PROFILES OF SWE PIONEERS

ORAL HISTORY PROJECT

Bonnie Dunbar Interview

March 2, 2002

Reuther Library Oral History ID: LOH001952.9

A copy of the interview audio recording and transcript has been deposited at the Walter P. Reuther Library and Archives of Labor and Urban Affairs, Wayne State University. The interview may be used for research and educational purposes only.

Copyright 2002 Society of Women Engineers

Bonnie Dunbar

Bonnie J. Dunbar received a bachelor's and master's degree in ceramic engineering from the University of Washington in 1971 and 1975, and a Ph.D. in mechanical/biomedical engineering from the University of Houston in 1983. She began her 27-year career at NASA in 1978, during which time she logged 1,208 hours in orbit on five space missions. She became the Assistant Director for University Research and Affairs at the Johnson Space Center in 1998, a position which she held for five years. She retired from NASA in 2005 as Associate Director of Technology Integration and Risk Management at the Johnson Space Center's Space and Life Directorate. Dunbar then served as President and CEO of the Museum of Flight in Seattle, Washington, led the University of Houston's STEM Center from 2010 to 2015, and joined the aerospace engineering faculty at Texas A&M University in 2016. She is a member of several engineering, scientific, and medical organizations and serves on a number of boards. Dunbar has also received many awards and distinctions from numerous organizations, including the Society of Women Engineers's Resnik Challenger Medal in 1992 and Achievement Award in 2005, and the IEEE Judith A. Resnik Award in 1993.

In her 2002 Profiles of SWE Pioneers Oral History Project interview, Dunbar explained how she became interested in engineering; her experiences in high school and college; her work on the Space Shuttle, Skylab, and other NASA projects; and her involvement in SWE.

- July 2016

INTERVIEW WITH DR. BONNIE J. DUNBAR, MARCH 2, 2002.

LK: This is March 2nd, 2002. This is an interview with Dr. Bonnie J. Dunbar, U.S. Astronaut and member of the Society of Women Engineers. And I was hoping we could begin with a description of your family background.

BD: Well, let's see, if I go back to my parents, my father was born and raised in Oregon, where his parents had homesteaded. They'd emigrated from Scotland. My mother grew up in Montana on a sheep ranch. She was one of nine kids.

My dad came back from World War II to Condon, Oregon, and was helping my grandfather ranch. And my mother had come down to see her older sister who had married someone in Oregon, in Condon, there. And my mother was working as a waitress at the Condon Hotel when she met my father. And they got married in 1948. And then my dad, having been a veteran, was eligible for some land draws for homesteading up in Washington State in the Yakima Valley, and some land I think used to be part of the Manhattan Project.

His name was drawn, and he and my mother moved up to homestead. And the land was unimproved. It was pretty rocky. My dad said it had been turned down by nine people before him. (Laughs) And they hadn't brought in irrigation yet. So they brought in irrigation. And I probably spent most of my childhood,

along with my two brothers and sister, picking rock out of that field so we could plow.

But in any case, my parents lived in a tent for most of the first part of their marriage before I was born. It was almost a year. And then I was born, and they had moved into two sheepherder huts they had moved together. We didn't have running water until I was about three. And then we moved into a house that they brought in. It was a two-bedroom house that had actually been brought in on skids. It was kind of a square boxy thing, as I recall. And we had a well dug.

And that's where they still live. They've added onto that house another couple bedrooms, but they're still living there. And they just celebrated their fifty-third anniversary.

LK: Wow. Congratulations.

BD: Thank you.

LK: So your early experiences with science and technology in this setting, can you talk a little bit about that?

BD: Well, my interest in science and technology came from reading. And as I look back on it, the engineering part of it was hands-on. My mom and dad were very self-sufficient, I think as most ranching and farming families were. And being the oldest of four kids, my dad never treated me any differently than my brothers. When I got old enough, and that was about nine, I was

driving a tractor. I would help him repair the tractors. I liked it. I like being outside. I liked doing things with my hands and understanding how things worked.

So the first set of books my parents ever bought was a set of encyclopedias, because they both would have loved to have had the opportunity to go on to college, or even my mother, to finish high school. But her dad died when she was about sixteen, and so they couldn't afford to keep sending her to high school, because she had to actually ride a horse into Havre, Montana, and board there to go high school.

So education was very important to them. And because of that, it was impressed upon it, that, you know, we didn't have a lot growing up. But I don't know if it was my grandfather or my parents had said, you know, the one thing they could never take away from you was knowledge, no one could ever rob you of knowledge.

And in the summertime, not being in school, reading is what I did most, so reading encyclopedias, or reading books out of the Bookmobile. I was fascinated by space because we launched Alan Shepard when I was about eight or nine, and John Glenn. And I was reading science fiction. And so that was my introduction to science and technology, was from reading, and more informally from doing. I didn't know any scientists or engineers.

