PROFILES OF SWE PIONEERS

ORAL HISTORY PROJECT

Ivy Hooks Interview

April 9, 2003

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Ivy Hooks

Ivy Hooks earned her master's degree in mathematics and physics from the University of Houston in 1965 and was involved in the early stages of aerodynamics of space shuttle flight. She began her career as an aerospace engineer at the NASA Manned Spacecraft Center and was an original space shuttle design team member. Hooks went on to hold a number of management positions, including separation system integration manager and manager of flight software verification. While at NASA, she was the recipient of the Arthur S. Flemming Award for Outstanding Young Civil Servant, NASA Outstanding Speaker Award, and the NASA Medal. Hooks left NASA in 1984 and started her own software systems consulting firm, Compliance Automation, Inc. She is a Fellow of the Society of Women Engineers, a charter member of the International Council on Systems Engineering, and holds membership in the American Institute of Aeronautics and Astronautics, IEEE, and the Project Management Institute.

In her 2003 Profiles of SWE Pioneers Oral History Project interview, Hooks talked about her career at NASA, including her experiences as an aerospace technologist, working on the Space Shuttle, and working on software consulting and development; her later career as a consultant and starting her own business, Compliance Automation, Inc.; writing a book; and her involvement in SWE.

- July 2016

INTERVIEW WITH IVY HOOKS, APRIL 9, 2003

LAUREN KATA: Good morning. It's Wednesday, April 9th, and this is an interview with Ivy Hooks, for the Society of Women Engineers Oral History Project. The interviewer is Lauren Kata, for the Society of Women Engineers. Hello.

IVY HOOKS: Good morning.

LK: Thank you for joining us. Can we start with you describing your family background, please?

IH: Okay. I grew up in East Texas, a little town called Livingston. I was actually born in Houston, which is where my parents were living when the Second World War started. And of course my father went off to war at that time. Then when he came back from the war, we moved to Livingston, which was his family home. That's about seventy miles north of Houston. The population was about 3,500 people. And I lived there from the time I was about four or five until I graduated from high school. It was a very small school system. I graduated with a class of sixty-two people.

I had four younger brothers, which I kind of thought were very helpful in going into the career I went into. Not much that they wanted to be engineers or did any engineering, but because just growing up around boys, it made me probably a little more immune to being in a mostly male environment. It wasn't as hard, maybe, as it would be if you hadn't been around boys all the time.

My father ran a grocery store. My mother was a homemaker.

With five kids, what else could you do? Some people manage it. I grew up working in my dad's grocery store. I'm the eldest of the five children, and probably to the detriment of the four brothers.

I went to a school that my father had gone to and my grandmother had gone to. I mean, we had generations there. And everybody in town knew you, and knew everything about you. There were really not many secrets at all in a small town. One time in my career, when I went to work on Dr. Craft's staff, Dr. Shellberg, who was the deputy administrator -- I mean, deputy center director at the Johnson Space Center asked, he said, "Why is it that so many of our engineers came from small towns in Texas and Oklahoma?" And I thought about it. I didn't really have any answers to him.

But later on I asked another friend that, who was from Oklahoma, and I think graduated with a class of six people, a really small school, you know, why-- there are a lot of us that are from Texas -- well, of course the center was in Texas, that would put you there -- but Oklahoma and the Midwest in general, and small towns in particular. And he said, "Well, I think it's because there is where you develop a really strong work ethic."

And a lot of us didn't want to stay in those small towns. You know, you run a family business or you're a schoolteacher, you know, that's about the only jobs. And back then there were very few real opportunities if you stayed in a small town. So if you wanted to leave and you wanted to do something and you had a very

strong work ethic, I think that is one of the things -- and one of the backgrounds that got a lot of us in the engineering profession.

I grew up in a very warm family with lots of attention. I had aunts and uncles and grandparents, and people around, cousins. You know, I didn't dare say anything bad about anybody, because it'd turn out that I'd actually be kin to them, and you weren't supposed to say bad things about your relatives at that time, especially if you were a child. So I grew up in that kind of environment. It was a very fun, fun childhood. Just lots of play. And school was easy, but I liked school. Of course, I was one of those typical kids that the teachers really liked, because you do well in school, you don't give them too much trouble -- although I talked too much.

When I was in grade school and they had that side of the report card where they would have little marks where if you whispered, they would just scratch that out and put, "Talks out loud." (Laughs) But that and the music classes were the only problems I ever had in school. I cannot carry a tune in a basket. I cannot sing at all, and I would get Bs in music. And it broke my heart -- because I was a straight-A student -- to ever get a B in anything. I went home crying about it. And my mother said, "I don't know why you're crying about that." And I said, "Well, I tried really hard." She said, "It doesn't matter. There are other children who try really hard in math and can't get it, and it's

easy for you." So that was one of life's first lessons, that it isn't all equal, ever. But like I said, school was really easy. I enjoyed it. I had a lot of fun.

LK: Do you remember always liking math--

IH: Uh-huh.

LK: -- and science?

IH: Oh, I loved math, but I didn't like science. Science in high school or grade school, was not interesting. Science was, you know, learning the parts of the flower or learning the parts of the body, or being able to identify the trees or something, and it was just memory. I did not like that science at all. Chemistry was taught by a coach (Laughs), and he tried really hard, but he wasn't very good at it. So, no, I didn't like -- I was interested in science, in terms of reading books, you know, and being interested in why the stars are the way they are and that sort of thing, but I probably wasn't the most curious child in the whole world about why this has happened or that happened, I just really accepted a lot of things. I mean, I know I have other engineering friends that questioned everything. I was not that way. But I loved math, and I loved puzzles. I like to work puzzles even today. And I think that was my first interest, was the math and the puzzles.

LK: Do you remember a favorite teacher, or a special teacher, math teacher or any other teacher that encouraged you in that direction when you were young?

IH: You know, I had some absolutely superb teachers, I really did. When you think how small that school was, and how small the school district was, it was just astounding the caliber of teachers. The ones that I remember the most -- probably the teacher that stands out the very most in my mind actually taught history and government, in junior high. Her name was Sylvia Brown. I'm not sure why she made such a big impression. I think the thing was that everything you learned from her, learning was fun. Learning was just an absolute joy, and so I think that made the difference, and that made it really interesting.

But I had Ms. Brown twice, in the seventh and eighth grade for history and government. It got me really interested in government and what goes on in the world. I think it was more part of the liberal education as opposed to engineering, but it was just the true love of learning. And also, just kind of getting in sequence, the events -- things happened in sequence, in events, like history, occurs, and what happens after something occurs, and what difference that makes in the world. I really remember her vividly.

In high school, again, if you're asking which subjects I liked best, it would probably be the English and the history, and those sorts of things, in terms of teachers. But the math, I just took to, you know, I never even had to think about it. So it's hard for me to look back and say why do people have trouble with algebra, because I don't remember ever having any trouble with

algebra. Algebra just seemed like what you were supposed to do. To me it just made perfect logical sense, so I didn't have trouble with that.

It's like learning to read. I do remember learning to read, because I actually learned to read before I started school. My dad loved to read comics, and he would sit and read the paper comics. I would sit by him every day, and he'd read me the comics. And so it wasn't very long before I started picking up what the words were, so that I could read them myself, without anybody really particularly trying to teach me those words.

Then kindergarten, I don't remember anything about reading, in kindergarten, but I must have, right? But I don't remember. I remember games in kindergarten and those naps on those towels. They weren't comfortable then, either. I didn't like that naptime stuff.

In first grade, I remember being so shocked because they had books I couldn't read. And the reason I couldn't read them was because of fonts. I didn't know the word then. There were words I kept having so much trouble with, and I finally figured out it was words -- it would be like the word "first." And you'd have f-i-r-- and it would be the way the "f" and the "I" fit together. Even today when people send me things e-mail or I get different books, I will pick up some and I go, "I don't want to read this one." They just seem to blur the letters together to me. They did then, and they do now.

But I figured out that that's why I couldn't read those words. So pretty soon, you know, okay, the ones you can't see well or that look funny must be words that start with this combination of letters, because I couldn't distinguish those letters. So as I grew up and I knew people who had trouble reading, to me that seemed so strange that somebody couldn't read. I would have been a terrible teacher of anyone like that, because I couldn't relate to that. I think I was very fortunate. I was very fortunate that I liked to read.

My grandmother ran an abstract company, that's like a title company. And it was in the courthouse. My dad ran the grocery store that was across the street from the courthouse. It was a very small town. And as a child I could walk from home to either of those places. I would go to my grandmother's office, and it was right across the hall from the library. So I'd go over to the library and check out my books, and come back and sit under my grandmother's desk and read books.

So I remember -- I think there are two things here, one is, I loved to read, from the beginning, and have always read a lot. The other is, I was in an office with a woman who worked, so there wasn't anything odd about a woman working. And I think even though my mother stayed home to raise us -- she worked before we were born -- I was immediately introduced to somebody who worked outside the home. So for me that was perfectly natural.

I was named for a woman engineer. Dr. Ivy Parker was one of,

I think, the original members of the Society of Women Engineers, if not in the first year, within a few years. And she was a really good friend of my parents. They were living in Houston at the time. But my parents didn't know that they both knew Dr. Parker, because my father knew her because she was his organic chemistry teacher at the University of Houston, and my mother knew her because they were in the same circle at church.

So one Sunday morning, they walked out of church together, and Mother said, "Oh, there's Ivy." And Dad said, "Oh, there's Dr. Parker." And that was the beginning of what became a very long and wonderful friendship. They did lots of things together and ran around together a lot for a number of years before I was born. When I was born, I was expected to be a boy. And since I wasn't, there was: What are you going to call her? And my dad asked that question in front of my great grandparents, who were there for my birth. And my great grandfather said, "Well, you can't call her anything but Ivy Faye," because he knew Aunt Ivy. In fact, just two weeks before, there had been a big article in the Houston paper about her and her work as an engineer.

I think one of the fun things about that is I just received that article about six months ago from a cousin who had been going through my great grandmother's papers, and had found the article and sent me a copy. And so obviously that article appeared just before I was born, which had Ivy on everybody's mind, and so that's how I got my name. So my family -- my extended family, at

least, included a woman engineer, which certainly at that time nor any time since have there been an awful lot of those around.

LK: That's such a great story. That was 1941?

IH: Uh-huh.

LK: And you graduated from Livingston High School?

IH: Right.

LK: Outside of school, do you remember having any kind of experiences generally with technology, maybe in some of your extracurricular activities or--

IH: No, not really at all. Most of my extracurricular activities centered around church work and church camps, the band, and boys.

(Laughter)

IH: I look back on that time and wonder why my mother didn't just take me out and drown me.

(Laughter)

IH: I must have given her a lot of grief and a lot of worry -- and just having fun. But I always knew I was going to college. There was never any doubt I was going to college. I didn't know what I was going to do when I got out of college. But nobody seemed to think I needed to worry about that right away, and so I didn't. It was a little bit of a pain to get there, because then they wanted you to fill out these forms and say what your majors are, and I had no earthly idea what I was going to put down as a major, nor any idea of what I was going to do.

I'm not sure if we went back to my records when I first signed up at the college. The first school I went to was Southwestern University in Georgetown, which is here in the central part of the state, a very small Methodist college. But I probably put down math. I had already taken some summer classes at a nearby university the summer after I graduated from high school. And then I went off to Southwestern and I spent a year there.

I really enjoyed -- again, I enjoyed the math. But I think it was -- no, I think I made it through math that year. Several of my friends dropped out, and said, "Oh, why are we in this class?" But I still had no idea what I was going to do.

And then I married that summer, and moved to Lufkin, Texas. The boy I married was a reporter for a paper there, and so I commuted over to the University of Austin College. And I know I put down math there and started back in some more math classes. I still didn't know what I was going to do. And I was afraid that, you know, maybe his career would be such that we'd be in those small towns, and I'd have to teach school, so I went and took a couple of education classes. Then I decided they were going to hang me before I was going to teach school. Okay? I mean, I'd go back to clerking in the grocery store, I would do anything. I was not going to teach school.

I have the greatest respect for those who do and do it well, but I'm going to tell you that facing thirty junior high students

is just more than I wanted to ever have to do. (Laughs) And the whole thing was just very uncomfortable to me. So it was like, well, I still don't know what I'm going to do.

I think what I learned to do was to avoid those things I knew I didn't want to do. I wanted to get out of the small town. I really didn't want to work in a grocery store the rest of my life. And then I didn't want to teach school. So now I'm avoiding things, not going toward something, I'm just going behind, leaving behind things.

I was always a little envious of one of my peers at NASA. One time he said he knew from the time he was six or seven years old, when he used to throw the chickens out of the hayloft at the barn to see how well they flew, he knew from then on he was going to be an aeronautical engineer. And I've met other people who know from the time they were a small child that they were going to be a teacher or a nurse or a doctor, or whatever, but I didn't. That was not part of my background.

LK: Based on your family's relationship with Dr. Parker, did you feel you had a clear understanding of what engineering was?

IH: No, probably not at all. I knew a little bit about what civil engineers did, because one of my best friend's dad was with the highway department there in Livingston, and he was a civil engineer. And he also had model railroads, just wonderful model railroads, and towns and all. So he would talk to us some about building things. And that gave me a little insight.

Then the summer I was sixteen, I went and spent a month with Dr. Parker in Atlanta. She had done this for her nieces and her nephews, and I was a niece, even though not technically a niece, I got treated the same way. So on a trip back from West Texas visiting her family, I rendezvoused with her in Houston and flew back to Atlanta with her, and spent a month with her.

So I would go to her offices there in Atlanta some, during the day. I went with her on her field trips and things. She worked for a company called Plantation Pipeline. She had a doctorate in organic chemistry, and a lot of what she had to do was check the pipelines and the water systems and all kinds of things for environmental problems and things like that. And she called on all these different locations all over the Carolinas and Georgia, and through the South back towards Texas.

