctic researcher, but they talked to me about what they were doing, and I could see some holes in it, where some kind of modeling up to the microwave frequency scale -- or you model down, the frequency goes up, the wavelength goes down, the model goes down with it. And I knew what could be done there, and I thought, "That might be kind of fun, if I had some graduate students who wanted to work on it."

And so I started out, I think, by working with a graduate student who wanted to make a model at a very low frequency -- at microwaves with this VLF situation with the dipole antenna and the lawseet (phonetic) layer, which was the ice underneath it. There was not very much known yet about the nature of those signals coming out of an antenna stretched out on the ice. You know, everybody knew, and had for years, about a dipole in free space,

but that's a different matter. And so there were questions about the shaping of the pattern and the power required, and things like that.

And so I worked with this graduate student, and we built a model. It was not a neat, easy model to build. In order to model the properties of the ice, which is absorbing as well as dielectric at those frequencies, we had to find something in the microwave frequency range. And this -- we're talking many orders of magnitude difference that would have similar properties at microwaves.

Well, we ended up with a mix of silica sand, very fine silica sand and powdered graphite. It was a lousy job for him, but he was willing to do it. And he constructed a whole model. You know, he could take measurements. And we had a theoretical model related to that, that one of their Ph.D. students had developed. So that was the first project. And that was really kind of fun. I didn't have to put my hands in the graphite, I will say, but the student did that. You know, it was fun to do. And then other students started coming in with related things they wanted to do, and it just sort of evolved. And the next thing I knew I was a co-PI on their grant. And it just all evolved from there.

The policy of the Polar Programs Office at NSF is that if you're going to do work in the Antarctic, you have to understand the environment to some degree, because it is so difficult to work in the polar environment. Your experiments have to be very

rugged. They have to be relatively simple in a certain way, and yet very sophisticated in other ways, or else what you want to find out is already known, you see. If it's research, it better be research. And that is not an easy criteria, necessarily, to meet. And so they wanted all their principal investigators to go to the Antarctic and experience the environment.

They didn't all have to do a peer reviewed project, but I did -- and not to satisfy NSF, to satisfy the Navy that didn't want to take me. The Navy controlled all the transportation at that point, and they did not want to take me, and they were very frank about it. And NSF refused to give up on that. My program director would tell me, you know, "We're going to do this. It's just going to take some time." And they were trying to negotiate with the Navy on this matter.

And at some particular time, my program Officer said to me, "Irene, the way we're going to have to do this is for you to write a proposal for a specific project that could only be done down there, that fits your overall project, you know, the program on which the University of Washington is working, and we'll have to send it out for peer review. And if we get it approved on that basis, then we will have the Navy in a position where to turn you down they would have to turn down support of a peer reviewed scientific project." And he said, "They don't want to be in that position."

And so that's why -- so okay, I wrote a proposal. But it had to be scoped very carefully. It had to occupy a certain amount of time and be doable in that amount of time in that environment. But fortunately, my partners and most of the students had already been, so they could help with crafting this thing so it was doable.

LK: Your students had been to the interior?

IP: Oh, yes.

LK: Before you were?

IP: Yes. Two Ph.D. students had, and the students of others of the project. And by that time we had an assistant professor who had gotten his Ph.D. with one of the senior men who was also working on the project. And he had wintered over. He was working on a different aspect of it. He was a very skilled electronics designer, and he had worked on the transmitter, designing the transmitter and the antenna. But he was in the group, too, so there was plenty of advice on putting something together. And I knew what the concept was. I knew something we needed to have filled in. We needed to know more about the properties of the deep ice than was known by anybody at that time in order to make some progress on what we wanted to do.

We were studying the lower boundary of the ionosphere. That was what we were doing. And we were looking at it -- or I was -- as the lower boundary of a very complex wave guide, so that in the air channel in which these very long wavelength signals were

propagating by the bounce-bounce kind of method, if I want to conceptualize it that way, we had a complex wave guide, with the lower ionospheric boundary as it's upper plate, and that was the unknown. Then we had the air channel. We knew a lot about that. Then we had a little tiny bit of snow in the surface where there's a lot of air mixed in, it doesn't make much difference when the wavelength is kilometers long. It doesn't make any difference. But the wavelength was so long that the ice at the point where the antenna was, was probably close to a quarter of a wavelength, just the ice. And electrically, that makes a lot of difference. You can't assume it's infinite, which makes the problem easier. We had to assume it's about a quarter of a wavelength. Underneath that was some kind of rock of unknown properties, although people guessed at that time that it was probably granite -- the geologists did. And at that time there hadn't been any drilling to the bottom. They were working on that at Byrd, and the Army Cold Regions Research Lab eventually did drill a hole down to the bottom at Byrd, but not where we were, but of course, you'd use those results. And we worked with that too, later.

