JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

INTERVIEWEE MICHELE BREKKE
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is June 20, 2017. This interview with Michele Brekke is being conducted at the Johnson Space Center for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Sandra Johnson. Thanks so much for coming in today. We really appreciate it.

BREKKE: You are very welcome.

ROSS-NAZZAL: I wanted to start out by asking you about your interest in space as a child.

BREKKE: Okay. Well—

ROSS-NAZZAL: Go way back.

BREKKE: It's interesting. I didn't really have an interest in space until we landed on the Moon, but I was always a tinkerer and busy kind of girl. The other thing is I had an older brother, who was two years older than me, so I was always wanting to keep up with him. My dad was an electrician by training, in the military, but he was a salesman. He sold electrical equipment. Sometimes he took me on jobs—business trips—with him, so I got to see him in action. He had an interest in airplanes, and the new jetliners, when they started coming out in the late '50s or

whenever that was—early '60s? He and I would go and sit at the airport and watch the jetliners come and go, and I would just listen to him exclaim, "Man! That's a miracle." I just remember thinking, "Wow, how do they work?" I was always curious about how things worked. So I had the airplane thing and had the salesman thing—and I'll tell you how that comes in a little bit later.

I was interested in how things worked—not necessarily just planes or anything to do with space, because there really wasn't a whole lot of space in our lives until we got into the Apollo era. I am from Rochester, New York, so space wasn't on the headlines like it is down here in Houston. I liked to tinker with things. I remember taking apart a phone, trying to figure out how it worked. I also fell in love with *Star Trek*. There was a blur between reality and Hollywood at that age, and I thought it was possible. It was possible the [*Starship*] *Enterprise* would fly around in space and have a crew of men and women. It just looked possible and normal. That was what was going on in the background. I was aware of the Apollo test program, but not that much.

But then something very significant happened in my life on June 8, 1969: my older brother died in a tragic boating accident. He drowned. I was 16, and he was 18. Talk about being at an age where something like that was just the unthinkable. I never even imagined anyone would die, let alone in my family, let alone my big brother. Shock, confusion, anger, anxiety, grief, all those emotions when I was 16—remember, June 8, 1969. A couple of weeks go by, and we had the funeral. It was just horrible, because he drowned, and they didn't find his body for two days. For two days, we didn't know if he was alive or dead. It was just a very compelling, profound impact on me and my whole family.

A couple of weeks go by, and I start to realize he's gone. He didn't get to live his life. I am still here. I am only 16. I got my whole life ahead of me; I better do something with it. I've got to keep busy. I don't know if you have ever lost someone close, but what I found is I had to keep busy. Otherwise it was always on my mind. My brain kept going back to the whole thing. So I had to keep busy, and I had to stay busy to distract my mind from thinking about that.

About six weeks later, we land on the Moon for the first time: July 20, 1969. It was six weeks later. I was watching it on TV, watching Neil [A.] Armstrong bound down the ladder and bounce around on the Moon. I just remember thinking, "Wow! That looks like fun!" And: "It would take a long time to learn how to do that, so it would keep you really busy for a long time. I think I'd like to do that." It was just as simple, as complex, as that, as just wanting to have something that would keep me busy for a long time, something that I could reach for that wasn't right there at my grasp, and something that looked like fun. The concept of engineering—I probably didn't even know the word at that time. So it was, like I said, as simple or as complex as that. I just got very moved by the Moon landing, and the timing couldn't have been better.

Then the fun begins. I am Catholic; went to Catholic schools all the way through high school. When school started in the fall, I would go to the guidance counselor and say, "I want to be an astronaut. What should I be studying?"

ROSS-NAZZAL: What did they think when you told them that?

BREKKE: The nun said, "A what?" I just remember not getting anywhere with our precious faculty at my high school. I come home and tell my dad—the outgoing, gregarious salesman—and he says, "Write to your congressman. That's why we elect them."