So it was a really wonderful time. I mean, I was just free to do what I wanted to. I could sleep in in the mornings, then I could get up. She didn't bother me at all that I didn't like to get up early, and most teenage girls don't like to get up early. So there was no hassle about that. She'd go off to work in the morning. I'd get up, get dressed, go hop on a bus and head downtown. Sometimes I would just go explore things. And I just did it. I mean, I look back and think it's so sad that so few people can do that today -- people would worry to death about their daughter doing that today. And even growing up in the small town I grew up in, you know, we could just run and play, and we'd

be gone all day. Sometimes our parents wouldn't see us from daylight until dawn. And we'd play all up and down the streets and all in the woods, and up and down the area we called the canyon. It was kind of a ditch. Now I see it as an adult and realize how it wasn't very big.

But nobody worried about us. And I realized that part of it was the fact that we didn't have air conditioning. All the windows were open. You could hear everyone. And all the mothers -- most of the mothers, a huge percentage were at home. So at any given moment in time, you could pick up the phone and call the local operator and say, "Have you seen my daughter or my son?" And they'd say, "Oh, yeah, I just heard somebody say that they were outside her house doing something." I mean, it was like everybody kept up with -- the village really did raise the children.

It was the same thing that summer in Atlanta, there was just no fear of me being by myself and running around. And occasionally I'd get lost, you know, I'd get kind of sidetracked. I'd go to something, maybe a museum, and then I'd want to go to a shop somewhere, and I would get confused about which way to go. So I'd just wait for a bus to come by that had the name of the street and an address on it I knew. I'd get on that bus and go back to my point I knew (Laughs).

I still find my way around that way. You can always get back to somewhere. But I did get to go with Aunt Ivy. We'd go to

these towns where they had a pipeline pumping station. And she would be there looking at charts, looking at data. I wasn't that much interested in the data, but the people were interesting. Their reaction to her was wonderful. I mean, she was just so much a part of everyone's family when she visited with them. And she was actually doing things to be useful to their job and to help them.

Probably one of the most memorable events: We were at a place where they drained a water tank. She was inside taking all these measurements of the pits inside the water tanks. And one of the guys that had helped scrub the tank out said, "I am never going to drink water again."

(Laughter)

IH: Because they get pretty slimy and awful after some period of time, so they have to be drained and cleaned and all. But the people normally don't see the insides of the water tanks, so they don't think about that. And of course, she was in them all. Somebody's, "I'm never drinking water again, I'm going to drink only beer." (Laughs) You know, because the water tank looked so bad inside.

And it was when I had just started driving -- well, I had been driving a little while, because back then in Texas you could get your license when you were fourteen years old. Can you imagine? But of course, there weren't nearly as many people around -- which made it a lot easier. Although people still

managed to get themselves killed just about as often. But she took me into all these places, and I met all these people, and they were talking like they did around me. It wasn't something I necessarily got particularly interested in, I was just very comfortable around it. It was fun to be there. So again, like with my grandmother working in the office, here I was with a woman who engineered, who worked with lots of men, who was just as comfortable with their families as she was with the men. And the way people treated her with so much respect was really wonderful.

LK: Was that the first time that you were away from Livingston?

IH: Oh, no. From the time I was about six on, I would connive to go visit a friend of my mother's who lived in Bryan. And her husband had died during the war, so she had no children of her own. She was a hairdresser. And I'd go spend a week or two with her every summer, and go to church camp -- Bible school with the little kids that lived next door. And I'd go help her at the beauty shop. Then I'd go to the movie theater, because it was a little town again, and you could just walk from the beauty shop over to the movie theater in the afternoons. You know, for a quarter you could see the movie and have popcorn and coke. And I'd do that. And then I went to church camp, and I went to Girl Scout camp.

I was always conniving to go somewhere. I liked to go. I liked to see other places. I had those four brothers at home,

(Laughs) so escaping to where I could be an only child for a few minutes, or at least not be with the herd and the mob all the time was really neat, and I liked to do it. So I figured out lots of places that I could go.

LK: Can you remember exactly when or why you did decide to choose engineering as a career, after having a math background?

IH: Oh, yeah, I backed right into it. (Laughs) I told you I was avoiding things. I got my bachelor's at the University of Houston, in math. And I went out and I looked, and applied for a couple of jobs I saw. I don't remember now what they were advertised as, they were just jobs over in the student center that were advertised. You know how they put the jobs up there. And I went to one interview. It was an oil company. And it was real clear what they thought I was going to do was like secretarial work, and it was real clear to me I didn't go to school those four years to do secretarial work, so that didn't sound like a good idea. So I thought, well, I don't want to do that, and nothing else looks very appealing.

I had done various kinds of part-time work while I was going to college. I worked in Foley's steno pool for a long time, which was the big department store. I typed. This was before computers, so you typed the lists of all the Christmas toys and all the prices, and all the quantities, and hours and hours and hours of making lists up, sitting in a back room where you never saw anybody. But I got twenty percent off on my clothes, see.

(Laughter)

IH: So that was my big perk. But it was money, and when you're a student that really matters. So I didn't know what I wanted to do, so I thought maybe I wanted to be a college professor, right, because you just stay where you are and you never have to leave. So I started on my masters. And I had been working on that for -- I took one course my last semester of college on my masters, and then started on it full-time for a semester.

And during that semester, NASA moved to Houston. Until that time, most of the engineers in Houston were probably employed by construction companies like Brown & Root or an oil company. And they hadn't had very many women engineers. Aunt Ivy had been one, but that was during the war and before the war. After the Second World War, women just didn't go into engineering. If you look at the plot of that curve, there's a whole time period in there where women didn't go into engineering. But you know, that was contrived by the government, they didn't want women to. They were trying to hold those jobs open for men.

So even women who had taught in engineering schools during the Second World War, as soon as the men could take their place, they were shoved out, and women weren't even allowed to go to those schools. So there was just a huge gulf in there of no women in those fields. It was kind of like, you know, "Well, we don't let women go down in the mines," you know, type of attitude, which

persisted long past that time. But that mentality had been driven home largely by an effort by the government to make the jobs available to the men.

LK: Was there ever any question about you pursuing your higher education?

IH: No. Oh, never. Never, never, never. Certainly nowhere in my family. I mean, it was expected. I don't think there's anybody in the family that didn't know I was going to college and going to get a degree. It was just going to happen.

So I went, first semester, working on my masters. And there was a little article in the paper that said, "NASA is looking for women scientists and engineers." You know, a little thing about that big (gestures). And a friend of a friend cut it out and gave it to me. It was a parent of a friend, actually. And so I said, "Well, I think I'll go apply."

LK: Do you remember what time period this was?

IH: Uh-huh. It had to be in the spring of '63. We're talking forty years ago. Right now, forty years ago. It's hard to believe. So I applied, and I went in. They called me in for some interviews. And in one of them, I met a woman who I actually had a graduate class with at the university, a night class. She was working in that group. And I didn't like that group one bit. She had been very rude in class, and aloof. And I saw her a number of times over the years. I think actually she was a very shy person, and her whole nature was just what I saw, she was

never being rude. She was so shy she couldn't communicate with people. But it just turned me off on the group she was with. And the building they were in was horrid. It was an old box factory. It was just awful, because they were building NASA. NASA wasn't built. Everybody was in temporary buildings all over Houston.

And then I had met a woman -- now, this is one of those things that, you know, how do these things happen to you? I had been in the beauty shop one day, and a woman was there who had -- she would come and bring her small children, little girls. But they were terrors. (Laughs) She couldn't control them at all. And the hairdressers just wanted her out of there really, really fast.

But I discovered her husband worked at NASA. And so we talked, and she said, "Oh, yeah, I know he's looking for people. Why don't you go talk to him?" So when I met with the NASA person that set up my interviews, I had said, "I want to go talk to this guy, too." So he set that up. So that was my second interview. And that went much better. First of all, they were in a much nicer place. They were in a new set of apartments that had never been lived in that had been converted to offices before they used them. And so you could see out, and you had windows, and it was much, much nicer. And the job looked more interesting, that was available. So I didn't actually end up going to work for that particular guy. I interviewed with several other groups within that, and ended up with a job in a parallel office with his. But

it got me some other interviews. And so that was fun, because I got to kind of pick, you know, which of those jobs I wanted to go to.

At that point I had not thought about what my title was or what my career was. I still hadn't figured any of that out. But I had a minor in physics and a minor in chemistry. I actually had one in English, too. It's what happens when you don't know what you want to do, you just keep taking courses. Right?

So when I went to work at NASA, the title I got was called an "aerospace technologist." Now, that really bothered all the men, because that's what they were, too. There was no engineering title. You were an aerospace technologist. You could be a mathematician or a physicist, but they didn't put me as a mathematician. Because of the other classes, they made me an aerospace technologist, so -- I got the same title as all the engineers.

I worked for a year. And the first year, the first job I had was to model the lighting on the moon, so that we could model it -- understand it and model it so the astronauts could be trained for the Lunar Landing, because they were going to fly that thing to the surface. And so being a student, I did what any student would do, I went to the library and looked it up. NASA had a teeny tiny library no bigger than this room almost. But they had a lot of microfiche of stuff because they were just, again, still moving there.

So I found a lot of data; it was written by the Russians in the 1920s. When I told them what I wanted they said, "Is it classified?" And I said, "No, it was written before the Communists really took over and shut everything down." And it was all totally mathematical, a description of the lighting on the moon.

Now, my heat, light and objects class in college was horrible. The professor would come in and talk about what was on the board from the previous class, which was mechanics, and mechanical properties and stuff, which I loved, but he never talked about what he was supposed to. He gave us the weirdest exams ever. I made a B in the class, and I never could figure how I did it, because I swear I turned in my final without putting anything to paper. Everything on the final was something that had never been discussed and never was on a test. And it was like, what is he doing?

So I'd learned nothing about lighting on the earth, which was probably real handy, because I had no preconceived notion. So I didn't mind reading about it on the moon. And the moon was wonderful, because with no atmosphere, piece of cake compared to earth. It was all very mathematical. So I could construct models. It was just, I did it.

Right after that I had some real problems with a couple of men I worked with. They thought it was really fun to play practical jokes on girls and be really cruel. And one of them was

my boss. He was in an acting position -- today if somebody did that, they would not only get fired, they'd probably get thrown in jail, they were so -- really cruel. But I was very fortunate in that I had two women that I could go to. One was another woman engineer who worked in the group I did. Now, I will point out that when I first went to work, I though it'd be fun to be the only girl, like I'd been the only girl at home and often the only girl in physics classes and things like that. But I found out when I went to work, that wasn't any fun at all, because many of the guys did not know how to work with women. Well, they weren't even real good about working with each other sometimes, but they definitely didn't know what to do with a woman.

So one was a woman who was not that much older than I -- well, they were probably each about six years older than I was. One was an engineer and the other was a secretary. The secretary was our division secretary, which gave her the highest ranking in that pecking order. But she lived in the same apartment complex I did, so I had talked to her before.

So the one that was an engineer said, "You don't have to put up with this stuff." The one that was the secretary, I went to her and said, "What do I do?" So she went to her boss, see, because that got me into the highest level within that organization. And I just said, "This isn't working, and I don't like being treated this way." And he said, "Well, we don't want to waste your talents, either, and so here's an opening." And

now, at that time, I did go to work for the first guy I had talked to whose wife went to the same beauty shop I went to.

So I went to work in his organization. He was trying to build a cost model to project future programs. And I remember we were doing things for 1984. That was way in the future then-- (Laughter) twenty years in the future. And we were trying to predict cost and layout programs for that far ahead, so it was all very advanced stuff. We were looking at different concepts of how we might get to do things. I mean, the Lunar program was going on, we were flying Gemini. A lot of people were working on the Apollo program, but we were working on just advanced stuff. And I'd never built a cost model before. I don't recall that not having done anything ever bothered me. You know, it didn't seem strange that you needed to do it.

He would explain to me what he was doing, because he'd done this in the aircraft industry. But in the aircraft industry, the more a plane weighed the more it cost. So that didn't make any sense to me, because we were trying to make things really, really light weight, and that really drove the cost up. So I didn't think we could use the same models that they used in the aircraft industry.

Of course, he had the spacecraft broken up into pieces and parts. And if you looked in the phone book, there were all those pieces and parts, because that's how we were organized. So if I needed to know what it might cost for a propulsion system, or to

try to figure out how you would estimate that, I'd just go look up somebody that was in propulsion, look him up in the phone book, and call the name and say, "Can I come talk to you?"

Well, let me tell you, how many guys object to a cute twenty-two year-old -- you have to use your imagination here -- a cute twenty-two year-old coming into their office and sitting there and asking them what they do and why they do it that way, because people love to tell you what they do. You do interviews, you know that. They really love to. And if you listen, they'll teach you a lot.

So I started learning all kinds of things about all kinds of systems. I also learned who knew things. There were the people who knew and understood things, who could explain things well, who would answer questions. And then I started putting that knowledge together to build that model.

I took my first trip with NASA after that, because some people at General Dynamics, up in Fort Worth, Texas -- this isn't very far from Houston, mind you -- were building the model for us, the computer model. Now, you have to understand, we did not have the minicomputers in those day. To get a program built, you would spend hours sitting down filling out little forms and punching holes in cards.

And then waiting days for somebody -- for it to run, and come back, for you to find out you punched a hole wrong and you had to go do it again. And we contracted a lot of that out. So this was

contracted to General Dynamics, and they were building the model.

So that was my first business trip. And it was really funny, because the reaction to me traveling was: Nobody wanted to travel with me. They figured that would cause all kinds of problems, a guy traveling with a female. Nobody wanted to send me alone because they were afraid something would happen to me. So they finally had to let me go on this trip. But it was interesting to me, because I'd gone and done things and stayed places before. It wasn't like I'd never done anything.