But we had too many unknowns in the problem. We had to get some unknown out of this if we're going to look at what's up here. That was what the problem was. So we conceived a method of using a theoretical model, which was, of course, somewhat simplified. You do what you can, add complexity later. We knew that all we could get from the surface -- it was like a remote sensing

project, a subsurface remote sensing project. We knew that all we could ever hope to get at that point in time was some kind of bulk average property of the deep -- of the whole ice sheet, the vertical slice. We knew that's what we could do. And we conceived a method by assuming a -- we assumed the properties of wet granite for the bottom layer, and we turned out to be pretty close to right. That didn't make much difference in the problem, maybe a second order difference if we change those numbers.

But we had our theoretical model. We related it to -- if this was the dipole, we walk a path from its center, perpendicular to it, and we take what amounts to near field measurements, so it would be at the far field pattern, you didn't even want it at that point, but if you did, you'd go miles and miles away. We made measurements along this baseline, which was perpendicular to the antenna and in its near field. And once we had those measurements, we could deconvolve the situation so that we could put different possible numbers into the properties of the ice, which we just put in as a complex number. We could -- it was a brute force method. I mean, you do what you have to do and what you can, and that's a method that is very workable, and still is. We did brute force methods to match our experimental data with numbers that we could have the computer put into the model for the complex permittivity of the ice sheet.

And that was what it was. And later on, a different graduate student -- well, anyhow, that's how I happened to -- what I did down there, what we proposed for.

(INTERRUPTION IN RECORDING)

LK: Okay. This is tape two, interview with Dr. Irene Peden. And you were talking about the need for the research that you were doing in the interior, and the need to write a peer review proposal.

IP: Yes.

LK: And how long were you given? What was your deadline to write the proposal, do you recall?

IP: I don't recall. I know that the season in which I was to go was the season that opened with late October, 1970. I knew that I would have, essentially, four weeks, something like that. And the equipment that I was to use, you know, we had to drive this baseline in the Sno-Cat, and that was allocated to us for a specific length of time, and then we had to give it to somebody else, whether we were through or not. That's the way it works. So we knew, essentially, what the boundaries were in that sense.

But after I got the proposal written -- and I could have written it over a weekend by the -- you know, in academia you just learn how to do what you have to do, in that sense. After the proposal was duly written and peer reviewed and endorsed, then other objections began to start, including the time honored, "No

facilities for women, no bathrooms for women." Well, the NSF could have counted on that one well enough.

But finally -- and oh, they had an orientation session in September, every year, for the people who were going to go to the Antarctic, the ones who had not been before. And it was a very important matter to attend that, and learn a lot of things you needed to know about how to live and work in the Antarctic. But one of the things they did was have somebody representing each major field in which research was being done at that time give a lecture to the rest, so that we would all understand what else was going on, you know, in NSF sponsored research in the continent, and so forth.

And apparently, the particular admiral who was in charge of transportation at that time, he must have suggested that I was some kind of -- what would you say -- an adventuress, you know, that I wasn't really serious, that I just wanted to go down there with all those men who were twenty years younger than I was! You know, why would -- it's like that thing I told you about, (Laughs) "Maybe you just want to get a husband, and that's why"--

You know, there are easier ways. Well, the same thing was true here. But they finally -- they decided they needed to have me make the presentation for the whole area. Other researchers, you know, in the similar area to what we were doing, I needed to make that lecture that year at the orientation session. Anyway, then it turned out I'd had a hard time putting it together,

because I didn't have enough notice. But their idea was that the admiral would attend, he would hear me lecture on this highly scientific technical subject, and he would realize that I was a serious researcher.

LK: Your credentials--

IP: My credentials, or get my ticket punches.

LK: But your Ph.D. and your tenure as a professor wasn't enough?

IP: (Laughs) No. They decided -- they were trying to checkmate him again. And he handled that by not attending.

LK: I see.

IP: I gave the lecture as best I could. I contacted other researchers and other universities, you know, and got some material from them, put it together, and he didn't come. And then finally, he took his final stand on the issue of my being there alone. He said that I might twist an ankle on the ice, I might get sick, I might need the attention of a physician -- and they had physicians at the stations, Navy doctors -- and then I would have to be treated by a Navy doctor. And he said, "No Naval doctor can treat a female except in the presence of another female, and therefore I'm not going to have any of my boys exposed to possible problems if she breaks her leg or something like that," see, that's what he said. And at that point, the time was running out, if I was really going to go that season.

So their representative in Christ Church, which was the staging area for going to McMurdo, found a woman geophysicist at the University of Christ Church who was willing to go and who wanted to go. And we thought that would be a good idea. So she failed the physical. And the time came for me to either pack up or know what I wasn't going. And my program director said, "Irene, we are working on getting a replacement." And let me also say at that point, I was not going to fight it anymore. All I wanted to do was go and do my project. I did not want to make a federal case out of it. In 1970, there was nothing to imagine would happen from a federal case, even if you go all the way to the Supreme Court, you would just lose. There wasn't any backup movement, you know, to support you particularly, that I knew anything about. So my decision was, "I just want to go, and if this is what I have to do, okay. I'll do it."