LK: How important do you think science reading and science fiction and things like that are for young people today?

BD: Well, I think reading is absolutely indispensable. That's how the world was opened up to me. I didn't really leave the state of Washington except for one short trip to Canada with my parents until I was eighteen, and then, you know, went on my own to Oregon to visit relatives in Eugene. But I'd felt I'd seen a lot of the world, you know, from reading. It's what opens your horizons up. If you can't read, you can't share the experiences of other people in environments that are different from yours.

Now, for me, science fiction, I selected that, because it opened up the worlds of space exploration, or just incredible inventions, you know, whether it be Captain Nemo underneath in the ocean or, you know, going to the moon. Or the book, *Angry Red Planet*, which was made into a very bad movie -- but it talked about the exploration of Mars, and I was fascinated with it. I can still lose myself in a book, you know, where I don't see or hear anything going on around me. And when I was a kid, books were my escape into other worlds.

LK: Sometimes I hear that, you know, there's a challenge for teachers to inspire children to read because of the multimedia opportunities that are out there to stimulate young people, and people of all ages. And so do you have a comment on that?

BD: Well, I know it's a challenge, but reading and being incentivized to read starts before you start school. And the parents have the control over that. And I think -- I watch my sister raise my nephew and niece. And they love to read. And you start reading to them, to the point where they want to be able to read and understand themselves. And once you get them hooked on reading, then even if the programming is not there -- because you're a slave to programming. You're a slave to what time it comes on and what the content is. You don't get to pick. Even, I think, with the multi -- a hundred cable television channels, you really don't get to pick. But you can go to a library, and you can pick a subject. You know, you can pick the level of the subject. You can tailor it to what you want to understand. You can pick science books; you can pick fiction books. You know, still the mass media hasn't been able to replicate what you can get through reading.

LK: Thank you. During your early school years in elementary school and high school, what were some of your favorite courses?

BD: Well, you know, it's kind of interesting. The school I started out in, Outlook Elementary, went to eight grades. It was a very small rural school. I think there were probably twenty-two, twenty-three in my class all the way through eighth grade graduation. And we were pretty much a core. There were the few

people that would change in and out, and we had quite a few migrant workers that were part-time there, that would come back every year, but very small. So we had -- we didn't have course selection, you know. And I liked everything. I loved school, because I loved reading. And I'm trying to think -- you know, I loved everything from the PE to the music to the art. I liked, believe it or not, phonics.

(Laughter)

BD: I liked looking up words in the dictionary and being able to pronounce them correctly. I know that sounds strange. I liked math, and I liked science. I liked everything I had in school. And you know, by the time I graduated from eighth grade and then went into Sunnyside from Outlook, I went into the ninth grade at junior high, and then tenth through twelfth at the high school, I always tried to take the hardest classes, because it was sort of a personal challenge, you know, going into physics, going into chemistry.

LK: Were there guidance programs in high school, career guidance programs in high school where you went?

BD: No. Well, we had a guidance counselor, and quite frankly, the only time I visited her was not much help. I told her that I wanted to apply to MIT [Massachusetts Institute of Technology] and Caltech [California Institute of Technology], and

I wanted to work in the space program. And she advised me that, you know, it would be better that since I grew up on a farm I marry a farmer and have a bunch of kids. So I had one meeting with her, and then I started talking to my physics professor, Mr. Anderson.

LK: Was he supportive of your views?

BD: Oh, absolutely. In fact, he's the one that directed me towards engineering, because I didn't know any engineers. I know that when I got my SATs back, I scored very high in spatial ability and in English. In fact, I scored higher in spatial ability than I did, I think, in the English part of it, or the literature part of it. But they didn't give me a science option as a career, as an ideal career. And I guess I heard years later that for girls that wasn't even an option. And I didn't know that.

But my boyfriend at the time and I shared scores, and I had higher scores than he did in spatial ability, but they said he should be an engineer. So when I was accepted to the University of Washington, and they sent a piece of paper back saying, "What college do you want to matriculate to," I took it to Mr. Anderson. And I told him, "Well, you know, I want to do all of these different things." I loved English literature, but I wanted to build spacecrafts, I wanted to fly in space. And he said, "Well,

I think you ought to select engineering." And I said, "Well, but you know, my SAT things that -- didn't say engineering." He said, you know, "Disregard that. Check engineering." That's how I ended up in engineering. It was the best choice for me. I mean, I have no regrets. But it was all serendipity at that time. I was very, very lucky.

LK: Do you remember if there were any fellow students in your senior class in high school that talked about being engineers other than your friend that you mentioned?