But it was really funny how protective everybody got, and how worried they were about that. I doubt seriously if they'd think about that for even a minute today, but certainly back then it was a big deal. It was a long time after that before I made my second trip, but I did make that one and get back home safely, with no problems. And I ended up working with a woman at General Dynamics, that's who was putting the program together for us, so that was kind of fun, too. That would have probably been in '64, '65.

In that same period I took off for one more semester and went back to school full time so I could finish my masters, because I was doing it part time, and that was dragging on uncomfortably. So I went back to school for a semester and finished my masters in math. I actually did some teaching during that semester, because at that time I was still thinking maybe I'll go get a doctorate, and maybe I'll be a college teacher. That sounded kind of fun.

You can play bridge at lunch every day, go to the faculty dining room. And I liked that part. But I went back to NASA instead, I didn't go on with the doctorate.

LK: Why did you go back to NASA?

IH: Well, when they sent me back to school, the agreement is you'll go back anyway, because they're paying you while you're in school. But because there were a lot of things I really did like.

I was tired of working on the cost model, and that wasn't going too well. The guy that ran that organization, he went off -- after I got my masters, he went to get his. Then it was time for a change again. I was really lucky, my management thought that it was time for a change. So they sent me to work in a group that did a lot of the designs of vehicles and all the aerodynamics for the vehicles and things. That was an absolutely wonderful place to work, and a wonderful group of people to work with.

It was all guys, except for me at the time, as far as engineers were concerned. They did have some women, and they had degrees in math, and these women were all probably twenty years older than I was. They were called "computers." What they did was sit all day on a Friden or a Monroe calculator, those big machines, and sit there and integrate numbers by just sitting there, adding things up--and running numbers. They could make those machines sing. But when you were estimating and you were doing your first analysis and all, they could get the numbers back faster than the computers could. So it's hard to realize that we

did Mercury and we did Gemini, and we did a whole lot of going to the moon with not very much capability -- I mean, with having to use a lot of manpower/woman power, and very simple calculations, as opposed to what we use today and the capabilities we have today to simulate things.

But it was just a great bunch of people. An awful lot of them had worked on all the projects. They worked on Mercury and Gemini. There were some others that were out of school about the same length of time as I was, a lot my age. And they loved to solve problems. They didn't seem to care if you were a boy or a girl, or if you were a little green man from Mars, they really didn't care. It was a place to really fit in and have a grand time. So I spent a very long time with that group. And that's when I first -- that's where I came out of to go into management. That's one of the first groups I managed, so that whole bunch of people holds a very special place for me.

I worked with a young man named Joe Gamble. This guy had -- his bachelor's was in civil engineering, maybe even his masters and his doctoral work was. He was always going to school and working on another degree. I don't think he ever received his doctorate, because the University of Houston wanted him to come back out there and be there for nine months straight or they didn't want to give him a doctorate, which was really silly, because they didn't have a single engineering professor at the University of Houston who was anywhere close to as smart as this

person.

Although his degree was in civil, all the work he did was in dynamics. I worked with him on several projects with parachutes and things, and he was just wonderful. I mean, he could teach you everything he knew, and he would, and just a gentlemen and a scholar, truly. So like I said, I just felt very privileged to work with that group of people.

(INTERRUPTION IN RECORDING)

LK: You were talking about your early experiences working for NASA in the 1960s. What was it like being in Houston at that time? What was the atmosphere like and being part of the development of the US Space Program? Or did that impact you at all, even?

IH: Well, yeah, probably. Of course, my family was all excited, and friends, you know, "Ivy's going to work for NASA as part of the space program," because the excitement of the space program then was really quite big. I remember -- you know, you had to get security clearances, so they go back to your hometown and talk to your neighbors. Well, my neighbors thought that was the neatest thing in the whole world. My mother's neighbors -- "Oh, boy, somebody's going to come visit us from the FBI" -- or whoever they are -- "and ask all these questions!" They just thought that was really neat.

I did hear back from some of the people who did some of those interviews. They said, "It must be really neat to grow up in a

small town where people think you're really wonderful."

It was like it was entertainment for these guys, too, to go back and talk to little old ladies next door, who of course had known me practically since I was born. They could have told them anything imaginable about me, and I'm sure they only told the good parts, because that's what you do.

So there was that sense. I think there was a very big -- I grew up in Texas, and so first of all you grow up with this big ego to start with, right, that you're a Texan, and therefore you're somehow a very special person. So I already had that going for me. And then I was working at NASA, and that was a very special thing. Everybody was interested, so this was -- it was fun to be there at that time, and a part of it.

At the same time, I don't think at that time I had any sense of history. Let me see if I can explain that. When the first spacecraft landed on the moon, I tried to figure out, what do I feel right now? How do I feel about this happening? I've worked on some of these pieces and parts of this. You know, I helped put somebody there. How do I feel about it? And I said, well, probably about like the sail maker for Columbus felt, right? You know, he made the sail up and Columbus went away, and then came back a long time later, but he did get back. And it was an awesome voyage, and new discoveries were made. So if you'd made those sails and saw that ship sail away and come back and had that sense of "somehow I participated in that," probably that was the

same kind of thing.

The Shuttle was a lot different than that because I had so much more to do with it. But certainly for those years and up through Apollo, it was like, oh, I am part of making history. It's really only a past reflection, you know, looking back on it, that you realize how much a part of history it was. And what a fun time. What a fun time to be an engineer. What a fun time to be alive, so many discoveries, so many things happening, and continuing to happen, not slowing down one bit. So that part has been really run.

Now, the Shuttle was different, because on April Fool's Day, 1969, I got this phone call and it said, "Go to Building 36, the Third Floor." Now, I'm going to tell you I've worked with a lot of people who were not above April Fool's jokes. So I was a little suspicious because I really didn't know why I was going there or who this person was who told me to go there, on the phone. It was a woman. I'd have been much more suspicious if it had been a man who called.

But about four people in my group, my area, also got calls. None of us even knew where 36 was, as it turned out. We got the phone book out and looked on the back and saw where it was, and drove down there. It was only a two-story building, and we were supposed to go to the third floor, so now I'm really getting suspicious. But I looked, and there's a test bay on the side of it that's three stories tall. And there's a stairway. I could

see other people going into the stairway there, so we figured that's where we were supposed to go. Now, it still could have been just a big April Fool's Joke, a real good one.

(Laughter)

IH: So I went up the stairs with everybody else. And we're standing around. There were about twenty of us. This is in the third story of one of these test buildings, which means it's just bare walls and pipes in the ceiling. And it's all dusty and dirty because nobody has used this for anything but to store furniture for years. And I'm in an all white suit, not the best thing to go in there in. And I still just thought it was an April Fool's joke, but there were some people in that room that you would not pull April Fool's jokes on. I'm not one, but there were some. So I decided maybe it wasn't.

And in a few minutes, Dr. Max Faget walked in. And he was carrying a balsa wood model of an airplane. And the airplane looked a whole lot like this airplane [holds up a model]. He was carrying this balsa wood model, and he strewed across the room, flew it across at us and said, "We're going to build America's next spacecraft. And it's going to launch like a spacecraft, it's going to land like a plane." And then he started describing to us what was going to become the Shuttle. So that was 1969, so I was twenty-eight years old. And I was in the original group with twenty or so people, that were on the original design team.

Now, when I look back on that, it's just totally awesome that

I got selected to be on that team. There were experts there in aerodynamics, there were experts there in thermal dynamics. There were the weight experts. There were guys for the drawings boards who did the artist concepts and the scale models. The propulsion engineers were there, the structural engineers were there. And I was really the generalist. And so very early on, I was off trying to figure out how you put air-breathing engines on this to land it like an airplane, because all of our propulsion guys were experienced in jet engines and things like that, not -- I mean, launch-type big engines, not aircraft engines. And I was the only one that flew, it looked like. And I did, I had a pilot's license, so they said, "Well, you know some of that stuff. Go find out about that."

And then things had to separate. And then there were going to be jet firings on these things where you had to deal with the exhaust plumes. And I did a bunch of work in exhaust plume during my years. That was something the guys didn't want to do, so they gave it to me to do. And I found it really interesting, so it didn't bother me. Again, it was one of those, I didn't know what to do, but I'd find out.

And all that general knowledge of every system and subsystem that would fly suddenly made a huge payoff, because I had some knowledge of all of them. I could look at putting things together and doing some of the things that involved all that. So it's about as fun a thing that could have happened to anybody in their

career. But it's like when they say, "How did you get here," you say, "Well, let's see. I was avoiding this, and I was avoiding that, and I was avoiding something else, and eventually you got to go somewhere."

LK: And you stopped at the hairdresser.

IH: Yeah.

(Laughter)

IH: Yeah, you got to go to the hairdresser, and you got to meet these other people. And other -- you know, things happen to shape -- some people, I think, really have plans and make plans that follow them, and then there's those of us -- me -- who don't really do that as often. I probably did that -- I do more planning today than I ever did in the past. But you can't plan it all.

I mean, when I'd gone to high school and college, there was no career in space. There wasn't anything in space. I mean, the first rockets were launched, really, for space about the time I graduated from high school. So you're not going to plan a career on something that doesn't even exist.

And of course, now, there's not too many opportunities to do some of those things in space that there were even back then. So sometimes you just got to go with the flow, as they say, and let things happen.

LK: How did you come to earn your pilot's license?

IH: I dated a guy that was an instructor and eventually

married him, and so it seemed that I should go get that done, and I did. But I didn't like it. I'd rather somebody else fly, and I'd rather read a book.

(Laughter)

IH: To be a really good pilot, you really need to be paying constant attention to things. And there are aspects of it, truly, that are scary. You know, you really can kill yourself, and so you have to be very attentive. And I just really would rather not be that attentive, and fly with somebody else who knows what they're doing. So I'm glad I did it. There's a lot of things I've done that I'm glad I did. I took music lessons as a child. I played in the band. I was never very good. I'm glad I did it because now I know what good is, and I know how different that is from anything I would ever reach. But I think I'm actually able to appreciate other people. And I think it's fun to try things.

There are a few things that I've scratched off my list. I'm not going to do bungee jumping. But I did, a couple of years ago, in Costa Rica, strap the harness on, you know, where they hook you up and let you fly through the rain forest. And I loved that. That was really neat. That didn't bother me or frighten me at all. That was fun. And I was going to try some rock climbing with a friend in Colorado many years ago. And so he had me climb up some rocks first, with the line on me, and working my way up, and then he was going to let me repel back down. But I didn't a lot of repelling before I ever got up, because I kept losing my

footing and swinging around and all. And he goes to me, "The rope won't break, you're not going to get hurt." And I said, "I understand the rope is not going to break. And I'm not afraid to fall. When I'm afraid is I'm going to be black and blue from banging into these rocks and twisting and turning like you do on the end of that thing." And so when we got to the top, I said, "If there's another way down, I am not repelling down, because I've done enough of that. I've already figured out this is a sport I'm going to leave alone. Somebody else can do this." (Laughs) But again, nothing ventured, nothing gained. You don't ever know what these things are going to bring you.

(TELEPHONE RINGS)

(INTERRUPTION IN RECORDING)

LK: This is tape two for our interview with Ivy Hooks on April 9th, 2003. Can you continue talking a little bit more about your experience working on the development of the Shuttle?

IH: Oh, you can't hardly keep me from talking about the Shuttle. We spent six months working in that loft. And I think eventually there were like twenty-eight people up there. And it was so wonderful because you'd have an idea for something you were working on, and you could go over and talk to somebody that you would have to interface with or do something with. And I remember the guys that were on the drawing boards, all of them -- remember, there were no CAD systems then, you just did it on drawing boards -- if you screw up, you erased it -- they had worked on every

spacecraft ever built.

So if you go up to them and say, "I'm thinking about doing this," and they'd say, "Well, I don't think you want to do that, because we tried that early on on Gemini, and this went wrong, and that went wrong." So it was just like this giant education. Or you'd be concerned about something, and you go ask them any question, you add an expert, within a few feet, to go talk to.

So I mean, it was just really fun. It was just wonderful fun.

I have a drawing here I'm going to pick up and show you. It's from that early Shuttle. And very few people have seen it. So if you have it on film, you'll have one of the few that's been around. And this was -- how's that look?

LK: Okay, that's good.

IH: This was a drawing that one of the guys dug up. One of the guys that -- one of our pack rats that never throws anything away had this from those early days. His name is Mark Craig. He was a co-op from Purdue, and we had him running from trajectory programs for us during the early days of the Shuttle. He'd go run the programs and bring us the results. He didn't stay up there in the room with us. But he had kept a bunch of the things that we came out of there with, and so we had these made up with us for our thirtieth anniversary party, which we had in April of '99. So there's a lot of signatures on here by people who were part of that original team.

And there's this little bitty orbiter -- it looks little bitty, but it's really about the same size as the one we have now. And then there's this humongous vehicle this was our booster. And so the plan was we would launch like a regular launch vehicle and go up to just one altitude, and then the booster would break away and go back and land, and then the orbiter would light off its engines and go on to get into orbit, and then it would come back and land.

And of course both of them had air-breathing engines. And I worked on those engines, never having had a class in my life about engines. But it doesn't matter. If you need to know about them, there are actually books and places to go to get information. And there are experts to go talk to.

So we came out of there with this type of design. And then the Air Force got involved, and they wanted to take away a lot of our room we had in the orbiter to do experiments and things to carry bigger payloads. Then they changed our payload day. And then they wanted to have a 700-mile cross range capability. These straight wings don't give you much cross range capability. And so that started changing the orbiter. And then we found out we didn't have enough money to build both of the big vehicles, so that's when we started toward the tank with the two solids on each side. And that was actually -- some of our contractor's came in with those ideas as alternatives to that.