So he told me, "You just go get on the plane." And it was a military flight out -- what is that Air Force base -- it may be now closed, near Sacramento? Big Air Force base at that time. That's where the plane was going to go. And he said, "You just go down there, you get on the plane. We are going to work this out." I really can't say enough for NSF. They really, really went to the mat. So I got on the plane. He said, "By the time you get off the plane at Christ Church we're going to have somebody." And so what they did -- and I thought this was really clever -- they said, "Forget about geophysics, forget about electrical

engineering, we need somebody now who can pass a physical and who wants to go." So they went to the Alpine Climbing Club at Christ Church. And there was a young woman there, she was probably ten years younger than me. She was a librarian. Her husband was an electrical engineer who had wintered over at Scott Base, which is the New Zealand station near McMurdo. And so she knew perfectly well what it was, and she wanted go, and there wouldn't have been any other way she could have done it. So she said sure, she'd go. And she was in great physical shape, you know, an alpine climber, so there was no question about passing the physical. And she met me at the airport when the plane landed.

LK: Do you remember how you felt when you saw that she was there?

IP: I remember thinking, "Thank God they found somebody, and she looks like a real friend." And she was, she really was. And as it turned out, it was a rather hostile environment for me to be in. There was a lot of resentment among the men who were there.

LK: The men on your project or the--

IP: No, the other men who were there in the Antarctic doing work. Not all of them, absolutely not all of them. But there was a lot of grouching, you know, "Damn women, tying up the equipment. If it weren't for her, I could be doing thus and so, and thus and so," whether or not that makes sense. It didn't. They might have been scheduled for somebody else, not them. But there was just a lot of grumbling, surprisingly, going on in the background. I

ignored it. There wasn't anything else to do but that, you know, just set it aside. But it was very good to have Julia, because she fit in very well. We were very good friends. And she did what she could to take the pressure off me, because she knew I had a very limited amount of time to do the project and an awful lot of work to do.

And as it turned out, it was even more pressure than I anticipated as being normal under the circumstances. The situation in the polar regions -- it's still true -- before you go you have to plan everything very carefully. You have to know where everything is that you will need. If something breaks and you need a replacement, it won't be there unless you brought it. You have to think this all through very carefully. And we had done that. And some of our equipment was rather fragile, so we had a hand-carry box that the technician, as part of the group, was carrying. And they took it away from him on the plane and said it had to go in the cargo hold. Whether that's really true or not, I don't know. I can't imagine that it was. But we went first to Hawaii, and we overnighted there. And that's where they took it away from him, and said, "It'll be in the cargo, and it will be on the plane when you get to Christ Church." And it wasn't. It was not there. And so we went on to McMurdo.

You have to go where you're scheduled to go when you're scheduled to go. The logistics are severe. The NSF people take care of that. But you have to do what you're programmed to do.

You don't wait in Christ Church for your equipment, you go. So we went to McMurdo. And the box had not been found. And the NSF rep in McMurdo said to me, "We're turning the route upside down. We're going to find it, Irene. But in the meantime, just do everything else that you have to do when you get into Byrd, and we'll find it." And he also said, "You can't fail. You can't fail." He said, "If you fail and are not able to complete your project and publish your results, there won't be another woman on the Antarctic Continent for a generation," which was an awful lot of pressure, because the box didn't come.

And we went on to Byrd when we were programmed to do that. And then we went on to our little substation twelve miles away, and it still had not come. And we did the things that we had to do to get ready. There was a tiny little electronics lab in our little station, which was under the ice. We did some things that we knew we had to do.

We went off one day to a place where the graduate student who was with me and had wintered over before, he had buried some equipment. He knew exactly where it was, so we spent a day going there in near whiteout conditions, to get that, dig it up and take it back. We did everything we could, and it still had not come. And that was getting pretty serious, because they were still telling me, "You have to succeed. You have to." And we couldn't without the equipment.

But we were saved. We were saved by a Stanford grad student who was at Main Byrd who came out to visit us. He immediately understood our problem, knew he had something that we could modify to use. He didn't have it in a form that we could just plug it in like that. But he said, "You can modify this, and I'll be glad to lend it to you. Do you want it?" Well, we wanted it. So we spent another day and a half or two days at the most doing the modifications that had to be done, and then we were ready to go. And by that time, we probably had half the time that we had expected to have. So we worked twelve-hour shifts.

And there were days when we couldn't work at all because we'd get up to the ice -- surface level and find there was a white-out. You don't work in a whiteout. It's like being on the inside of a milk bottle, you can't see anything except white. And it's something that happens in the polar regions. Nobody has any control over it. You just don't flirt with it, because if you go out and get disoriented and lost, which you almost certainly would, then everybody has to drop everything and try to find you, and everything is disrupted, you know, for a lot of people. So you don't play games with it. You just don't do it. And we had some of those days.