BD: Well, as it turned out -- no, they didn't talk about engineering. But we had five of us that came to the University of Washington. And the others, one of them went into architecture. Jerry and I went into engineering. One went into physics. And I'm not sure where the other one went. But we all went pretty much in the technical end of it, in the science and engineering end of it. None of my friends who went into the liberal arts went to the University of Washington. And I think that's, you know, strange, but it just -- because at the time, I think in the state of Washington in 1967, if you wanted to major in science and engineering, the University of Washington was the best place to go.

LK: So what was it like when you started at the University of Washington in the engineering school?

BD: Well, that's kind of interesting. You know, I was in -- I took all the higher-level stuff I could in this high school in Sunnyside, which looking back on it was remarkably good. You know, it serviced mostly a rural area, but we provided physics and chemistry and math analysis, pre-calculus. We had a math club. Mr. Jacobsen, I remember, was the professor -- or the teacher advising the math club, and I was in that.

So I had all these great classes. But I was also a cheerleader, and I was in debate club and speech club and Latin club. And you know, I had a very normal, I think, high school life. And I was in sports. So I had this really naive vision of the university that it was just going to be a bigger high school. (Laughs) So it didn't occur to me that once I checked that engineering college that it would be so structured, or that it really was a separation of groups of students on a campus, that, you know, there was the liberal arts, and the arts and sciences, there was, you know, maybe the nursing college, and all these different -- the business college.

So I showed up and found out, you know, I was one of nine women in I think an entering class of like 2,000. I don't remember the exact -- but a lot. So it was a real shock to me to show up to class and be the only girl in the class. And it was a mixed bag in a way, too, because all through high school, everyone

had been so supportive of anything I wanted to do and study -- you know, Mr. Anderson, my physics teacher, who was also our chemistry teacher. And I showed up as a freshman, and it was sort of a mixed bag. There were some professors that were really happy to see you, and some that weren't. My statics professor was one of them. I showed up to my first day of class, and he asked me to sit in the back of the room so I wouldn't distract the real engineers. And when I got ready to leave he asked me why I wanted to major in engineering, because -- and then informed me that there were no women's bathrooms in engineering plants. So I asked him where the secretaries went, and he couldn't answer that question.

(Laughter)

BD: I did it nicely, you know, because I was kind of meek and shy. But I thought -- I was very surprised that anybody would ever say that to me.

LK: I can imagine it would be intimidating.

BD: Well, I think it didn't bother me. You know, when you're eighteen or nineteen and you've grown up in an environment your parents started with nothing and said that -- you know, we won the war, and then my dad had come back from World War II -- and that this was a democracy, and that the whole world was available for your children, you know, if you've heard that all

your life, then somebody saying it's not possible is not a serious factor. You just work around them. I looked at that as their problem, not my problem.

LK: Okay. What were some of your favorite courses at the University of Washington while you were studying engineering?

BD: Well, I have to tell you that statics ended up being one of my favorite courses.

(Laughter)

BD: Not because of the professor, but I really loved solving problems. That was why when I took geometry, you know, it was a real challenge for me to get the right answer. When I say challenge, you know, they put the answers in the back of the book, and I'd work every problem so I could get them right a hundred percent. I didn't like anything less than a hundred percent. So statics is one of those courses that has no in between answers. You either had a right answer or a wrong answer. Of course, all the math and stuff -- but for some reason I just liked that part of the design at that time.

And then I went into ceramic engineering my sophomore year, and I liked the design class. Of course, he was also a professor that -- you know, was an old German who didn't give much above a "C." And he was a terrible professor, but I liked the design course because it was a solution based course. You know, I could

see it from the front end to the end. And I just enjoyed that. I found it very creative in a way. So those kinds of courses I liked the best, the design, the labs, you know, wasn't just working problems that I didn't understand the outcome to. Those courses were the building blocks, and I enjoyed them to an extent and I knew they were important, but when it finally came to the icing on the cake it was actually being able to take all those tools and then doing something with them.

LK: At that time was the program -- did the program emphasize working in teams as part--

BD: I don't know that all engineering curriculum did. But when I went into ceramic engineering -- and again, I was in a small subset of engineering. And Dr. James I. Mueller was the person who recruited me. He really recruited me. He was looking for students. And he had a NASA grant working on the Space Shuttle. And I was on Engineering Student Council. And someone told him I was interested in space, so he asked to see me. And then he showed me this picture of the Shuttle. And said he was the only department with a NASA grant. And that's how I became a ceramic engineer.

But that small group, we did work in teams. And he was very much -- had a relationship with all his students, and we had team-type work. I don't think that was true, necessarily, in

electrical or chemical or civil, because they were much bigger colleges -- or departments within engineering. But we were sort of more of -- almost a fraternity, you know, in the way with we interacted in Roberts Hall.

LK: You mentioned being part of the Engineering Student Council.

BD: Uh-huh.

LK: Did you join that body as a freshman, or can you talk a little bit about that group?