But at the end of six months, we brought a contractor in who

took all of our data, put it into presentation form. Everybody in NASA got briefed on what was going on. And then we actually started to work on this with contractors working with us. And with lots more people involved, we went back to our home organizations.

So when I went back to my home organization, I had been working separation systems, the air breathing engines and several other things. And so I kept working those, plus I was working all the problems that we call plume problems. And that's exhaust coming out of engines results in a big plume, which has a big effect on how the vehicle flies, especially in certain conditions. So I had worked on that in my early days at NASA, because nobody else wanted to, and helped solve some problems and analyze some events that had occurred on some of the early flights, some Gemini flights and some Apollo flights, with plume interactions with vehicles. So having that knowledge, I also worked anything that dealt with that on the Shuttle.

So in '70, '71, and early in the beginning of '72, my whole organization, who worked on advanced studies mostly -- anyway it was (?) -- the Lunar Landings were landing. Okay?

We still had a few studies we had to do for every flight for them, for some abort systems we worked on. But other than that, those were just happening, they were done, we built it, it was flying, and we were just working on this advanced vehicle. And then they called us in one day and showed us the reorganization

chart, and suddenly I was a manager. I was an acting manager to start with, because they had to actually open it up and let people bid for the jobs and all. But I was just absolutely astounded. I guess some people go to work, and they start mapping their trail of how they're going to move up and what they're going to do and all the things they're going to do. I never even thought about it. I was having a wonderful time. I mean, there's just so many problems to solve and so many fun things to work on and so many neat people to work with, I didn't even think about it. But they needed a section that would deal with the separation of these vehicles and would do some of the plume dynamics, and to specialize in the stuff that I probably knew more about than anybody else in the group.

And so I looked at the org. chart, and they had put one guy in the group that I thought, he won't work for me. And in fact, he's going to be so angry that he's not made a manager, that he probably wouldn't want to work for any of us that were making manager. And so I told somebody at that meeting, I said, "I don't think that you can put him in my organization, I don't think he'll do it. I think he's wonderful, and I'd love to have him, but he's not going to want to work for me." And so they did a swap that night before they announced it to the whole group.

And sure enough after the whole group was told what was going to happen, he came just raging out of the meeting at me saying, "How did you -- it's not fair that you made manager. I should

have been. I've been here longer than you." Well, he had. And he said, "And I've done everything they ever told me to." And he had. And I should have probably kept my mouth shut, but I said, "Yes, Ralph, and that's all."

He had done everything people had expected of him, and he had done it very, very well, probably ten times better than it needed to be done. They didn't want it out to a hundred decimal places. They only needed a sort of good number. He was a perfectionist.

And I'm definitely not a perfectionist. And I don't think I ever campaigned to get a management job. I never even thought about it. What I did do was look for fun problems to work on all the time. And if you didn't give them to me, I would be out finding them. And some managers figured that out and said, "If we don't want her uncovering and fixing problems that we would like left alone, it's best to keep her busy with the problems (Laughs) that we want her to work on." And I'm very grateful that I got to work for people who could figure that out, because my nature is not to sit around and be idle. I'm not going to be idle; I'm going to find something to do.

Looking back on all that now, and having read *Men Are From Mars*, I realized I was really in too much of a hurry to help people with their problems and telling them I'd fix things for them and volunteering my assistance, realizing that men don't like you to do that to them. If you read *Men Are From Mars, Women Are From Venus*, there's some things in there that indicate that men

don't volunteer to each other to help. We women do. And they have to wait until somebody asks them for help. So if you're volunteering to help them, you're making them feel like you realize they have a problem and therefore there's something wrong with them. And of course, never would I do that on purpose. I may think that, but that's how they think, it doesn't matter what I think.

Having read that book many years later, I wish I'd had that book back then. But in years later talking to people, I found out that Dr. Faget, who was the one who was the head of engineering, and who put this all together, and came in with the airplane, that he insisted that I get into management. For whatever reason, I did things in a way that he wanted to promote. And there were some of my bosses who kept trying to put me in a staff position. And it was because I was a woman they did not want to put me in a management job, and he just told him there weren't any options that they would have to. And it was really hard, I know, for some people to swallow it.

The people that worked for me -- and initially it was all males -- we did hire some young people shortly thereafter, and I got one woman working for me, and several just great young men, too. But the guys that came to work for me, most of them had been my peers, some I knew better than others, I don't know that any of them ever complained about working for me to anyone. I never heard that they did. And they treated me with the greatest

respect. They kept doing the wonderful job they were doing. And again, years later, I found out they were harassed very, very badly about -- being teased about working for a girl-- and harassed about having to work for me, and really put down by some of our other peers within the whole organization. And I can guess who it was, looking back, which guys would have caused that trouble no matter what. But they handled it; they just let it roll off them. They didn't let it affect any of the work that they did.

So it isn't just the women sometimes who have to deal with discrimination, sometimes it's anybody who's your friend or who works with you. And I thought they were really great to wait twenty more years before they ever even told me that.

And I worked on Shuttle -- well, we got rid of this configuration that I was telling you about with the two planes, and we went to the two boosters, which now had to be separated, and the tank which had to be separated. And then we had this orbiter, which looks a lot like this fellow [holds up a model]. Then we had this orbiter. He's lost some of his tail here. It got knocked off when one of the cats knocked him off the counter once. He did have a tail. But the wingspan looks right. We went to this, and now we decided we were not going to go with those air breathing engines because they were way too heavy, and nobody trusted that they would light when you came back into the atmosphere after they'd been in space. So we said, well, if we've

got to make it land, even if they don't work, we might as well not take them because they're so heavy.

So now we had to get the orbiter, which was built in California, back to the Cape where it was going to get launched. So it was kind of like we built the boat in the basement. So along comes the concept of the 747. The first drawings I saw of that kind of thing were with the C-5A, with the orbiter slung underneath, kind of like we flew the X-15, and then the airplanes with the orbiter in the back, and then some special airplanes just built to carry the orbiter around. And even an orbiter with another set of wings on it that were mounted in the paylor guide (?), which had engines on them that you'd put on and just fly the orbiter to bring it back, and then take those away for when you really launched it.

So there were all these configurations. And they were so awful, some of them, it was like, oh, my gosh, surely, we're never going to do any of this. Wrong.

So we flew the orbiter on the 747. And that's kind of an interesting story. We were looking at a C-5A and we were looking at a 747, and the orbiter was going to sit on the back of it. I used to have a model of that, but the cats knocked it off the very top up there, and it broke into a million pieces, so I don't have that model anymore. I just have pictures.

But for separation purposes, I was worried about the C5-A, because it has a T-tail, which means at the top of the tail

there's this big flat section. So when the orbiter would fly off of it, the downdraft from the orbiter, then, would be hitting that tail. And I didn't want it to be able to push the C-5A back up. But I didn't have enough test data, aerodynamically, to know what that impact would be or that effect would be.

And we were just looking at those configurations, and then one of the -- I was at the Rockwell plant down in Rockwell, who had built the orbiter for us. I was out there, and we're discussing this, and one of the guys got called out to go to a meeting. And he came back and he said, "Well, they've made the decision. We're going to go with the 747, and we're going to buy it from Continental Airlines, and they're going to move their tail for us." (Laughter)

IH: That was their ad thing back then, "We really move our tail for you."

(Laughter)

IH: And of course we worried about running into that tail. (Laughs) And he's this -- you know, he's a wonderful stoic-type character. So he comes back and, "We're going to buy the airplane from Continental Airlines, and they're going to move their tail for us." We did buy an airplane, and it came from American Airlines, not Continental. And we did go with the 747, but for none of those reasons. The reason was the Air Force wouldn't let us have a C5-A, they would only loan it to us. And the Air Force has a tendency to decide they need to use all their own airplanes,

and then you don't have anything. So we didn't think that was very good idea, so we got the 747.

So now I've got the separate tanks, boosters and a 747, all kinds of things to work on. So right in the middle of working on the Shuttle to launch it and build it, we had this (Inaudible) program that everybody said, "Well, you know, if we're going to fly it on top of a 747, maybe we could launch it off the top of the 747, and get at least some testing in. Well, that's from 10,000 feet to the ground. That is not where all the problems are.

So in terms of really testing the vehicle or anything, it wasn't that. But what it really did was give us, in the middle of a program that took from the day it started -- from the day I started out until the day I got to see a launch was twelve years and twelve days.

LK: Wow.

IH: The anniversary comes up from three more days, of the first launch. So in the middle of this, we had this two or three year program to be able to take the orbiter up on the 747, launch it off the 747, and land it in a lake bed.

And it was really good. It was good for a lot of us to work with people we really hadn't worked with. It got me working with a lot of the computer people, because we had a computer failure on that first flight. And I obviously did not understand how the computers worked at that time.

At the time that the first flight took place, I had left my job and gone to the center director's staff in a staff position. And I had been told years before I ought to go do that, that it's really a fun job, to go over there for six to eight months, and just see how upper management really works, and get just see the run of things.

But the person who I actually would have worked for at that time was somebody that terrified me, so I wasn't interested. But by the time that the next -- an opportunity came around, a really good opportunity -- and it was funny because it happened because something else didn't go right. You know, one of those things again -- I had applied to go to the Sloan [School of Management] at MIT for a year. I really wanted to do one of those types of fellowships. And I didn't get selected. And this position on the center director's staff had already been filled. But the guy who was in it had gotten selected for some other fellowship like that, so he was going to have to leave, he couldn't be there. And so they said, "Well, since you didn't get selected for this one, how would you like to go on Dr. Craft's staff?"

And it was so much fun, because it was when the first woman astronauts were selected. So every Thursday night I get to go to a cocktail party with twenty hopefuls, either a whole bunch of males, because it would be the military, and they would be into the pilots; or when it was the classes that were going to be mission specialists, it would be a mix of males and females,

military and civilian. And of course, then, meeting those people for the first time who ultimately became the astronauts.

So that just was a fun time to be on the director's staff. And it was a good time for me. We were getting ready to fly these missions, but I had guys who were doing the work, a lot of it, and I just got to go sit and make the calls for the staff, and we were done, and go out for some of the flight tests and be involved in that flight testing. But I'd done enough there. Things were moving along. It was time for a change.

And at that point, when it was time to go back, there was nowhere to go. I couldn't go back to my old org.; they'd already replaced me. I couldn't go anywhere else in engineering, because Dr. Faget really would not have put me in a management position in any other engineering organization, because he tended to use only people that were technical specialists. So unless you were the structures person, the propulsion person or something, he wouldn't think you could manage them. I don't think that's true, myself, but that's the way it worked, and that's the way it was done, so I had to go somewhere else.

And I did some interviews. And the organization that was Operations, I called them up and I told them I was coming to talk to them. Well, they know I'm on Craft's Staff, and when you're in that position you can go anywhere you want to. And so I went over and I said, "Well, I'm looking for a job." And they said, "We don't want you." And then they realized they probably had not

been very politically correct. (Laughs)

And they said, "Well, what we really mean is we like to get people that are really low GS levels and bring them in. We don't like to have somebody that's already got all the experience you do." What they really meant was that, "We want raise them our way. We don't want anybody different."

And I interviewed in the program office, and they didn't have any openings that looked the least bit interesting. I have a rule. One should not go to work around people who are not as smart as you are. I always go to work around people who are smarter than I am, because then you can just keep learning and learning and learning. And so the positions that were available just were not within the areas I was the least bit interested in.

So I went back to Dr. Craft and said, "What am I going to do?" And he said, "Well, no matter what's going to happen in your career from now on, everything is going to be run by computers. The more you know about computers and the more you know about software, the better off you'll be. I think you should go see if they have anything in the software area."

And I went there. And they needed verification done of the Shuttle software, somebody to manage that. And of course, nobody knew how to manage that, nobody had ever done it before -- one more thing nobody had ever done before. I went to the library to find books on verifying software, there were none. And I said, "Well, I'll just treat this like it's any other system, and we'll

go from here." And when we were doing that, IBM was our contractor, and they had some brilliant people, so it was fun. It was exciting. And they were right, it doesn't matter what you do, everything is run by software today, everything.

Today I spend most of my time doing training and doing consulting work. And I started off with that doing it for NASA and government agencies, because what we teach people how to do is how to write requirements, how to figure out what you want this vehicle to do so you can describe it to somebody so they can go build it for you.

Today our customer base includes almost every kind of business you can imagine, from grocery stores to insurance companies, to just a variety of things -- foundations, because everybody has software. Everybody has to give somebody a requirement to say what they want that software to do, so it's become the focus. And it's a huge amount of money every year spent on building software, and a huge amount wasted. And a major problem is people don't know how to define what they want.

So the English minor -- remember the English minor, way back there a couple hours ago?

(Laughter)

IH: The English minor has been real helpful, because communications has been one of the major problems. And it's always a major problem in engineering. Nobody goes and just builds something by themselves anymore -- well, one or two might

do it. But even Steve Jobs, with the first MACINTOSH, did it with somebody else -- because we work well -- most of us get stimulated by other people who do what we do, or who have interests like ours. And you're a history major, so if you read history, and you look at the times that great events took place, whatever they were, in chemistry and biology and all, you look at some of these periods, and there's all these people that were involved, and if you look, they all lived in the same town. They all talked to each other. And even if they didn't, they knew each other. They communicated. The arts, the great years of play writing, the Shakespeares, the Marlows, that time period, those were very -- they're like layers, they're strata. And there's not just one, there's whole groups of people that all produced during that period, and feed upon each other, all the way up to the Round Table at the Algonquin, you know, in the '30s, with the writers. And I think that's true in the sciences and engineering too, and that we need -- that feedback is very important. And so that means that communication is important.

You know, I've told you about people I worked with that would tell me what they did, describe things to me. Those that best communicated also did some of the best engineering, because they could explain it, and they could show other people how to do it. So it's a very big part of things. And yet, when you're talking to students, many, many times in engineering, people want to go in that field because you don't have to take any of those English

classes. And yet, you do. You have to learn how to communicate. And it's much more important today than it was in the past, because our systems are based -- they're complex, and it's really important to communicate.