But we worked twelve-hour shifts. And Julia was wonderful during that period. See what we did, we were in a little station that the Navy did not support except to bring in food stocks **RSD-50s**, to use. They didn't have a Navy cook there or anything, it

was just us in our little station. And we had to rotate the duties. The main duties that were on the schedule were shoveling snow and ice into a melter so we would have water, and cooking and cleaning up. Those were the major duties. And when we first got there, the altitude was -- it was not extreme. It wasn't any higher than Boulder, Colorado, where I had been for years, but I was exhausted by the time we got there, and somewhat stressed. And I really felt the altitude. And I was forty-five. And they had me on the roster for snow shoveling duty. And I said -- you know, I remembered something my husband had said to me (Laughs) -- one of the last things he said before I left, he said, "Now, Irene, I want you to remember that you are not a man. You don't have to do everything that they do." And I didn't pay much attention to it at the time, but it came back to me.

So I said to them, "Kids," you know, "They're going to take me out of here on a banana sled if I try to shovel snow," because I had a cracking headache. My nose was bleeding off and on, you know, from the altitude, that I wasn't used to. And so they said, "We never thought of that. We'll fix it." So they gave me extra cooking and dishwashing duty. And on the days when we could work and we were out twelve hours at a time, Julia took my duty. And that was a great contribution, you know. If I'd had to do that too, I could probably have done it.

But it was really a heavy duty. We had to bake our own bread. The Navy supplied a mix, and we mixed it. We made ice

cream. They sent in their food supplies in Navy quantities, and it was all frozen. It was like trailer vans put together under a big Quonset hut, which they call a Jamesway down there. We'd have a can of peaches that big around and that deep, and it was frozen solid. So when it was your day to cook, you had to think far ahead and get it down and warmed up so you could use it. But we did all kinds of things like that. It was an interesting experience.

Another thing, the graduate student who had wintered over, before we went, he appeared in my office doorway every now and then to give me another tip of the Antarctic. One day he stood in my office doorway and said, "Don't take anything white to the Antarctic, it will never be white again." So I said, "Okay." Another day he stood in my doorway and he said, "Your nose runs all the time. Nobody pays any attention to it," and things like that, you know. It was great.

LK: Things you don't learn in books.

IP: (Laughs) That's right, that they don't tell you, even in the orientation session. It's a desert. It's an exceedingly cold desert. It's very, very dry, low humidity. First thing happened was all my nails broke off. They did not regrow until I left. And the advice is you should have wire frames on your glasses, and glass glasses, because plastic can't withstand the cold. Well, I had obtained some wire -- not wire -- supports, but I had glass glasses, but I had a plastic thing on. I ignored that, the only

piece of advice I ignored. And immediately, it parted right at the nose, the glasses.

LK: What did you do?

IP: Well, we tried various kinds of things. And finally, some technician said, "We're going to use epoxy." So he got some kind of an epoxy, I suppose. And it ended up with a big ball right over the bridge of my nose, but it held the glasses together, and that's the way I saw what I had to do down there, yeah.

LK: Do you have any other examples of everyday things that you had to learn, or had to combat while you were there that you didn't even think about when you did the orientation session?

IP: Yeah. Well, the snow vehicle that had to be driven along the baseline. My legs were too short. In order to let out the clutch, I had to lift my bottom off the seat. It was exceedingly awkward. And Julia was a tall girl with long legs, so there were days when she wasn't doing my cooking or hers, or my dishwashing and hers when she would drive the vehicle. Normally the technician did it, but sometimes he had other things he needed to do. And Julia, then, would drive. And I really couldn't. That was the interesting thing. I wouldn't have thought of that. It wasn't that hard to work it out. But that's the kind of thing it was.

Another thing (Laughs)-- bathroom problems. I mean, when you go out for twelve hours, there are no comfort stations out there.

And these things have to be dealt with. And one thing Leo had done before I left, he came home one day with a package, a box under his arm, a thin box, but a box. It was a porta-potty, and he said, "Here. Take this. You might need it." So I packed it. Well, and I did. Now, when Julia used it, she would tell everybody to stay in the vehicle, and she would go out with the porta-potty. I had the obverse feeling about it, and I would send them all out in the cold, and I would use it in the interior. We had plastic bags, obviously, we sealed them up, and we threw them. There wasn't anything else to do. Everybody else did that. At least for the men, it wasn't in a plastic bag.

One thing I noticed, in those days, there were really no environmental concerns of any serious import. And everybody was terribly thirsty all the time. That's something that low humidity and terrible cold does to you. So people were constantly drinking soft drinks out of cans and pop, and beer, probably in some places. And they'd just throw the cans, throw them anywhere.

At McMurdo they had a little nuclear power plant for melting the snow. And you had pipes carry warm water running along, just over the surface, melting the snow. They wouldn't do that now. That's gone. And if a vehicle stopped running, they would leave it where it was. Now the New Zealand people were much more conservative then. If a vehicle broke down, they cannibalized it for parts and used them. The Americans just left them and walked off. Now all that's been cleaned up. They don't do any of that

anymore. They're very careful. But in those days, they really weren't. And so people were strewing things all over. So for us to throw out our little plastic bags was nothing.