BD: Well, you know, I've been thinking about how did I get involved in that, and I can't remember. I guess it's just the number of years. But I wanted to because I was involved in so many things besides schoolwork as a high school student, and it was a way of interacting with students and so forth, and I wanted to continue doing that. So Engineering Student Council sounded interesting to me, and I was sort of surprised that so many engineering students weren't interested. So I thought, well, I'll volunteer. I think I -- I don't remember that I was elected, but I volunteered, and so then I participated in it.

LK: Were there other women participating in the Engineering Student Council at that time?

BD: I think there was at least one other woman on Engineering Student Council, yeah.

LK: What other student organizations -- engineering organizations, for example, student chapters, were there at the University of Washington at the time you were there?

BD: Well, I joined the student section of the American Ceramic Society. And then somewhere -- I think my junior I was inducted into Keramos, which is the student honorary. And that's based on grades and being elected into it. And it was a lot of fun. I don't think I was the first woman, but there hadn't been that -- there weren't that many. And so the induction ceremony is still -- you raise your hand and say, "As a brother of the fraternity" -- or something (Laughs) you know, "Keramos." And the guy that was giving me the oath started laughing, and I started laughing too. And I said, "Yeah, I'm a brother" -- (Laughs) "of the Keramos. And so those were the two technical societies that I belonged to as an undergraduate, the engineering societies.

LK: Did the program emphasize the importance of that, professional membership?

BD: Yes, very much. In fact, Doc Mueller, we called him, or Dr. Jim Mueller, was very much interested that his students become aware of and involved in professional memberships so they could carry that over to their professional life. So he encouraged membership in the student branch of the American Ceramic Society. We even went to the West Coast Regional meetings. It was a

requirement, a one-credit requirement as a junior and senior. And we'd take these bus trips to Portland, to San Francisco or San Diego to go to the West Coast meetings.

LK: I'd like to shift gears maybe and talk a little bit about the Society of Women Engineers at the University of Washington. How did you first hear about SWE?

BD: Well, I didn't hear about SWE first as much as I heard about this meeting that Dr. Peden was pulling together of all the new freshmen women engineers.

LK: Dr. Irene Peden?

BD: Irene Peden, yeah. And I think it was in the General Engineering Building, if I recall.

LK: What year was this?

BD: 1967. I think it was the fall of '67, somewhere in there. And I didn't know anything about the Society of Women Engineers at that point. And it was after that that I was introduced and then I started going to some meetings. And it was at one of those meetings that I was introduced to Shirley Holmgreen and, you know, some of the other women in this area.

LK: Can you talk a little bit more about the meeting that Dr. Peden arranged, that you're referring to?

BD: All I can remember -- remember, this is 1967.

(Laughter)

I remember specifically this room; it was kind of a casual room. It was kind of a meeting room. It wasn't a classroom. It did have couches in it. It seemed to me that you came in to General Engineering -- maybe even stepped down into it. You know, you have these little glimpses of memory -- and go off to the left.

LK: How did you hear about the meeting?

BD: I don't know. You know, I think about, how did I hear about that meeting? I don't know if I was contacted or how it happened, but I went to it. And I remember there were other girls there. And you know, it was kind of interesting for me, because I'd grown up with two brothers, you know, and I was very comfortable being around men and boys. And I'd never belonged to an all-girls group before. (Laughs) Even in 4-H when I raised steers, you know, I was the only girl in my class. So it was kind of interesting to see -- you know, to talk to these girls.

And also, at that point, I hadn't really encountered my statics professor yet. So I was trying to figure out, well, why -- I remember my first -- a question in my mind is, well, "Why do they feel, you know, that -- do we have a problem here?" You know, I was really naive. I said, "Do we have a problem here that we, you know, have to call the girls together?" Because I hadn't encountered, you know, any problems yet. And so it was kind of

interesting for me to find out, well, what's this all about. You know, why is there a Society of Women Engineers? I didn't know, you know, that for many years women weren't allowed to be part of technical societies. When I finally became a member of Keramos, you know, it was kind of amusing to finally be part of the brotherhood.

(Laughter)

BD: But I really didn't know all these things, so it was kind of interesting. And then I didn't understand. And even when I talk to my parents these days -- my dad is eighty -- he doesn't understand. You know, I look at my dad as probably one of the most enlightened men that I've ever known, and the same with Doc Mueller, and quite a few of the men that have mentored me along the way. But you know, not everybody is. And the Society of Women Engineers was born of the fact -- not because they wanted to separate, but because they were not incorporated early on, and necessarily welcomed.

LK: When Dr. Peden addressed the group, did she emphasize why a Society of Women Engineers?

BD: I don't remember that that part came out. I think what I remember -- see, I don't remember verbatim what she said. But the sense was that if we needed a place to come or to talk to that there were other people there that we could share our feelings

with, or get help with, or advice. And that's what I remember it coming out of. And that there'd be an opportunity to listen to and to interact with other professional women engineers through those meetings. And that's what I remember. And that's why I went to the student meetings.