Now, in all these years of doing all these things and moving from all these different jobs, it was probably in the winter of '72 or summer -- or '73, that time period, I was going to Langley, Virginia to do a presentation. We were working on the Shuttle design, and we had a lot of contractors working for us. And we would meet every quarter, or something, and have these presentations where everybody had the results of whatever they were working on, so we could share that information.

I was giving a paper at one of those, so I arranged my trip so that I could go to Atlanta, spend the night, see Aunt Ivy, and then take off the next day and go on up to Langley, because I hadn't seen her for quite a while. And I did that, and I went to her office the next day, and was with her there before I went to catch my plane. And lying on her desk was a flier for a Society of Women Engineers convention in Dallas, Texas, for that summer. I didn't even know about SWE.

LK: Even knowing her growing up, she--

IH: No. It just had never come up in the discussions or anything. And I guess, even if she said she was going or coming to a convention, she went to lots of different kinds, because she was in the oil and gas industry, and she did a lot of those. So I

just hadn't caught on. So I read the brochure while she was on the phone or something. And I said, "Well, this looks really interesting, and I think I'd like to go to this." And so I filled out an application and mailed it in, and arranged to meet her in Dallas.

And her sister, Bertha, was a math teacher in Tucumcari. And Bertha always made the SWE conventions, too, so I got to see both of them that trip. And I had some cousins who called me and wanted me to go hiking with them in Colorado. They had done it for years and years when their children were small. Now their children were college age, and they were going to go back and meet some old friends that now their children were all grown, too. Well, wouldn't I like to go? And that sounded like a really good idea to me.

So I flew to Fort Worth and stored my suitcase that had my SWE clothes in it -- I mean, I flew to Dallas, stored my clothes. They picked me up there. We went out to Colorado, hiked for a week, and then we came back and (Laughs) I went to my first SWE convention. And it was just a ball! I think it's one of the last conventions that was ever done without some professional support. But I mean, it was totally -- everybody was a volunteer. And the women -- the Texas section, which was the whole state, is a single section.

(PHONE RINGS)

(INTERRUPTION IN RECORDING)

LK: Okay, we're back.

IH: So I got to the hotel in Dallas. And the Dallas section -- or the Texas section -- the whole state had a single section for the Society of Women Engineers. And there were maybe a half dozen women that belonged from the Houston area, probably a dozen in Dallas, maybe one or two over in Austin and San Antonio. And they had put on this convention, which, if you've never put on a convention, I don't know why anybody would ever put on a convention. They are so hard and so much work. They had done it.

And as I started finding out about SWE, I found out that there had been a Houston section, and it had held a convention in 1958. It lost money. It wore out all the members, and it just collapsed under that.

So I said, "Oh, this is really wonderful, but I'm going to go back and start a Houston section." And the people in Dallas said, "Oh, you can't do that. We're not strong enough and we're not big enough to spin anybody off. And we'll just fail if you do that." Besides, they were so tired, they -- they just were exhausted. I mean, these women had worked so hard. But that got me started in SWE. And what I have here -- and you can put it wherever you need to get a picture -- is a picture of the women from the Texas section at that convention.

LK: Oh, wow. I can hold it up to the camera.

IH: I am on the very far right-hand side in light blue. And my Aunt Ivy is right in the middle with the light hair, very

short. And one thing I love about this picture is, you know, okay, now pick the -- guess what these women do for a living, right? Aunt Ivy was actually on that show where you guess, you know, who's the -- *What's My Line?* -- many years ago. Guess which one is the woman engineer. But you look at this picture, and we're tall and we're short, and we're old and we're young, and we're every shape you can imagine. And what is there in there that would say that that would or wouldn't be a woman engineer? I mean, there's absolutely no uniform to this.

Now, jaunt with me twenty years later -- longer than that, to '98, when held a SWE convention in Houston, finally. (Laughs) All the years I was there they kept saying, "We're going to hold a convention." I kept saying, "Not on my shift."

(Laughter)

IH: "You don't know how much work this it." They held a convention. And we had that picture, and it was even more awesome. The thing was diversity. I mean, the one thing that is common in all these is we're mostly Anglo-Saxon, in this picture. The mixture at that convention was every nation in the world, every background imaginable. And of course, it's not just a reflection on women engineers; it's a reflection on all engineers in our whole culture. But what an amazing thing to watch happen over twenty-five years, that change. I joined. I started a group in Houston. I got a hold of the one or two people that were there; found a few more once I got the word out. And I have no

earthly idea, actually, how I did that -- have no remembrance of doing it. But I must have gotten a hold of headquarters or somebody and said, "I need everybody in the Texas section that has a Houston address," or something. And so we just started meeting in my apartment.

Well, there was six or eight of us. We'd just meet and have lunch and visit, and it was wonderful. Over the years that group called ourselves Old SWE, because we were the ones that started that group, although most of them in it were ten to twenty years younger than I am.

LK: Were there any other women from NASA?

IH: A couple. Karen Morrison, who had worked in my area -- not for me. She worked in another section in our group; she was in there. And Diane, who had actually worked in my section -- Diane Kanipe (phonetic) -- Diane was in. And all these women had been in college, and they were looking for a place to go when they got out of college, so we started finding more and more.

But then they came from all kinds of places besides NASA. And one of my favorites was always Helen Haskin. Helen was at Texaco. And when I would get really depressed at something dumb the government was doing, I would call Helen and say, "Please tell me a Texaco story." Because no matter how dumb the government did it, they could not do it nearly as dumb as Texaco could do it. I mean, NASA was only a twenty-year-old organization at that time; Texaco was a hundred-year-old organization. They could really

botch it big time.

And I went to make a speech one day -- I used to make lots of speeches for NASA, publicity-type speeches. And I went to do a brown-bag lunch at downtown Texaco one day, and I told that story about when I got depressed at NASA, I just called and asked for a Texaco story. There wasn't a person in the audience who didn't know what I was talking about.

(Laughter)

IH: But it was really one of the more fun parts of my life. I got involved in SWE. We had our meetings. And once I became an officer, and especially once I became president of the section, what I'd do is, I'd hold a meeting in Houston, a meeting in Dallas, and a meeting in San Antonio -- a meeting in Austin. (Laughs) And whoever could go, we'd go. We'd car pool. And we never had more than eight or ten people at one of those meetings, usually. I mean, sometimes they just weren't any bigger than that. But slowly we grew and grew and grew.

And by '78, five years later, we'd grown enough that Houston could form it's own section, the Southwest Texas Section, which is this Austin -- at the time, the headquarters in San Antonio -- it's now in the Austin area -- was formed, and a Dallas, the North Texas Section was formed.

So we ended up with three sections, where there had been just one. And it made it a little less traveling, although each section is still huge. And of course, what I'd like to see is a

section here in San Antonio, as well as the one the Austin, because I never get to Austin for the meetings. And occasionally they have something here. And most of the time I'm out of town, and I can't make those, so I don't get to participate very much in those kinds of things.

Nor have I made the convention in a long time. Last year I was signed up to go, and some customer needed something right at the time of the SWE convention, and customers take precedence when you have a small business. So really, during my years at NASA, I got to do a lot more things with SWE than I've gotten to do since then.

But the friendships have been the big thing, the being able to talk to other women who suffer the same things you do. Years ago I was finding a gynecologist, and somebody said, "What's your criteria?" And I said, "It has to be somebody that can hurt the same place I do. No more of these male gynecologists. I don't want any of those. I want somebody that hurts like me." And that's kind of the way it was with the other women in SWE, you know, somebody that can hurt and that goes through the same experiences.

And I still stay in touch with an awful lot of the SWE folks. And when I do make the conventions, it's like -- everybody's like, "Oh, we're so glad to see you again." Nobody forgets who the heck you are. And you wonder, how can you remember me after all these years? Although I can rattle off dozens of their names, you know,

that you would never forget all those people.

And I go back to that first one, with Aunt Ivy, as she was introducing me to all these women that were in SWE then. Most of those are now dead, or so many of them are, but so many of them were history makers.

And it was just so much fun meeting them. And after I left NASA, I went to work for a small company for a couple of years, helping them with some work before I got into my own business. I went to the restroom late in the afternoon when it was the end of the day. And there was a young lady stretched out on the couch looking kind of green. So I went to the bathroom and I came out. I didn't know her.

I said, "Are you okay, and can I help you?" And she said, "Oh, I'm fine. I was just changing clothes in here, and then I just felt really queasy, but I'll be okay in a minute." You know, "I think it was something I ate at lunch or something, but I'm feeling better now. I'll be okay." And I told her my name, and I said, "If I can help you, let me know."

And she said, "I know you." I said, "What do you mean, you know me?" And she said, "You spoke at my college." And gosh knows how many years before. And she had since gotten -- I'd spoken at her college, and I had met her at a SWE convention. And then she had since gotten her doctorate, and she since then has become an astronaut. And it's like when I go to the SWE meetings, there's so many people there now that are way up in their companies, or

gone on to really great career things, or other different types of work and all. And I knew them when they were students, because I spoke at their college campuses or met them when they were students coming to the SWE convention and things. So it's one of the more interesting bonds that I've ever formed. It's certainly different than any other organization I've ever belonged to.

LK: What other organizations were you active in while you were building your career?

IH: Well, all of us at NASA belonged to AIAA [American Institute of Aeronautics and Astronautics], because that's our... But you know, I just went to the meetings some. I never really participated in the organization itself. I never felt a part of it. Since I left NASA, the International Council on Systems Engineering has been formed. And I went to the first meeting they ever had of that and became a charter member of that. And I participated, but I have not been an officer or run any of those things. To do that and do it well, it takes a lot of energy. I don't need to do it for my resume. (Laughs)

I wish people wouldn't do it for their resumes. That is something that I find really offensive is in the volunteer organizations where people do it to make themselves look good, and they don't put in the hours it takes and work hard. But in my years working in SWE, everybody that I dealt with worked hard, and really worked to make SWE work.

LK: Why was it important to make SWE work?

IH: Well, those of us who had gone into engineering had done it for different reasons and gotten there from different paths, and as you do all these interviews, I'm sure you're going to find everybody took a different path to get there. But many women have made some huge contributions.

And I would hate to think that some young woman wouldn't go into engineering who could and would like it just because they never heard of it, or who would slip out of it because there was nobody to call and say, "Could you answer a question," or, "Would you help me?" It's kind of almost like a duty, you know, to -- and that does sound onerous or something, but I don't mean for it to. But it's kind of pay back time. Okay? I don't know any other way to put it. I feel like I was lucky to end up where I did. I'd like to make it possible for somebody else to.

I'm not saying we can actually make it easy. Engineering isn't easy. People who want to do "easy" don't need to be an engineer. But for people who love a challenge, who love to solve problems, who are good at math, who are good communicators -- and I think women -- you know, I said I did teaching.

In my teaching, we do lots of workshop types of things, and people have to work as teams. And it's really interesting to watch how often the teams with one or more women in them will actually get more creative in a shorter period of time. And it's because they communicate better, frequently. It's not a hundred percent, you know, but they are frequently -- in general, women

are better communicators than men. And so having a woman on the team can sometimes speed up that communication.

So in order for our country to do well, then we ought to be taking advantage. I mean, I've always liked the NAACP, you know, "A mind is a terrible thing to waste." It doesn't matter the color of the person or the sex of the person, or anything, it's just that's still a terrible thing to waste. And like I said, I have these friendships that have gone on and on and on in SWE that are some of the ones I cherish the most. So I think to me, that's one of the reasons I think SWE is such a great organization. And I like the way it reaches out to women who want to go back to school, and maybe the ones for whom this as a second career, engineering as a second career. There's more and more in that life, now.

And I don't know anybody else that would do this. I don't see any other -- I don't even see the professional organizations -- I belong to IEEE and other things now, but I don't necessarily see them doing things to help people go back to school, or who want to make second career choices. So I think, to me, the objectives of SWE and what it tries to accomplish are something that's worth accomplishing. And I get a lot for it. I mean, I get a lot for it in those friendships, and just being around people who are an inspiration, and seeing what other women engineers really look like.

LK: Some other disciplines as well.

IH: Yeah. And I think another thing that always comes up is, you know, how do you combine family and work and all this stuff. Well, I really managed to skip the family part. (Laughs) I started with stepchildren that were nearly grown. And in fact, I've been through two sets of stepchildren, but they were young teens or teenagers by the time they were in my life. And I wasn't the only person responsible for them, so it wasn't like -- I really don't understand how some people do the thing with the babies and the working and everything all together. I'm not sure I could really do that. I know couldn't now, but I'm not even sure if I could get it done when I was twenty years old. I'm not sure I had the patience.

But I got to skip that and go right into having all these nieces and nephews, who kind of fulfilled my needs for the little kids around at that age, and then I could send them home. And now I have grandchildren, and I can do the same with them. So I didn't do what some people do, and try to have the children and the career and all.

I see some people do it that looks to me like they do it very, very well. In some ways it's probably easier for women engineers than for some other fields to do it, because we have a lot of choices in the kind of jobs you can do -- you know, jobs where you do travel, jobs where you don't travel; jobs where you have to work extra hours, jobs where you don't work extra hours. So there's a flexibility, and we make good money. And that helps,

because then you can have good care for the children. So compared to a lot of other people who are out there working and raising children, I think, you know, we can do it.

I've never believed you could have it all. There's just not enough energy in a single human being to have it all. So I think there are periods in your life where you devote more to one and less to another. I've certainly reached the point in my life where I want to spend more time at home. And I've been traveling a lot for a number of years now with this business. I want to be home more. I want to be with Bruce more. And so I've had to do things to make that possible, which means hiring a lot more trainers and getting them ready to go out and do the training instead of me doing it all the time.