LK: Comparatively.

IP: Nothing compared to what else, yeah. And there was garbage, you know, they'd just bury it, but not very far.

LK: So in total, how long were you there?

IP: I was actually -- I was in the station four weeks. And I was at McMurdo a few days before going in, and a full week coming out, because there was not a flight going back to Christ Church. There was a flight that I had been assigned to, and I had to take it. So Julia and I, we went around in McMurdo and visited research that other people were doing.

We went out on the sea ice, where there were divers working with seals and fish. Some of them were diving from holes in the center of their huts, for God's sake, diving in their polar wet suits, down to swim with the seals, and learn about that kind of thing. That was fascinating. Well, the ice was beginning to break up, and there were a lot of seals out on the ice. And they were not afraid of us. They didn't evolve with any natural enemies that looked anything like us, just leopard seals that they would worry about.

And my blood freezes when I'd think about it now. We'd come to a big crack in the ice, we'd just hop over it and keep going.

And my God, if you fall in, you know, you've had it. We didn't even think of such a thing. But we did that.

We visited other research stations. We wanted to go to the Pole. Everybody wanted to go to the Pole. Congressmen had been taken to the Pole. The four women who had preceded us the year before on a coastal research project had been taken to the Pole, and we wanted to go. But I guess it was the admiral's last revenge. He declared that we were not to go. And in those days, anybody -- if a plane was going to Pole and somebody wanted to go for the ride, they could go, but we couldn't. And what he said was, he "wasn't going to take any damn foreigners to the Pole." Well, that was a terrible insult to Julia, really, to both of us, but really to her, because you know they had taken foreign dignitaries to the Pole before. It was totally out of line for him to say it. It was a very rude thing. But we didn't go. I have now been to two of the three U.S. stations, and I will never go to Pole. And I have kind of a feeling about that.

LK: A regret?

IP: Yes. I would have liked to go, just to be there, and talk to people. I have at home a videotape of the interview that Diane Sawyer did with Jerri Nielson, the woman physician who found her own cancer down there at the Pole. I had nothing as dramatic as that going on. But it's a wonderful tape, and they did a great job. And among the many things that you learn from watching that tape and listening to them, you learn it from the doctor. The

kind of comradery that they had in those situations. Hers was extreme, and they obviously loved her, which I'm sure she was justified. But there is really a connection, even so. If I run into somebody who was at McMurdo thirty-two years ago, or any place else, you know, instantly we have a connection. We talk. We know each other. We know about it. We've shared something that was very difficult. It's important.

LK: There aren't many people who have traveled through the interior of the Antarctic.

IP: Well, there are now. There are now. They've had women at the U.S. stations for years now. They've even wintered over. Oh, yes.

LK: So do you feel that you succeeded then?

IP: Well, yes, I do. I do, yes. And NSF gets a great deal of credit, because they really went to bat to see that that happened. And NSF has been very supportive of women in science and math and education and engineering, very much so. I was told recently that they -- depending on who wants to go -- you know, people also vote with their feet. Not everybody wants to go to a place like that. But they try to see that they have twenty-five percent or more women at any of the stations any time. And if they can have more and they want to go and they have projects that need to be done, they're authorized to go. And thirty-four percent is the largest I've heard, but there may be higher numbers for some stations.

LK: Do you feel that that's an influence of things like Affirmative Action and Equal Opportunity, or do you have an opinion about that?

IP: Well, I think some of it is. And I think some of it's due to those of us who labored heavily in the early days, when the doors were shut, and wanted to stay shut. I think we had something to do with it too. But, of course, Affirmative Action, and civil rights movements, and federal laws prohibiting them from asking you t dumb questions they had no right to ask, that's a result of federal regulations, laws.

LK: You obviously helped change the image or the opinion of what can happen by doing--

IP: I made it harder for them to argue against it, is probably what it was.

LK: Right. How was your experience at the University of Washington after you completed that research trip?

IP: Oh, well, I worked as frantically as I could after I got back to write this thing up, you know, and write more grant proposals for the group, and like that. I think there was -- academe being the way it is, there was an appreciation of the publications and of the grant involvement. But I never was sure that they really gave me as much credit for keeping the grant going as they should have, because the presumption always is that if you're working with male partners, they just may be doing more of it than you are.

Which was really not the case. One of the senior partners became an associate dean, and spent most of his time on that job instead of on the research. And there was a period when I was really kind of running it. But I never was listed as more than co-PI, the senior people kept that for themselves. And I think there must have been those in the department who never really were sure that I wasn't just tagging along. I think so.

LK: So do you feel that you didn't receive enough recognition for ...?

IP: I got a lot of recognition, ultimately; but from within the department, I don't think so. In fact, when I was elected to the National Academy of Engineering, the first one the department had ever had, there was no recognition, particularly. I got a pro forma letter from the dean and one from the provost, but as far as the department was concerned, the major thing was that I immediately was petitioned to nominate a colleague whom they thought was more deserving than I of that honor, which I did, and he's in too. And he was deserving. He should have been in. He should be. But he is now.