LK: So you continued to participate in the student group?

BD: Yeah, as much as I could. I divided my time, you know, between that and... And the fact that I was recruited by Doc Mueller was kind of interesting, because while I think some of the other women were finding themselves excluded, maybe, from their student sections of their technical society, I was encountering exactly the opposite.

LK: As part of the Ceramic Society?

BD: Ceramic engineering department. So you know, because when the department chair, who has two daughters and he's your father's age, is out there recruiting, you know, the girls -- actually, he didn't -- was not recruiting girls. He didn't care. He just recruited me because he knew I was interested in space, and he was trying to enlarge the department. So that was nice to not have them care, just that you were another student, and to be able to say something and have it heard, and you know, understood, that your opinion mattered. That was a wonderful environment. So it took me a while to figure out that maybe that was a little

unique on campus. (Laughs) So I participated very actively in the student section of the American Ceramic Society, and then I went to the SWE meetings.

LK: It sounds like you had an early interest in space exploration and wanting to be involved in that as a career.

BD: Right.

LK: And you communicated that to as many people as you could?

BD: Well, at mixed times. I shared it maybe with my sixth -- well, my sixth and eighth grade teacher was the same teacher at the Outlook Grade School, Mr. Miller. And Mr. Miller -- it started because -- you know, even though I'd been reading science fiction and I had this interest, and I was in sports and everything, I was also kind of shy. I was more -- always receiving information, but not always sharing it.

And then in sixth grade he decided that we'd have this one session a week where he would read a book to us. He would read it, you know, and we'd listen, so he could enlarge our horizons because he had a captive audience. And one week he read the *Angry Red Planet*. Or, it was, you know, an installment a week. And I couldn't wait until he got to that installment.

So in the eighth grade when I had to go from Outlook School to Sunnyside Junior High, I told him, I said, "Well, you know, I

really want to do something in space. I want to fly in space. I want to build spacecrafts," you know, whatever. And he said, "Well, you're going to have to take algebra." And I didn't know what algebra was, and I hadn't even signed up for it. He was the first person to ever mention that word to me. And I said, "Well, what is algebra?" And he said, "Well, it's the math you're going to have to take to do everything else." So I signed up for algebra in the ninth grade. And it was not a requirement. And I know today that if I hadn't started down that path of algebra, geometry, trig, so forth, that I'd not be an engineer now. So that chance conversation where I shared that dream with him, you know, changed the course of my education.

But of course, there were other people that thought you were kind of crazy, you know. And I used to have to ride a bus back and forth to Outlook. It'd take about an hour, you know, each way, while they picked up all the kids out of the rural farms. And some of my friends thought I was crazy. I finally just took advantage of it; I convinced them I was an alien. You know, they wouldn't take me seriously, so I knew all the buzzwords. So I think I actually had a couple of them going at one time. But you know, just playing with them. (Laughs)

And then I didn't say much in high school because there's, you know, kind of a little peer pressure in there. And I don't

think I really shared it -- even though I told Mr. Anderson, you know, I wanted to do something technical, and he's the one that checked engineering. I don't think I told him that. When I came to the University of Washington though I remember sharing it with one professor who told me not to say anything because it would damage my credibility.

But when Dr. Mueller showed me the pictures of the Shuttle, I told him, and he didn't laugh. And in fact, for the next four years I went through school, when anybody from NASA came to visit or to review the research, he made sure that I could sit in on the meetings, or that I would meet them, or he'd introduce me. And sometimes the people he trusted, he'd tell. And nobody laughed. And you know, if it hadn't been for Doc Mueller, I'm not sure I would have met all these people in NASA. It was a wonderful experience.

LK: So he was very important in your life?

BD: Absolutely, absolutely. And he was always, you know, getting me in trouble until the day he died.

(Laughter)

BD: He'd sign me up for these things, I'd find out later. He'd tell me it was good for me, and I'd go, "Okay," you know. (Laughs) No, he was really great.

LK: How do you think the University of Washington has

evolved in its program and its student interaction and the mentoring that you were just describing in your own experience?

BD: Well, you could say, you know, subjectively, that it's a different environment. I mean, it's very proactive in terms of diversity. And then objectively, just look at who the dean of engineering is, Dr. Denise Denton. Okay. So I don't know how many women deans there are in this country.

LK: Not many.

BD: Not many. And so I think that's a statement.

LK: I agree. We talked about why you chose engineering and how you got involved in ceramic engineering, specifically. What was your first job?

BD: Well, my first job -- well, if you go back to an undergraduate, I worked in the summers on the Shuttle tiles as an assistant, you know, a technical assistant to one of the professors. Then I did some post-graduate work at the University of Illinois.