I think one of the things that have made so many engineers that I've worked around so much fun to be around -- and I will tell you, I think engineers are actually -- I know everybody has this nerdy picture, you know, the guy with the glasses and the slide rule on his belt and all that, or his calculator, or something -- but most engineers I know seem to be fairly broad people. They have families and they have lives. They coach their kids' soccer teams, whether they're male or female. At NASA we had ski clubs and dive clubs and flying clubs, and this club and that club, and an awful lot of people just took part in those things. I didn't do them all, but I did a lot of them, and it was fun. So it's not all "all work and no play."

There certainly are times -- especially running the business -- I will tell you, it's like a vacation working at NASA compared to running my own business. It doesn't seem to be that way now. We really were never supposed to work more than eight hours a day, so you just got it done in eight hours. And they got really upset if you stayed late. You really were not supposed to stay late. And I actually think that's a pretty good idea, myself. I think if you really commit to eight hours of serious working, you have just about burned your brain out, and you need a break. And we got great vacations and things like that, when I worked at NASA.

And then when I went into running my business, it turned out I'm a workaholic, and I didn't know I was. I mean, I just can't quit working. And I have the office here at home, so I can work seven days a week any hour of the day or night. So sometimes I just have to close the door and say, "I'm not going in there anymore," and I won't do any. On the other hand, if I want to do a little work and take a little off, and do a little work and take off, I can do that, too, which is kind of nice. But you never get away when it's your own business.

I have people say, "Well, I think I want to be a consultant," or, "I want to start my own business. I don't like working other people." And I say, "Well, come talk to me before you do it. Come talk to me before you do it." Because there were years that we went through when we had built products and we were trying to sell software products that all the money went into those

products. And so we were taking so little out to come home, it meant eating up every bit of your savings to keep the business going. I did that for a number of years with one of my partners. And we finally said, "Okay, we're not doing this anymore."

And we went through the, "What are we going to do now?" One more time, "What are you going to do when you grow up?" And I said, "Well, I could go back to work for NASA, I could go to work for one of the contractors." And I thought, "Oh, my God, I'd have to go to those interminable meetings again." I don't like wasting my time in unnecessary meetings. And it seemed that that had become a management style that was real popular. So I said, "Well, I guess I'll just figure out a way to make a living doing what I'm doing, and turning this around and making it really profitable."

And over the last five years we've been able do that. But there was a lot of time there that there wasn't any money for any fun, and there wasn't any time for any fun. And I heard a consultant say just before I went into consulting, she said, "Consulting is so much fun, because you can just work half time. You can decide which twelve hours of the day it is." And you talk about not having a boss, everybody is a your boss.

So I think you have to, to be successful, also expect to make a lot of sacrifice. I know a lot of people who really don't want to face that and don't want to do it. And I'm not saying that's wrong, I'm just saying you've got to acknowledge if you're that

kind of person, and then don't go take the -- don't go to try to start the business. You won't like it. You'll really feel like it's not fair, and it's too hard.

Having done it and being in it now, I'm glad I did it. I can look back and see about a thousand things I could have done better. You know, by the time you figure out how to do it, you're through doing that one, right? So it's typical of most of the things we learn in life.

LK: How did your family feel about you deciding to go off and start your own business -- your immediate and then your extended?

IH: Oh, most of them were -- I don't know -- I think I've been very lucky as a female, in the way people have treated me in my relationships, because I'm close to my family. I stay in close touch with my aunts, my uncles, my cousins, my brothers and all -- and my mother and my aunt. And I do things with my family. Most of my family is more scattered than that, my immediate family, and they don't all keep in touch with each other, but I keep in touch with them, because to me they really are a great deal of support.

They told me a long time ago that when men go to work, they're expected to succeed. But when women went to work, they were not necessarily expected to fail, but they really were not expected to succeed, they had to really fight to get there. And I think that's probably true, but I realize that certainly nobody in my family or any of those relationships has ever acted like I

wasn't going to succeed. I mean, they just, "Well, it's Ivy, she'll be okay." And I don't know whether they were that secure in everything or that's just what they did so that I wouldn't be insecure, but I never had that feeling.

I do understand what people mean by that because I've seen it. When I first started managing that section, one of the guys came down the hall to me one day. He worked in another division down the hall. And he said, "Oh, the intern we hired" -- that's what we called our new hires, interns -- "she's going to get married and leave. She's only been here a year, and she's going to get married, and her future husband lives somewhere else, so she's going to leave us." You know, like, oh, this is a problem with women. Of course, I've been hanging around here twenty years, guys, you know.

So I said, "Oh, yeah, I understand." I said, "You know, my intern that I liked so much, Danny, and how wonderful he is? Yeah, but he's going to leave." "Oh?" I said, "Yeah. He really wants to get another degree, wants a graduate degree. And he can't stand living here in the flatlands of Houston. He wants to go where there are mountains, so he's going to go somewhere where there are mountains and get a degree." I just wanted to make it clear to him that male and female alike can decide to move, and it's not necessarily that women do it more than men. And in today's environment, I see young men changing jobs because their wives get a better offer somewhere. But man, that didn't happen

when I first started to work.

LK: So it wasn't ever an issue when you were working that you were married?

IH: Huh-uh. Probably the most annoying thing was in the early days, maybe the first couple of years, I remember somebody was forever asking me when I was going to have a baby, which I kind of considered not anybody else's business. So one day, (Laughs) one of the guys -- and they weren't malicious. Okay? They really weren't. "Everybody else was having them, why aren't you having any?" So one of the guys one day said something like, "Do you want children?" And I looked at him and I said, "Are you giving them away or selling them?"

(Laughter)

IH: And he turned kind of bright red and he said, "I shouldn't have asked that question, should I?" And I said, "No." And he said, "And I won't ask it ever again." But it was just that he never thought about how it might be. You know, if they had children, they didn't take off work, their wives took care of that for them. So they quit asking. They quit butting in about that so much. And after a number of years, they gave up all together, and just didn't even -- you know...

But what they would do was during Christmastime -- because a lot of people would take vacation at Christmas and go back home because they weren't from the area. Well, I always liked to work during that time because there was no phone calls and no meetings

at all, and you could just catch up on everything, and clean out your desk, and get things done you never had time to do. So the guys would come in during Christmas, the ones that were there in town, and bring some of the toys in so I could play with some toys.

(Laughter)

IH: They felt like I was really -- it wasn't really fair that I never got to see all the latest kids' toys and things, and they got them at their house, so they would bring them in for me.

LK: Oh, that's great.

IH: See the toys. See the toys.

You know, I took the bachelor's and masters in math, and I went back to U of H for a little while. At first I thought about working on a doctorate -- but this was just part-time schooling. And then I decided, no, I was never going to -- I couldn't stand it in math. I was tired of math. And I really liked doing engineering work. I liked solving the big pictures. I didn't like the theoretical; I liked the real stuff. I liked -- the physics part was, of course, the first -- the fun-est part.

And then I thought, well, I'll go take some engineering classes, because I don't have an engineering degree, maybe that'll make things better. And I really couldn't deal with it. If I went back and took some beginning engineering courses, they were all taught by graduate students. Now, I'd been one of those graduate student teachers at one time. But not a one of them had

English as a first language, so just understanding them was hard. And then it was, "Memorize this equation and do this." Well, I already knew how to derive that equation, and I didn't like that approach. I liked the approach I came from, which was, I understood why I was doing it and I could evolve it. But I really didn't like the way they taught those undergraduate first-year classes.

And an awful lot of people I know at NASA were either physics or math majors, and I think a lot of them were very good at what they did, because we were not solving problems anybody had ever solved before, in many cases.

And so we didn't have to go back to the textbook stuff, we could evolve in the things... And I'm glad I got to work in that environment. Bruce, my better half, was an aeronautical engineer, and he said -- you know (Laughs) -- well, his degree was in mechanical engineering, actually. There wasn't probably even an aeronautical degree at the school he went at the time he went there. But he was a mechanical engineer. But you know, some places you would go and you would work on boilers and pipes and things, and you'd use just a book, and you look up formulas and stuff. You know, it's standard stuff. And he said that didn't look interesting to him. He wanted to do something different, and that's how he ended up going into the space program and first going into the National Aeronautics. And then, of course, when that became NASA, he was on the team that built the first Mercury.

But he said he wanted to build something new, do something different, and that offered him that opportunity to do that.

And of course, working at NASA was fun. Being on the NASA side, there were many cases, I think, we had a lot more fun than our contractors did. Not that we restricted them all that much, but they kind of built their own culture, which said, well, unless they tell us to do it this way, we have to you know, just do things certain ways.

And there certainly are as many different kinds of engineering organizations as there are different kinds of people. And I think that's another important thing at NASA. I love the co-op program. Are you familiar with that?

LK: Uh-huh.

IH: When you go to school a semester and work a semester. Some of the best engineers I ever knew went through that co-op program. It takes you longer to get your degree. Who cares? I mean, what difference does that make in the course of history? Zero. You go to school a semester, you work a semester, you try different things when you go to work. You move around, you get to go to different companies, you do different jobs in different companies, and you start finding out what you like, what's you, what turns you on and makes you excited. Because what turns you on and makes you excited is probably going to be what you're good at, and what you're good at is what you really ought to be doing for a career, because you'll make -- you'll have the most fun at

it. I don't care if it makes the most money. There's always ways to make more money, but how much do you get out of it?

I don't think your career should be everything. I do think you have to balance your home life, your family life, your spiritual life, exercise, all those things, to make up a really -- to be a really good person, and to get the very most out of this time we get to go around in life. But I really do believe that work ought to be fun -- not every minute, maybe, but it ought to be fun. And it can be.

And I've had my career at NASA, which was wonderful. I've had a career running another company and doing this training and stuff, which has been fun. I even wrote a book. I'm going to show you my book. This came out in 2000. It's about writing requirements; it's for managers, about training requirements. Did I get it in the right place [holds up book to camera]?

LK: Yes.

IH: Good. Okay. I've had several friends tell me for years, "You need to write a book, you need to write a book, you need to write a book." And I said, "Oh, it's going to be so painful. I never have time. I'll never get time." So one of my friends, in '98, I think, said, "No, you aren't going to have time, so hire somebody to write the book." Well, I'd not even thought about that. I went off and I said, "Mmm, I don't know how to hire somebody to write about this." So what you do is find somebody else who may have some time that I know knows how to

write, and that maybe is interested in the subject. So I started thinking through. Now, this is where my discrimination starts showing. I started thinking through the women I knew that might want to do this or could do this with me.

And I had thought about a young woman named Kristin Farry, who I knew was working at NASA. She was on an NSF grant. And she'd be through my training, and we'd met and talked a number of times. And I was thinking about her, and she called me and said, "My grants have run out, I'm out of money, and I don't have any more grants. Do I have anything I can do?" "Ahh, have I got a job for you." And so Kristin came in and helped me write the book, or it would have never gotten written.

Some things are just -- the time has to be right. And some things you can't control, they take care of themselves, thank you very much. I'd like to write some more right now. I'm probably traveling too much and working too much to write some more, but I'm hoping that'll change.

And then all I ever wanted to be growing up was a writer -- that's because I love to read books, okay. Understand that? But I still think I want to write some other books. And I have some fiction started, and it's been started for fifteen years probably. And everybody in SWE jokes about Ivy's books, because Ivy's books never get written. My old SWE friends and I have been struggling with this for a long time. But I really would like to do that, so you know, I'm going to kind of be like Grandma Moses and not write

the books until I'm really ancient, but I'm going to go back to writing books at some point, I hope. And I'm certainly glad I got this one finally written.

LK: That's wonderful.

IH: And when the first one showed up in the mail, it's like, oh, you can actually say author--

(Laughter)

IH: -- and it's legit. You can say it and it's legit. And it gives you a great appreciation for all those people who actually do turn out some pretty good books. (Laughs) I can tell you that it really does.

I'm never going to do the singing, because there's no way that's going to change. The tune I couldn't carry, I still can't carry. My oldest grandson, I tried to sing him lullabies when he was small, and he'd say, "No, grandmother, no."

(Laughter)

IH: So I can't do anything about that. There's some things in life we don't get to do anything about, and some things we do, thank goodness. So I'm really glad I got to have a career as an engineer. I'm glad that NASA came to Houston when it did, and that whatever shenanigans LBJ and everybody told to get NASA into Houston and opposed to somewhere else happened, or I probably would have never gone to NASA.

And I'm glad that people have a need right now for all this requirements training that we do, because that means we have lots

of business in lots of different areas, and I get to learn about things. I get to go learn about medical devices and immunology, and stuff I never thought I even wanted to know about.

If I were graduating today I would be hard pressed not to want to do something that dealt with the genes-type biology. I would never have studied biology. When I got out of school I thought it was boring as all get out. It's not boring anymore, because of some great discoveries there's things that can really be done. But the bioengineering, combined with computers, today would be, I think, would be irresistible. That's where I would head, because I just think there's going to be 10,000 more discoveries made and they'll make a huge difference to people. We'll be healthier and--

(INTERRUPTION IN RECORDING)

LK: This is tape three for our interview with Ivy Hooks on April 9th, 2003.

IH: Well, you just asked me how did our company start. And I have this company called Compliance Automation, Inc. And I can tell you truthfully, I wish I'd named it something else. Okay? That's a long story. Naming things it's truly terrible, naming businesses and products -- awful.

But I left NASA in January of '84. It was time to go on, time to move. NASA changed a great deal. It was not what it had been in the past. So I was ready for something new and different. And Bruce was talking about retiring from NASA in '85, when he was

eligible for retirement, and starting a consultant company. And I thought, well, before I would want to do that, I would certainly want to know more about running a business. I don't think we've been very well prepared for that here in the government. Of course, I've been involved in my family being in business my whole life, enough to the point that I always said I would never own my own business. I have a lot of those "I never wills" that I ended up -- you know, take back.