LK: I'm sorry. What year was that?

IP: 1993? But you know, they didn't have a party for me. NSF did. By that time, I actually was a division director at NSF, on rotation from my department at the time I was elected. They had a big party at NSF. They love to have a party and everybody comes. But the department did nothing.

LK: In 1973, the Society of Women Engineers awarded you their Achievement Award--

IP: Yes.

LK: -- the highest honor that they have there.

IP: Yes.

LK: And that was just three years after your trip to Antarctica.

IP: Yes, and it was partly based on that. It says something like, "Contributions to radio science in the polar regions and engineering education," or -- no, maybe "education" I don't think it mentions women. I think it's "engineering education."

LK: Uh-huh. It's in overall career achievement.

IP: Yes, that's right.

LK: And how did you feel about receiving that award?

IP: Oh, that was the first major honor. And I was really -- they handled it so beautifully, you know, the big banquet. And oh, it was wonderful. And I felt very privileged. I still do.

LK: How have you used your career experiences to talk with young people who aspire into engineering?

IP: Well, years ago when I was much younger, I used to go to the high schools myself. I would contact them and say that I wanted to come and talk to young women in their math and science classes, or clubs, or whatever they chose to let them know that there were some possibilities for careers that they might not have thought of, that would be rewarding and interesting, if they

happened to want to do them. I don't believe in trying to encourage somebody who should not be in the field in the first place, to dangle the offer of salaries or whatever. I think it should be people who really want to do it that you support and encourage. And I just felt that nobody was giving them that information.

And I had a brother-in-law who was a head of the math department in one of the Seattle high schools, and he kind of paved the way for me to -- I went first to talk to his math class, to tell you the truth. And then he let the other teachers know, you know, and it sort of spread, and I would get invitations then. I found the teachers of math and science to be very encouraging. They really liked hearing what their talented young women students could do that they might not have thought of. The vocational counselors were not so positive -- as a group, not all individuals. But as a group, they were much more reluctant. They felt there would be problems that these young women would have that they maybe didn't want to counsel them into taking. And I think if you won't take a risk in this life, what have you got?

LK: Really.

IP: Yeah.

LK: Your nomination and then your acceptance into the National Academy of Engineering in 1993, how did you feel about that when that happened?

IP: Well, I mean, I was pretty elated. I mean, that's about -- that's one of the highest honors you can get in the field. You always sort of have the feeling, "Gee," you know, "How did this even happen? There are lots more talented people in the world than me. How did this?" I had a similar feeling when I first -- the first night I spent in my little bunk twenty-five feet under the ice, 10,000 miles from home. I remember thinking to myself, "How did I get here?" And I had that same feeling a little bit. But I was very, very honored, of course. And that was really due to good friends and mentors doing the -- one of those nominations is very time consuming. You have to know how to do it. You don't just send somebody's resume and think they'll be elected. They won't. It has to be an excellent candidate who meets all the criteria. It has to be an excellent nomination. There has to have been some networking done behind the scenes. And my friends and mentors -- there weren't any others from the University of Washington in EE, but my friends and mentors from other universities were doing some networking behind the scenes. It doesn't happen easily without that.

LK: But it is important.

IP: It is important.

LK: And recognition, professional recognition, can you comment on that a little bit?

IP: In what way?

LK: Specifically for engineering.

IP: Professional recognition. Well, I think working with your professional society is a good way to get known. Going to meetings and giving papers and circulating and talking with people so they know who you are, where you're from, what kind of work you're doing; getting to be known by the granting agencies, because money is very important in academic life; getting to know the people from the granting agencies and know that they know who you are; being willing to serve on their proposal review panels, so you find out how it's really done. The approvals are -- you know, it's not always just the way a naive young professor thinks. A naive young academic may think, "All I have to do is write -- take this marvelous idea I have and write it up and throw it over the transom and they'll give me money." It doesn't work that way. But if they know you and know your institution, they can put together, essentially, in their own minds how what you want to do fits what their overall program is about, where it fits in, know whether or not your university can really support you in doing that, etc., etc. -- whether you've got a good track record. If you don't publish, you won't get any more, no.

And being willing to serve on those panels, it's time consuming. They reimburse you for expenses, but that's all, a little bit, a little bit of (Inaudible), maybe, honorarium, but not very big. But be willing to do that and give your time that way, you find out how the system works, and you have to know how the system works. It's not truly, totally a merit system, as

women like to believe it is, it isn't all. Merit has to be there, but that isn't always the whole story. You have to know how, too. And that's something you can learn from all these connections. And it's something you can learn in SWE just as well. Other women know now.

LK: How can you learn it in SWE?

IP: Just by interacting with people, and asking their advice, or giving advice when you are asked, just talking with people, networking with people. They can advise you. If you're in a bad situation and you need some fresh perspectives, they can advise you, give you other ways of thinking about things. And maybe you've trapped yourself in one rut of thinking about the problem you have, they can give you other ideas about what might be going on, improve your perspectives, just support each other.