Then my first real job, actually, was with the Boeing Company, just after they had started hiring back in. They had a big layoff. And I was supposed to go into the materials branch, but they parked me temporarily in the department -- actually, it was in Boeing Computer Services, which had just started off. They knew I had Fortran IV experience. And they had, you know, all of

this computational capabilities, so they were looking for anybody with computer experience.

And I'd also, during the summer, done a lot of the work for the department on -- it was brand new TeleType capability. In fact, it's kind of funny. We used to do just batch cards, you know. You do the cards, take them down to the computer center, then they'd run the program through. Well, one of the summers I was working on the NASA grant, we had this really radical new technology. We had a -- did paper teletyping punch tapes, so you could do it remotely. Well, I was the only person in the department who could type except the secretaries.

LK: Oh, you're kidding.

BD: So, you know, I automatically got the job of doing the coding, because they needed someone who could type fast and do that. So I got very intimately familiar with all the computational capabilities there at the campus and then the department.

So when I went to work for Boeing, they knew that. And I said, "Well, I want to work in the materials group, you know, as a ceramic engineer." And they said, "Well, that position won't open for a while. Why don't you come work for Boeing Computer Services?" I said, "Fine." So they also put me through COBAL school, which is a business language. And I went to work first in

the main plant in Seattle, then down to Renton, and then eventually the Kent Space Center.

Well, a job hasn't opened up for -- you know, this so-called place that they were holding (Laughs) -- they were holding for -- wasn't open after about a year and a half, and I was getting a little bit frustrated. And Doc Mueller called me and said he had a NASA grant, and would I like to come back to graduate school for my masters degree. And he convinced me that was the right thing to do. And it was good timing, so I left.

LK: I'm wondering if we can talk a little bit about the -- just the magnitude or the experience of working on the Shuttle. I think that I take for granted, you know, how important or how outstanding the development of the Space Shuttle was. Can you give me your personal opinion about that?

BD: Well, the Shuttle really was revolutionary. We keep talking about evolutionary research versus revolutionary research. And there are people who criticized the Shuttle as being old. What they're forgetting is that there's no other Shuttle in the world flying, and it's the only vehicle in the world that takes cargo up and brings it back, and is reusable. And one of the reasons it's reusable is the thermal protection system, the ceramic system. That was revolutionary.

There were people who said it was impossible. You know, it

always had either a bladed skin, or you know, heavy ceramic nose cones that were too solid, you know, that would be -- if you tried to cover the entire shuttle with it you would never get off the ground, it was too massive. But this is made up of basically glass fibers, ninety percent air, you know, covered with a ceramic glaze. And there's, you know, 50,000 of them. A little less now, because we've substituted ceramic blankets for some of them.

But at the time, you know, 1972, and we base lined this design until the time we flew in 1981, nine years later, -- tremendous technological research that had to happen, and development and design. So you know, that and the main engine, which were the other big technology driver, we think about -- we did that in nine years, built a vehicle that flew and is still flying. It's just really -- to me it's still incredible.

LK: And how do you feel about being part of that revolution?

BD: Well, I look back, and I'm just so excited that I was so lucky. You know, Dr. Mueller brings me into ceramic engineering, I get to -- during one of my summers, I'm doing devitrification studies on silica fibers that make up the tile, doing x-ray diffraction studies on them. And then I go, you know, away, I work for Boeing. And I went to the University of Illinois for my graduate work. I went to Boeing. Then I spent a summer at Oxford. And I come back in October of 1976; I took a job with

Rockwell International in Downey, California. And they put me in production operations, and then send me out to Palmdale to start working on Columbia.

LK: And if I recall, that was also the first year that NASA made an announcement that women were -- they were calling out for applications for women to be -- for the astronaut program?

BD: Well, I had heard from Dr. John Buckley, who was at Langley and had reviewed our program at the University of Washington -- I had heard from him in the early '70s, that they'd probably be selecting women for the Space Shuttle program. And the formal announcement for that first class came out in 1977. And I applied for that class while I was an engineer at Rockwell. And I was a finalist. I was invited down to Houston to go through the physicals, and so forth. But I wasn't selected for the '78 class, but they offered me a job. (Laughs)

So I went back to my Rockwell management, and said, "Well, they've offered me a job. What should I do?" And at that time I was the youngest in my group. I think there's sixteen years that separated me from the next oldest person. So I was the least experienced. And there was some real concern that they would be doing a reduction in force, or a RIF as the Shuttle program wound down. And so my boss told me, he said, "Even if we don't RIF, your opportunities for getting promoted are going to be pretty

limited in this group for quite some time because of the high age -- you know, experience level." He said, "Why don't you take this job" -- it was as a payload officer in Mission Control -- "and if you don't like it, you can always come back. You have a place here." But he also knew I wanted to do whatever I could to enhance my opportunities to reapply for the next class.

And the job was being offered by George Abbey, who was at that time director of what was called Flight Operations, which was both mission control and the astronaut office. And he offered me the job, and I came back to NASA in July of 1978 as a flight controller payload officer.