So I actually just resigned from NASA and went to work for a small company called Barrios Technology that was actually a woman-owned company in the NASA area, and worked for them for almost two years. I ended up working on proposals back to NASA, for them to get new business. And in doing that, I worked with a lot of the big major contractors that they were subcontracted with. So I got to meet a lot more people. I got to see other pieces of the business, learn more about business itself. I should have learned enough and just said, "No, I'm not going to do it at all." (Laughs) But of course, no, you know -- "I can do this better than anybody else." But I learned a lot.

And then in '85, Bruce started his consulting company. I had kind of scheduled to leave Barrios when we got through turning in a proposal, so that I would finish a job when I left. And so Bruce already had some work, you know, some things that I could work on if I wanted to do consulting.

But a young man that I had known at NASA, he'd been a

contractor, worked on contracts for me, he said, "We have this great, great idea. And nobody is ever going to build it at NASA, and it needs to be built. It's a program to decommutate the data that comes down from the orbiter." We would collect a lot data, but we don't process it -- or didn't, at that time, process it very well on the ground. We only processed what people needed to see to run the mission, and if you happen to put payload on the shuttle, and you were waiting for your data, you had to wait until they got all the tapes together and processed way after a flight. It didn't happen real time. And these guys had come up with something they knew would work. They'd done some work in some labs over at NASA, and they knew -- they felt like it would work, but nobody wanted to do it. You know, it was just, "don't change anything."

So they wanted to do it and make it commercial, and they needed somebody that could set up the company and that could do the management of things -- not to help them write the software. They definitely did not need my help or anybody else's. So I talked to them, and decided we'd do that. So when I left the small company, I went to work helping Bruce, consulting in his firm, and I also started another company with five guys at the time -- or four at the time, to build this software product.

And two of the guys just wouldn't quit their jobs to work on it full-time, or even take any leave to work. One was in the Air Force and couldn't, and he had all the brains behind it, we had to

have him. So he had to just work nights. And the other person actually quit his job, the one that called me, quit his job do this.

And we just bravely went tromping up to RCA in Princeton, New Jersey, and said, "We want to sell you this product." They said, "Why don't you just lease it to us?" And we said, "Okay." And we said, "Oh, and by the way, we don't really have any money. We could some, so could you please give us a little money in advance? And if we fail, we'll you your money back." And they did, if you can imagine anybody being so bold as to do that. Of course, it wasn't a huge amount of money.

And we were a success. And we flew the first mission for them in -- I think it was October or November of '85. In '86, the first mission in January, they had a spacecraft on the shuttle. And again, we could decommutate all their data for them in the Mission Control Center, real time.

And then, of course, the Challenger blew up. And suddenly we were in business, as consultants, with a product that we didn't know how to sell anywhere else outside of NASA, although it probably should have had a lot of applications elsewhere. For probably six months we went along in a dream that it'll all work out, and NASA will start flying again. Then it became real apparent they weren't, so we started looking for other work and doing other things.

I was working on a lot proposals back to NASA that dealt with

space station management information systems and those sorts of things, because the contractors had to have somebody explain to them what NASA really wanted, because NASA was writing requests that didn't make a lot of sense -- or didn't -- unless you had a huge amount of knowledge and background in NASA, you wouldn't have known what was going on. So they had to hire people like me to come interpret for them.

The other guys -- by that time we recruited a third -- one more guy to come help us, out of Denver, that had worked with us before. So we had three of us that had left jobs, and none of us consulting, that didn't have retirement pay or any other kind of pay, that had to make a living. And we started doing several things, and one of which was working on a product to manage requirements. And so we started on working on a tool we called "Document Director" at that time that would help manage requirements. The problem was, we're engineers, we don't have any idea how to spell anything, no good at all.

But our Air Force buddy got out of the Air Force, became part of the company. And we already had had a call from IBM, would he please come rescue us from some problems we're having with NASA right now. And he really is a genius -- his name is a Tom Sola (phonetic) -- he truly is. And he's one of those wonderful geniuses that can explain things at any level to you, so it's wonderful, because no matter how technical it is, Tom can explain it so I can understand it, or you could understand it, or no

matter who and whatever your background is, no matter how different it is, he can get there.

And so he started working at IBM, and then ended up hiring more people to work at IBM, and over the years developing that side of the business quite a bit, into about thirty-five people that were doing programming for different companies. But it wasn't very satisfying to any of us, because that's not the kind of business we wanted to be in, because we felt like just were body shopping for these companies. And so we sold off that part of the business. And Bruce said, "Okay, I'm retiring."

And then we took -- Tom had his product, and Dave and I had our product for requirements -- Dave Hottman and I. And we said, well, let's just split again, and everybody go their own way, essentially -- although each owned parts of each other's companies still.

But Dave Hottman who was the one who had come from Denver to help, in 1994, said, "Ivy, you know I came down here nine years ago to help you temporarily. I think I'd like to go back to Denver." So he went back to Denver. But before that happened, we formed the company we now call Compliance Automation, with Dave and I being the active members of it. And we had to come up with a name, and at the time we were trying to solve a tool to do compliance with other kinds of things, like environmental audits, or nuclear audits, and stuff like that.

And so we said, "Well, the tool really does compliance, and

maybe" -- I just wanted to name the company something like, you know, Apple or Lotus or something. It seemed like to me that it was a good idea to use those kinds of things, and not even worry about whether it describes what you do, just something easy to remember. But the male engineers could not go along with that. That did not suit them one bit. And so we kind of came up with this descriptive thing that's very long. And not only that, we ended up with a website with that kind of name, because somebody already had the initials, the CAI we used. So we ended up with this very long, now, website name, and a company name, that if you put it up when you do trade shows and things, people said, "What does that mean?" So we just make that little now in the corner (Laughs) and put what we do in big letters. And the product's name changed from Document Director to Vital Link.

And so we decided we cannot keep totally supporting this tool, we're going to have to support ourselves, so we put it a little bit on the back burner, and it's been there for quite some time now. We have customers who use it, and we support them, and we've got some people looking at what can be done with that tool. It's still a very useful tool. I still use it. And so we've got some people now -- we've hired some outside people to look into that. We decided we're not very objective about that tool.

But the company has changed a lot. I'm not sure we really had a vision to start with. You know, it was just we needed a company in order to do what we wanted to do, which was to either

do consulting or sell the tools. Now that I've reached the age I have, I have to look and say, what's going to happen to this company in the future, and what do I want to have happen to it? And I'd like to retire someday, and so what do I have to do?

And so now we're at that stage of going through figuring out succession, figuring out what you have to do, figuring what you ought to build it to before you do something with it. And because I've built up the other trainers now, it's not just Dave and I, it's other people who are doing training and stuff for us, so it's like, hmm, they care what happens to this. So now I have a whole new set of challenges of figuring how do you take this business and make it into one that either will survive anyway, with or without me? I always think things will survive without you. I mean, they can. Nobody is totally indispensable. But also, what can I do to make it really successful in the future, or successful to sell, or whatever, maybe, is the thing to do? So it's just a new set of challenges.

And it's like, what's the next career? I've had two; maybe I'll go to three. That's the writing part, that's the doing the writing or something.

LK: In your career as an engineer, you've worked the NASA side, and then the contract side, and now your own business. And a lot of it seems to have all revolved around the development of the Shuttle. Is that correct -- or much of it?

IH: No. There was certainly a period in there that did,

yeah. And it certainly influenced other things. I don't think very much of our business -- after we built the tool to use for the Shuttle's data link, not very much has really had to do with the Shuttle, in terms of any engineering stuff I've done or things I've done.

LK: Right. I guess the influence part is really what I might--

IH: The influence, oh, yeah.

LK: That's kind of an interesting thread that I've picked up on your career.

IH: Well, you know, it affects you. You know, you put all that energy in, and you actually are getting some interesting things out that you don't know you're getting out, of what you're working on -- the knowledge base, the understanding of different things. Because you take that knowledge and you move it to everywhere else you go.

I mean, and everybody does, and that's what makes these requirements that I work with, that I try to teach people how to write, so hard. Because if I write something down as a requirement that I want some thing, okay, whatever it is I say, you're going to read it based on every experience you've ever had. I'm going to read it based on every experience I've ever had. There are no two people alike anywhere in the universe -- no two. So we all read into the nuances and differences. And that's where so many of the problems occur in trying to develop and build

things, is to communicate those ideas where they can't be misunderstood.

And that, to me, is a real challenge, of trying to understand: Why do people have problems? What can they do to do it better? What kind of tricks can I teach them to make it easier for them? Because they're trying to get a job done, they need some way to make it happen, and happen easier than it's happening now. So essentially, it's engineering a process. How do people think? How do they -- what do they understand? What can you do to make it clear? And all of it goes back to -- you're always relating back to your own experience. Everybody does.

LK: What would you consider to be your greatest contribution to engineering? That's kind of a loaded question.

IH: That's not a loaded question, because I'm not sure I've ever made a contribution to engineering, as such. I mean, I know people who have, who have made major contributions to engineering. Probably the separation systems on the Shuttle. I think that my team did a tremendous job, that they're simple as they can be; they're straightforward as they can be. They dealt with lots of complexity that worked. They always worked.

And that wasn't a single person doing something; that was a whole team. I'm very proud of those people I worked with, and to have worked with them. I think we did our jobs probably more efficiently and more effectively than lots and lots of other people I've looked around and saw. There's a lot of talent, but

there was a lot of ability to work together.

And it's funny, because when I first started teaching these classes thirteen or fourteen years ago in requirements, people were starting to form IPTs, Integrated Product Teams, that was the big buzz word of that era -- well, they're still using it. But I would say things in class, and people would say, "You don't sound like you want teams."

And I said, "That's not true. I think we can't do much of this without a team. But I don't -- teams for teams' sake I don't go for. They form these teams of people, and then they just want to let them -- you know -- I don't know what they expect them to do, actually. Sometimes they get them so big they won't do anything, they'll just kind of move around like herds or something. But they're all just herding and munching. I mean, they're not getting anything accomplished.

I think teams have to have a real reason for being. I think every meeting has to have a real reason for being held. I think people have to be held accountable, and I think there has to be leader, and the leader has to be the final word. And so somehow I think what happened and what people were trying to teach people how to do in working together in teams, the meaning was good, but it got misused. It was like, "Oh, well, let's just go stick a whole bunch of people together and tell them to come out with this product." You know, that doesn't happen, and especially where you have to get consensus from everything.

I mean, why? Why do we need consensus? You don't need my consensus for a lot of things, I don't need yours for everything. Why can't we just agree to disagree on some things, and it goes my way, your way and somebody else's -- some others' -- that, to me, is fine. It isn't like it's black and white and there's right and wrong. I mean, hardly ever is it really that way, it's all just different shades of gray. And in engineering, there's a thousand ways to do things. So if we find something that works and it fits our budget and it'll do, let's just go, do it. Quit -- you know, we could work on it forever, and some people will (Laughs), and never get through. Well, that's not any fun. Let's get through with this and go do the next one. You know, I like to get through with some stuff.

I mean, this is why I thought I wanted to be a prof. You know, you go to school, and every semester, you're through with something. With work, you don't ever do that. It just keeps going and going and going. It's hard to get through with anything. And especially when you do one of these twelve-year, twelve-day things. I told them I'm never doing one of those again. I'm never working on anything that takes that long to build. That's too long. I wouldn't have made it building those chapels -- I mean, the cathedrals and things. It took five generations of people to create them.

And I don't know, hopefully some of the work we're doing in requirements and some of the changes we're making and the way some

organizations work may be -- may end up really being the thing I end of being proud of still. I've seen it work in some places, where it's way ahead of where they were before we walked in the door and helped them, and that's fun. I like the training, although I said I never wanted to be a schoolteacher. I didn't, not with those rooms full of small children.

But teaching adults and providing help there, and watching the light bulbs go off in people's heads, and the people suddenly having a tool to do something with that helps them work better, that's very gratifying. And in a very indirect way, we're affecting engineering, because so many of the people we work with are engineers.

LK: Right. It does seem very important and very interesting. It's so less tangible of a product than like the space shuttle or you know, a bridge, which is the sort of stereotype identified.

IH: Yeah.

LK: But that's very interesting. During the twelve years twelve days, or your early career, did you feel like the atmosphere for women changed or evolved in any way? Was that obvious or not?

IH: Yeah. Well, if I looked across those twenty years I worked at NASA, certainly there was an evolution going on. It was not a revolution, but it was an evolution. It was changing. By the time I was in my last, say, five years at NASA, what would

happen is men would say, "I want to bring my daughter in to meet you." Okay. They're engineers, they've got daughters. Now they think about engineering as a career for their daughter. They want her to meet a woman engineer. They want to bring her in for lunch and let me meet her, which was really fun.

I think in many of the organizations there at NASA at least, and at the contractors too, to some extent, they got more accustomed to just seeing more women. When IBM came in to do the software, because it was software, there were -- well, they were doing the hardware. They did our computers that were onboard, too. But the huge number of people who were in the software, there were an awful lot of women in that group. And so that brought a lot more women in higher -- in marketing. I think that's the first time we'd ever had any kind of woman in marketing in a company in Houston that dealt with NASA -- women in management positions and things. And the more exposure of that, the better things got, because then it just becomes more the norm, and people quit acting like it's weird.

I said, when they chose those first six women astronauts, I was so happy to see them, I didn't know what to do. Because it seemed like everybody was always keeping up with me and what I was doing, and all of a sudden they had these other six women to just go focus on all the time. And they were taught to accept it and to expect it, and so all of a sudden they had somebody to go watch all the time and see how they were doing.

LK: That took some of the pressure off of you?

IH: I think it took some of the pressure off. And we laughed about, you know, we had women astronauts for at least six years before we had a woman flight controller. So that part of NASA couldn't make the change to women. It was very hard on them, even though the women astronauts were being trained, the controllers were communicating with the women, they still -- it was like "only men could be in the control center."