LK: Do you feel that the Society of Women Engineers is a support network in a different way that other groups are?

IP: It's a different way -- or it was a different way for me than the IEEE was. My initial connection with the IEEE was purely technical, through several of the societies, the Antennas and Propagation, the Geo Science and Remote Sensing, and then the Education Society. Those are my technical connections in the IEEE. But thanks to the efforts and counseling of one of my main mentors, Professor VanValkenburg, that I mentioned, he's the one who convinced me that engineering education, per se, is more important than I thought it was as a young researcher in a

university that was pressuring me for research. He convinced me that there was a lot more going on in the world, and that coupling into it was important. And thanks to him I got involved in engineering education too.

And eventually, again, thanks to him opening doors, persuading their nominating and whatever the committee was -- Nominating and something Committee -- that I should be tapped for it, I became a vice president of the IEEE. That's where I learned about politics. I learned a lot more than I ever wanted to know. But you know, and sometimes it was painful, but it was valuable. And I think you can learn that in SWE, too. It's just that my channel was IEEE. I didn't have time for everything. There isn't that much time in the world. And I had to make a choice. And the IEEE connections, because they were partly technical, were the ones that I chose to put so much time into.

For a while I was associate dean at the college at the University of Washington. And the dean who asked me to do that was also a friend and a mentor. And he was ahead of his time. I think, if I was not the first, I was probably one of the first two or three women in the country who was an associate dean of engineering and also an engineering faculty member. There weren't very many.

He was kind of a mentor, too. And when this thing -- I was working with him as associate dean when the invitation came. And I said, "You know, Roland, I think maybe this is something I

shouldn't take my time to do." And he said, "You do it. This college needs more national visibility than it has." And not all deans -- successors of his felt that way about it, but he did. And he said, "We could use the visibility, and you're the one who can do it, and you go do it, and I'll support you."

So I took it, and I got drawn in more and more to the IEEE. So I ended up -- even after I went back to the department, ended up doing more than the faculty might have wished that I had done. But it was interesting to do. And I would say -- and this is a general thing, and I think it applies to me, too -- I think women generally have broader interest patterns than men do. Academic criteria were developed by men, not women -- male faculty members who had one-track minds, and nothing mattered but their research. And they made that the criteria for success in academe. If your interest pattern was too broad, you tried to pursue too many things at once, you would be found deficient in what they had decided was the main line. I think the presence of more and more women will change that, and it's already happening, because the values of women and the particular interest patterns of women had no place, especially in a male dominated field like engineering.

LK: How do you think that it's changing?

IP: There are more and more of us. I was the first one in my department, and for many years, I was the only one. Now I think they have half a dozen. And in the College of Engineering, I don't think there is now a department that doesn't have at least

one woman, although there certainly is a department that has only one, and only recently. But there are more and more of us, and I think that's what it takes. My experience was that I wasn't very discriminated against as the only one. You're just a curiosity, you're a singularity in their field. However, when there gets to be a small group, they get nervous. And then I think that's where some of it comes. If you're a member of a small group, you're now a minority group, and there's something about that. But after a certain point, if there are enough of you -- and I think they're reaching that point in many areas at many schools -- then you can actually have an impact on what's going on. And if you also are good at what they want you to be doing -- and you have to do that -- but if you can go beyond that and impose some other things as valuable on their thinking, I think you can make a change, but not without sacrificing -- well, you can't do it with sacrificing what they have said is important. You have to go with that, too. I think it's hard because of that, but it's also very rewarding to be able to do a few other things too.

And you have to choose very carefully. You have to decide what your priorities are and then go for those. If what you want to do in a research one university is counsel students and work closely with undergraduates and teach 101 courses -- which can be very valuable, because good teaching at that level opens their eyes and opens their horizons -- put a very high value on it -- but if that's what you want to do primarily in a research

university, you're in the wrong place. You need to go to a four-year college where that's highly valued and rewarded. You have to know at some point what you really want to do, where you want to go with it, and then you have to do what's required, plus whatever else you can and want to do.

LK: And do you think this is advice that's neutral for women and men -- young women and men today?

IP: Yes. I think it's a matter of degree. I think being -- many of the problems that I have had and other women have, men have too. It's just somehow exacerbated by the gender factor. I do believe that. I've had wonderful support from many male colleagues and friends.

LK: And as a woman first in different venues, do you feel that you're a feminist?

IP: Yeah, sure.

LK: Do you identify yourself as a feminist?

IP: I do, yes. And I'm sure my whole campus does. I did a lot of work in the '70s with two women colleagues. One was a professor of psychology, the other was the first associate dean of the graduate school. She was a neurophysiologist. The three of us worked together very closely, and we -- one of us -- not me -- one of us got us established as a subcommittee of the faculty committee of the faculty senate on the status of women on the campus. And this went beyond engineering. I was associate dean

at the time, and that dean would support me in those things, whereas some of the successors would not have, but he would.