LK: And then in 1980, you were chosen in the--

BD: Yeah, then I worked for two years. My first assignment was as a guidance and navigation flight controller for Skylab re-entry. You know, Skylab had been put up in the 1973 time frame. We'd flown nine people up there, three separate crews. And then we'd hope to reboost it, but Congress cancelled the reboost vehicle that was supposed to keep it up at a higher orbit, so its orbit started declining. And we needed to make sure that it declined into an appropriate place on the earth. So we reconvened a flight control team in late '78, after I got there. And I was one of the guidance and navigation officers. And we brought Skylab back in in July of 1979.

And then I was assigned to several payloads for the Space Shuttle. We were getting ready to launch in '81. And so I was helping to support the integration of the TETRA Satellite, which was that communications satellite we have up there. We also launched it on the Shuttle, and it's one of our communication satellites. And several other payloads that were going to go up. One of them was from Germany called SPAS. And then they opened up the applications for the '80s class. And I applied and then selected for that.

LK: I'm wondering if you could talk about the experience of working on these projects during the time -- what you just described. You were working as an engineer on these projects.

BD: Right.

LK: But were you interacting with other non-engineers and scientists, other scientific specialists?

BD: At Rockwell my primary interrelationships was with engineering, okay, because I was in the organization that specifically was doing design problem resolution and development work. So one of my very early assignments was to work with the Palmdale facility in setting up a tile production facility. And that was everything from, you know, calibrating furnaces to -- you know, it was all from safety to actual production to quality assurance. And that went back to my design experience in college.

I said, "Oh, this is fun." You know, I've got end to end, and I was teaching people how to work optical pyrometers. And I couldn't understand why I was being paid for that, because I thought, "Well, this is so simple. This isn't hard." You know, but they've never seen an optical pyrometer before to be able to gauge the temperature on a tile.

And then I would give briefings to the production folks out there on just ceramics. I would teach them all the right language to use that when NASA came to review with them that they'd know what devitrification meant, you know, just all of the key words and the definitions. Because I knew that the review teams would be asking, you know, the lead engineers there who didn't have any materials background, you know, key questions. And so I'd give some briefings there.

And then I worked on that for most of the time I was there. And then I had some other projects. One of them was we waterproofed the tiles. We subject them to a higher temperature and a vapor that's supposed to penetrate into the fibers and coat the fibers so they repel water. And it was a brand new process. And it wasn't working properly. So I was assigned to figure out why the process wasn't working.

So we brought one of these waterproofing units back down to Downey, hooked it up. And basically, I started characterizing it,

you know, from point A to point B. And it was fun. It was troubleshooting. You know, I'd sit there and go down. We'd check all the temperatures, all the pressures, all the chemical compositions. And then, you know, we figured out where the problem was. Basically the problem was that we weren't preheating our components hot enough, so when they got into the oven they were all crystallizing around the nozzle and not getting out to the tiles. So it turned out to be a real simple problem to solve, but it was one of the tasks that I was involved in.

LK: Throughout your career for NASA, do you find that as it has evolved you continue to work mostly with engineers as an engineer?

BD: No. Not -- of course, even as a flight crew member you're not working all with engineers. You're working with the scientists. And of course, in my career in the last twenty-four years, you're working with the American public. After flights we went to Congress and we met with -- you know, we explained what the program was to Congress. That was part of our technical visits. So, no, at this point in my career, I've worked with a very wide cross-section of the American public.

LK: Do you still identify yourself as an engineer?

BD: Yes, yeah.

(INTERRUPTION IN RECORDING)

LK: This is tape two for our interview with Dr. Bonnie J. Dunbar. It's March 3rd, 2002. Finally, I'd like to ask why you feel there's a need -- or do you feel there's a need for a Society of Women Engineers today?

BD: Well, the Society of Women Engineers invented itself with the future goal of going out of business--

(Laughter)

BD: -- because we felt that once women were integrated into engineering there would be no need for SWE. SWE was started because there were many professional societies that actually wouldn't let the women join. And in fact, when I started engineering at the University of Washington, I was very actively discouraged from studying engineering by a couple of professors. At the same time, I had a couple that were very encouraging, and remained mentors throughout most of my career. There was still a real debate and a dichotomy about it.

But women professionals wanted to be professionals, you know, in engineering. And if you couldn't do that through your home societies, whether it be, you know, mechanical or civil or electrical, then you need an environment where you can meet with other engineers and professionally develop. And that's how SWE came about.

Now, as SWE evolved, we started inviting men. And I think

there were men that became interested, because when we have our national meetings, it isn't a single engineering discipline that's represented. We're cross-disciplinary. So if you want to look at it historically, we actually became interdisciplinary before interdisciplinary became popular in the current environment. And I think SWE will stick around until, you know, women are completely accepted in this environment.