But certainly it was going on not just there, but out in the rest of the world, too. I will still do training classes where I'll walk in a room, and I will have, out of thirty people, twenty-nine will be male. It isn't as often as it used to be. I guess I had, in one in Minneapolis about eight years ago, I had no women. And since then I now know a woman who works at that firm, and they're getting more women in there. In fact, she's come here to take one of our classes. And when I go to Minneapolis, I manage to have dinner with her, because like it just keeps -- the female thing is the -- the old girl network is really kind of nice.

But I still, in the Midwest, and some of the older companies, you know, because -- well, let's see, we've been to Delphi, and there actually were one or two women who showed up in that one -- not many, but a few. But you're dealing with industries that were traditionally all-male organizations for so long. The automobile industry, the aircraft industry, and all had -- you know, as soon

as they got Rosie the Riveter gone, they were back to all-male again, and they stayed that way for a very long time.

And a lot of times I'm in places, and Minneapolis is one of them, where the culture seems to be an awful lot of women don't work. So I'm in firms where all these guys work as engineers, but none of their wives work. They stay home and raise their families. It's a Midwest-type culture. So I still see that in some places. But I don't see -- I rarely ever come up on anybody that I think is really highly -- you know, I don't run up against the blatant discrimination anymore. I'm not going to say there isn't some, because I'm sure there is.

But a lot of it, you have to recognize, is because people tend to communicate better and be more comfortable with people like themselves. Okay? And so people will do that. They will group together with people like themselves. Actually, it's because it makes the communication easier, because we have so much in common, that we have these common viewpoints, and therefore it's easier to communicate. You start putting all this diversity in there, and it makes the communication a lot harder. So I think that's a natural thing.

And until we've had a number of generations where people have worked with people from different cultures, and men have worked with women, and we've learned how to do that and learned how to communicate, it's just going to take a while. I'm still hoping it's going to be really good for my granddaughters' generation.

But they're getting close to out of high school, and I'm not sure it's there yet.

And then like you have a few women who've made it up very high in some companies, and I guess I've been a little disappointed with some of them – Carly [Fiorina] at HP. Well isn't it wonderful? You know, we've got a woman that's head of a huge corporation, and she's merging it with another corporation. And so I think she's very much like her male peers. I would rather her to have been a little less like her male peers. I would have liked her to have some of those traits, some of those characteristics that I think make women maybe better managers than many men are, because of caring about the people that work for them.

And I don't mean to say all women do and all men don't, because that's never true.

LK: Well, sure, yeah.

IH: But you know, she flies around in her private jet and has her private yacht, and gave all of her managers huge bonuses for making the Compaq deal go through, and didn't give any of her engineers raises for two or three years, and maybe has not yet. And I'm like, what difference is there in you and having a guy up there, if you can't do it better? If we're going do it, we ought to do it better. So, that's been disappointing.

LK: Did you ever feel any kind of -- I don't know if "pressure" is the right word -- that you do need to be like the

men in order to succeed in the field, you have to play by their rules or--

IH: I think it helps if you understand their rules, although I'm not sure all the guys know what they are, either. Okay?

LK: I mean, that's kind of a question that's the stereotype in itself as well, but--

IH: I know, but I do think the men, -- like I said, read *Men Are From Mars*. It really does tell you the way we act differently and the way we do things differently, that are, really, I think, very true. And then, well, I think it's -- I think more than anything, you have to be yourself. Okay? I have a couple of friends who are just -- they're so wonderful. They can be so stoic at all times. They're so cool. They never lose it, they're just -- sometimes you would think they didn't even have any emotion. And they're very good managers. And I like to be around them, it's very comfortable. You don't have to worry about them erupting ever, or doing anything in too big a rush, or doing anything foolish. You feel very comfortable with those kinds of people. And I always wanted to be that way. But I'm not. I'm much more an emotional person.

And I know that a lot of times there are people who thought that was a female trait and they didn't like it. I knew guys who would make me look like I was calm. You know, it's just different, emotions are just different. The way we react to things is different. But I think if you're trying to play a role,

it's very hard to do. It's very hard to hold it. I guess you can become more and more -- I think you can become more like somebody else, but do you really want to? What do you really want to do? What is right to you? What is good to you? What are your ethics and morals, and what do you want to -- you know, what do you want them to carve an your tombstone?

One time I had a guy tell me, he said, "Well you're" -- you know, I was trying to learn how to play tennis. I've taken the first tennis lesson a hundreds times. I can teach the first tennis lesson, but I cannot play tennis. Okay? He said, "Well, you're just not competitive enough." And that probably is true. I mean, in a big sense, about a lot of things, I'm not a very competitive person. I've been very successful, but I didn't do it by going out and trying to beat somebody else to something. I was just trying to solve problems and having fun doing it, and make something happen. I don't even get any joy out of, quote, beating somebody else. I understand other people do -- I mean, it's fun for them. I can play card games for hours. I love to play card games. I'm so glad computers play card games. They never get mad at me, they never throw their cards down. They never quit on me. (Laughter)

IH: I'll try to get Bruce to play, and if he's having bad hands, he doesn't want to play anymore. And it's like, it doesn't matter if it's good or bad, it's what can you get out of it, you know. And so -- but that's me. That doesn't mean that's good or

bad for anybody else, it's just the way I am. And I'm not likely to change about that. But I don't think I'm particularly competitive.

And one time one of my sisters-in-law said, "Where are going to take your business to? Where do you expect it to go to?" And I said, "Well, I want it to pay for a nice retirement so I can take my grandchildren on trips and have somebody take care of me in my old age, and not have to be a burden on anybody," that kind of thing. And she said, "Well, I thought you'd want to be a Fortune 500 company. I thought you'd want to grow it to that." And I said, "Why anybody would want to do that is a mystery to me." Yeah, "I thought you would want to have a huge company." I said, "Why?"

You know, that is a huge responsibility, a huge burden, and it can be here today and gone tomorrow. The whole world wants to compete with you then. That isn't where I get my kicks from. So it's okay with me if somebody else does, and they do it, but I just don't -- I'm not going to. And I don't think that's even a male/female thing. I really -- I look at Bruce's kids. Kevin is forty-five this year, I think. And he's a vice president of a company. He's an engineer. But it's been very important to him his whole career that he has time with his family. Although heaven knows, he doesn't -- there are a lot of days that you have to wonder about the number of times they put him on airplanes and ship him around the world. But he turned down several jobs

because they would have meant he would not be able to coach the soccer team or be with his children some. And although he still works huge numbers of hours a day, he still has time for a family.

And I see more and more of that, both in males and females, of, you know, we want this other life, and this family stuff is important, and doing things with our kids is important. And I think there is a whole generation, mine in particular, where people didn't do that very well. It was like -- you know, the '50s and '60s were like, oh, "you got to get out there and really chew up the pavement" or something. And the guys were busy doing that, and the wives were trying to stay home and raise children by themselves virtually. And now what I see is all this sharing.

I mean, our youngest son, when he had his first baby, I was down seeing my mom, and I said, "Could you come over while I'm in town, because I'm not here very long?" And he said, "Yeah, we'll be over." And it's a forty-five minute drive. Well, he shows up all by himself because somebody in the office had had a death in the family, and Shirley had to go bake a dish and take it over there. So he's coming along driving this three-month old. And my mother's like, "Scott's here with the baby all by himself." I said, "Scott takes care of the baby all the time."

And I see that, and I think, I think this is better. I think it's much better than it was for our generation, where the moms stayed home and tried to raise the kids, and dads went to work every day and tried to have all that burden put on them of making

the money.

We probably do want too much, and so everybody has to work all the time now. And it would be nice if people could take off some. And I even know several families where the men stay home and take care of the children in order to support the wife's career, and it seems to suit them. And to me, that makes sense, because I don't think the other made a lot of sense. I mean, it may have looked good for the American family or something, but I'm not sure it was always the right thing for the people involved, to try to play those roles. So I think there's much more flexibility in what people think they can do, and how they can live their lives, and I think that's good. And I think there's much more acceptance of it. People don't raise their eyebrows quite as high -- well, eighty-year-olds do, still, a little bit. But even they can deal with it. So from that standpoint, I think it's a -- and I love the fact we have people from all over the world that we get to meet and talk to, people from different cultural backgrounds and all. And people don't sit and stare anymore. It's just they're supposed to be there. And so those things have come a long way. They're positive.

LK: Well, all of that said, do you still think that there's a role or a need for a women's movement?

IH: Uh-huh, uh-huh. Yeah, it was like when the ERA was trying to be passed. I wish we could have passed it, because if it's not in the Constitution that we have all these rights, it

could very easily go away tomorrow. People don't realize that. It really can. You can say, "Oh, they would never be able to do that." But oh, boy, they have in other countries. They can. It would be much better to have the security of that. And I think the woman's organizations are still very important.

I work, I own my own business, and I have a family. How much time do I have to get out and meet and have a social life with other people? Not a lot. And if I did, who would it be? Because I need some peers. I need peers. That's one of the first things I noticed in management, was the minute I went in management, I went to zero peers.

I looked around me, and I thought, you know what, the males aren't any better off than I am, because as soon as you got in management, the people you had worked with who were now working for you were not your peers anymore. You were cut off from them, but there was no real association at your level among you and the other managers, because you were either vying for -- it's almost like you're always in competition for the funds or the time, or whatever. And so you don't merge as a real group.

And so where do you find these people that share your pain, that understand the same things that you do, that go through the same kind of problems, that could help counsel you if you needed it, or they could just help you laugh about things that happened? Where do you find them?

And SWE brings -- makes that possible. But more than that,

it gives all of us that direction of saying, "I will help the next generation, and the next generation, and the next generation. I will put some of my energy in and some of my money in, so that there's more opportunities, because it's still -- you know, we're a long way from equal. I think we now have about twenty-percent women engineers, but they're slipping down back in the -- in the schools again. They're not building it up. So it's a long, long way.

And I think it could be much closer to an equal number of men and women. I don't think engineering is an all-male field. I've known some women that I think had as good or better spatial skills than any guy I ever knew. I don't. I give them that one, boy. They do better on that one than I do. But I don't think it should be 90/10 or 80/20. I don't why it couldn't be a lot closer to 50/50, and be making the best use of all the talent.

And it worries me in this country today, because so many of our engineers do come from other countries. I mean, our graduate schools are stacked with foreign students. Even in undergraduate engineering, there's way, way huge numbers, so the Americans are not becoming engineers. And we need engineers out of our own culture. I don't think we're going to like it if we get to where everybody who -- you know, all we're producing are lawyers, in this country, and everybody else is in this country from somewhere else originally. I think we need to -- and surely there are lots and lots of young people who would have fun being engineers. It

is a fun profession.

But where are they going to learn that, male or female? You don't learn it on television. On television, you get to see lawyers. Ooh, God, how many lawyer shows do we have now? Anyway, I'm not a television fan, and so when I walk through friends' houses, or I visit with friends, it's like: Oh, and what's this show I don't know about? And medical shows -- we have all these doctors and emergency rooms. And then we have a few other careers, but nobody is ever an engineer.

LK: Yeah, that's interesting.

IH: I think there was one dad that was an engineer, where there was the little boy and the little girl, the little Buffy, and whatever the name was, back thirty years ago. I think he was an engineer. But you know, he just left and went to work, and he left and went out of the country, you know, and let somebody to take care of them all the time, so you never saw what he did. So there's this huge gap in understanding that, hey, people go and do these things and they have a good time, and they make things that are really worthwhile, and they make your life worthwhile.

And I would be dragging children all the time to exhibits that show ingenuity in engineering, and taking them on day trips from school to see plants that run and talk about the people that make them run, and that sort of thing. And I wish we did a lot more of that, because I don't think we do enough. I don't think we do near enough of that -- of helping them understand, you could

build something like that. You could be a part of the team that does that.

Well, at least with the computer games they now know they can go build computer games someday. So that's kind of --

(Laughter)

LK: Do you think that that's SWE's role?

IH: I think it's the major role of SWE, is to make the world aware of engineering, and the possibilities of it, especially for young people. I think the scholarship program and the programs where they give the certificates in the schools, where at least a woman engineer shows up and says, "We do this, we can do this"... And one of my granddaughters going to Austin went to one of the SWE events, or maybe SWE held jointly with UT or somebody in Austin, a year or two ago, where that's really what they were doing, was exposing them to engineering stuff. It may have been even one of the Scout things. I've done a lot of the Scout things here locally.

You just never know when you're going to touch that little light and make it so they can at least think about that possibility. And I think we didn't do that, there wouldn't be very many people doing this. So I think it's a really big part of SWE.

LK: Do you have any final thoughts?

IH: Well, I will tell you it's really rough thinking I am a pioneer. (Laughs) I think of Aunt Ivy and her generation as

being the pioneers, and Grace [Murray] Hopper, and those folks. So it's really hard for me to think of myself as being a pioneer. And then I think about it, and I think, well, I guess when the older pioneers die off; you're now the pioneer. So you know, I've been working for forty years as of June 3rd, this year, I've been out working in this profession for forty years, and it doesn't seem like a minute has gone by. It's been a lot of fun.

One of the NASA guys, when I do talks for his group, anytime I'm there he always says, "This is one of the pioneers in NASA. And for those women in this room, she helped pave the way for you." And so I hope that I did. I hope I made it easier on some. But if I were to look at this film, I would go, you know, "Who's that," because I still see myself as that other person that's a lot younger than this, and hasn't done all these things yet. But I guess that's part of what aging is all about that you never realize until you get there, that that's going to happen to you.

So I hope I've made it easier for some people, and I hope I opened a door for some people, and I hope I get to open a few more. So I think that's it.

LK: Well, thank you very much.

END OF VIDEOTAPE