We launched the first salary study. And the results did not please the administration. We were very careful. We did not involve any untenured women in our study. We took advantage of the offer of some of the biostatistics people on campus, the medical school on campus, to do the data reduction, so it was impeccable. And those women did it over the Easter weekend, by hand. And we wanted the salary data. We couldn't get it at that time. It was state information. It was supposed to be publicly available; it was not. And we petitioned and petitioned, and they always had a reason why they couldn't give it to us yet -- the computer -- ah, you know, all kind of reasons. And at one point -- I would have done it myself if I had known to do it, but for whatever reason, Leo Peden, my husband, an attorney, took it upon himself to call -- he knew what -- you know, we were wringing our hands over this -- how are we going to get it? What are we going to do? They keep saying -- they were putting us off. He called the lieutenant governor, whom he knew personally, and told him that we were having this problem and that we couldn't get the data. And I forget what his name was. He finally said, "Well, you can get it, Leo, it's state budget. I'll get it for you." And he did.

And so then we had it. And there was a lot of unhappiness over that in the university administration. But we used those

data, and they used a very rigorous statistical method. We only analyzed departments that had both men and women in them. We did not go to the school of nursing, for example, because the statistics would have been different to try to -- we were advised on that by our biostatistics friend. We went only to departments that had both men and women. And I don't remember any more -- this was about 1974 or '[7]5 -- exactly how they did it, but they did something very rigorous that showed absolutely definitively that women were not making as much as men, with similar or even better records of productivity.

We did not advertise our results. What we did was write a letter to the dean of each college, the heads of departments that turned out that way. We did not send any copies. We sent a letter only to that dean with no copies, saying, "This is the result of an investigation we've done. This is how we did it. We've got some results here that we think you'll want to look in into."

LK: Why did you choose to present it that way?

IP: Well, can you imagine what their reaction was? They were humiliated, outraged. The messenger gets an awful lot of blame for the message. We knew that. Of course they knew who was doing it. There was no secret about the faculty -- Women's Committee on Faculty Women. And we started -- we had to think -- originally, I was the first chair of it -- how are we -- what are we going to do first? There are so many things that are crying to

be done. So many faculty women came to us pleading for help from us at first. And there were so many problems. What were we going to do first? And I think it was the engineer in me, I said, "We're going to do something first that we can do that will be numerical that they can't contradict, and can be done in a finite amount of time, and that nobody can argue with when it's done." I mean, isn't that what engineers do?

LK: Data gathering.

IP: Sure. And data reduction, and impeccable methodologies, and so forth. We said, "We're going to do that first." So that was why we did that first. And we knew that the message would not be well received, but we knew it had to be done. And we did not let the name of any junior woman be associated with any of it. The three of us took it on ourselves. We paid a price. But we understood going in that there was going to be a price. I don't know -- at least I was not sophisticated enough at that stage to realize it would go on forever. I thought it would be short-range, and it wasn't. But it had to be done, and it had to be done then, and had to be done by somebody, and we did it. It reached a point where they used to laugh, you know, if the three of us would come into to the Faculty Club to have lunch together, members of the administration would look at each other and say, "What are they up to now?" (Laughs)

LK: And this point you were tenured?

IP: Oh, yes. I was a full professor by then. That was a very difficult thing to achieve. When you get to the higher levels, that's when your glass ceiling begins to show up. And in my generation, there were very few women who made full professor in engineering anywhere. In fact, in 1975, SWE gave its Achievement Award to Sheila Widnall at MIT. And Sheila and I were two of the only eleven women engineers who were faculty, full professors that I could find in the country. I think I chaired the committee, actually, that SWE committee at that time, the Awards Committee. And as part of getting together a package for Sheila, the question came up, you know, how many, really, are there? And I could only find eleven in the USA.

LK: In 1975.

IP: In 1975. And Sheila and I were two of them, yeah. So it was very hard to do. And the resistance gets -- I don't think the resistance to becoming a full professor is that great anymore. There are enough of them. I'm sure it's not. The resistance comes if you want to be dean. In those days there were no women who were deans of engineering. There are now. There are a few. They've broken through on that now, too -- successive generations.

LK: So I mean, in a sense, the data gathering is the first step.

IP: It certainly can be; it certainly should be. You have to do something that -- you have to play the game to win, to start, at least. You can lose some rounds later on, but if you're

going to have credibility with the people who are going to receive the message and who don't really want to hear the message, then you better do something that is going to work, and be known for having a workable approach.

LK: Is there anything that you wish you could have done differently?

IP: Oh, dear.

LK: A loaded question.

IP: That's a very loaded -- there are things I would do differently, if I could go back, knowing what I know now. I can't say that, with the amount of information or understanding that I had at the time, that I would be likely to do anything different than what I did. You just have to go with your gut feeling sometimes when you don't have enough information. That's what you do. And if it doesn't work out, you take your lumps on that one.

LK: Well, I think I'm going to end. Thank you very much.

IP: Okay. It was a pleasure. I enjoyed talking with you.

LK: Okay.

END OF INTERVIEW