LK: And what do you feel your greatest contributions to the Society of Women Engineers, but also to the field of engineering, have been?

BD: Well, to the field of engineering, of course, I started out working on materials and ceramic engineering and working specifically on the Space Shuttle. And I think, from a personal point of view, my contributions in helping to set up the Palmdale facility for tile production, just as kind of a consulting ceramic engineer for production operations, but helping provide some education and maybe some guidance there was of help. And then as a professional astronaut, having flown five flights and conducted probably about 200 experiments is each time that I start working with an experimenter that's going to go on to the Shuttle, and that can occur anywhere from a year and a half maybe to two years before they fly, then I help with their designs. And I enjoy that.

We optimize the designs; we optimize the procedures. We look at the whole environment, the microgravity environment. In the case of one of the payloads I worked with which was exposed to atomic oxygen, we looked at how protecting it when we brought it into payload bay. So just a broad range of things there.

And I've chaired a couple of different committees for NASA on microgravity research, and one in 1987, and then an evaluation of the space station redesign in 1993. And I hope we brought something to the table for design and for the future of space stations, you know, in our development, through what we did in those collaborative meetings. That's probably it.

LK: For the Society of Women Engineers?

BD: Well, I think the Society of Women Engineers, maybe because I go out, just like many of the other women do, and I talk to young people, both men and women. I talk to young people about considering engineering careers. And I talk to both men and women, because engineering is a team effort made of men and women. So I don't just focus on the women.

So I think I help SWE by also talking to the men and the young boys, because they need to see women engineers. And they need to see us very just normal human beings who happen to be utilizing whatever tools and talents God gave us. And if it's engineering, it's engineering, just like if you're a nurse, and

that's what God gave you to do, and a talent, then that's fine. But we need to depart from a lot of the very stereotypical ideas about what human beings are capable of doing, especially as a nation, if we're going to continue leading into this next century.

LK: Do you have any further experiences that you would like to share?

BD: Oh, gee. Well, I've been very lucky. I've had -- I didn't seek mentors when I had them, and I've been very fortunate. You know, those that are inspiring, just as Dr. Peden and Shirley Holmgreen, and you know, Pete [Elizabeth] Plunkett, and many of the other people that I had the privilege of meeting at the University of Washington, Dr. James I. Mueller, Chair of the Ceramic Engineering Department at the University of Washington.

As I've moved out into the corporate world and -- well, actually in graduate school, Dr. Wendell Williams at the University of Illinois; when I came back here to graduate school, Dr. Suren Sarian was in the ceramic engineering department.

At Rockwell, I had a very supportive branch chief by the name of Mr. Robert Heisman. I remember my first trip out to Palmdale to help him with a furnace. And I was the only ceramic engineer -- actually, kind of the only engineer out there helping them. And I was getting a little bit of resistance. I couldn't determine whether it was because I was female or because they just didn't

want a ceramic engineer telling them how to make bricks, you know, and they were kind of treating it as a low-tech environment, when it's very much a high-tech environment.

So I found out that one of the leads there had called me a pushy broad, which was -- I was very young at the time, and wanted very much to please people as well as do my job. So I went back to Mr. Heisman, and I didn't want him to find out from anybody else that I was -- I wanted to do the best job possible. So I remember going into him and saying, "I'm having a little trouble out there. I want you to know that they've -- someone has labeled me as a pushy broad." And he looked at me and he says, "I only hire pushy broads."

(Laughter)

BD: And he said, "Let me give them a call." And whatever he did really made things a lot better. (Laughs) And so I've always been grateful to old crusty Bob. Yeah. And I'm sure he's retired by now.

Stan Yoshino, who was my chief at Rockwell, and a really great supporter as well. And then when I came to NASA, the person that hired me into NASA, Mr. George Abbey, who's been a mentor for twenty-four years, and just a really, really great person.

Dr. Carolyn Huntoon who was chief of Biomedical Labs, eventually became center director, but was also on my dissertation

committee, has been a really great person. I mean, she's just wonderful. She's retired from NASA now. But she really made it possible for women to become astronauts. And I don't think many people realize that Dr. Huntune probably was the only woman on the selection committee for maybe the first ten years. And she made it happen. And I hope history records that sometime. But yeah, Carolyn was just a wonderful person, and was on my dissertation committee, as I mentioned. And so I've always appreciated her.

So I've been very lucky to have mentors along the way, and people who inspire you, because you'll always find nay-sayers, regardless of what you choose. And I just looked at them as maybe having too narrow a vision of the world. And if they have a narrow vision of me, maybe they have a narrow vision with respect to other subjects, and so maybe you don't want them necessarily on your team. And that's their problem. I'm doing exactly what I feel I was meant to do.

LK: Well, thank you very much.

BD: You're welcome.

END OF INTERVIEW