So I wrote to my congressman; I don't remember who it was at the time. He writes back. I don't have that letter, but I have some other letters that are pretty interesting. He writes back and said, "It's very interesting that you, a girl, want to be an astronaut. Unfortunately, NASA isn't allowing women to be astronauts because they have to be jet pilots, and blah, blah, blah, blah." And so on. "Plus, you'd need a degree in science or engineering, or aeronautical engineering, and the capsules are not designed for the female anatomy"—namely, going potty. My first thought was "Wait a minute—doesn't this guy watch *Star Trek*?" There's women on the *Enterprise*! They figured out how they can go potty in space, so surely NASA—brilliant NASA, who sent people to the Moon—they'll figure it out.

I said, "Okay, so I can't be a pilot," and I didn't really want to be a pilot. I didn't have an interest in flying. I was more interested in how things operated, clearly the engineering element of it. So I said, "You know what? I'll take a look at this aeronautical engineering thing." I couldn't even spell it. Fast-forward, I started applying to colleges, and I really wanted to go to the University of Colorado [Boulder], because I wanted to go west to school.

ROSS-NAZZAL: It's a beautiful campus.

BREKKE: Yes. I didn't know anything about the school; I just knew Colorado must be beautiful. I had never been there. Well, I didn't get accepted to Colorado. I can't remember who else I applied to.

I played a lot of volleyball as a kid, and I continued to play as long as I could get to the ball in time, when I was much older. I played school volleyball and club volleyball, and my senior year of high school, my club coach moved to Saint Paul, Minnesota, to head up a YMCA

[Young Men's Christian Association]. We were keeping in touch, he and his wife, because his wife played on the team he coached. So I wrote him. I said, "Yes, I am looking for schools. I wanted to get in Colorado; didn't get accepted." This is all snail mail back then. He writes back. He says, "Well, there is a school down the street called University of Minnesota [Minneapolis]. Maybe they have what you are looking for." So I had that big, thick college book; we didn't have computers back then.

ROSS-NAZZAL: Right. Everything was print.

BREKKE: You are too young to remember.

ROSS-NAZZAL: Well, no.

BREKKE: We won't get into ages.

So I'm thumbing through—University of Minnesota. Oh, they have an aeronautical engineering [program]. I applied, and I got accepted. I got accepted to the University of Minnesota in aeronautical engineering two years after we landed on the Moon, and I decided I wanted to be an astronaut. That's part of the story. Maybe I should let you prompt me some more.

ROSS-NAZZAL: No, I think you're doing a pretty good job. What did you think of moving to Minnesota from New York? The climate is probably pretty similar.

BREKKE: I knew nothing about Minnesota. I was so naïve, just absolutely nothing. I didn't even know the Mississippi went up that far. I didn't know that it got 30 degrees below zero. I think I knew from watching football—I am a big football fan; I got that from my dad—that it snowed there, because when they had the games there in the winter, it would snow. So I knew it was going to be maybe similar to Rochester's weather, but I didn't know [about] the extreme cold. But back then, that cold didn't bother me.

I fell in love with the campus. My senior year, when I got accepted, I went out and visited the campus. I remember the taxi took us from the airport to the campus and dropped us off in front of the hall that I had a meeting at. Or we weren't sure where we were. It was snowing, a really light snow. Somebody walking down the sidewalk said, "Do you need some help?" real friendly and outgoing. I said, "Yes. We are looking for such-and-such hall." "Oh, okay. Yes. Go down there and turn that [direction]." And I just thought, "Wow, people are nice here." You know how your first impression is your first impression? I just thought, "Wow, people are nice here. The campus is beautiful. The snow falls nice and easy. I love it. Yes, I'm going here."

The other element of going west, not only to go west, but I wanted to get far enough away from home that I wasn't expected to come home very often. I was just ready to branch out and start moving forward. I didn't have to come home very often, and I didn't, maybe three or four times a year, holidays, that kind of thing. Minnesota ended up being a perfect fit for me.

ROSS-NAZZAL: That was a time when the feminist movement was going on. Were you interested in that at all?

BREKKE: No. Let me tell you about this. I had this big brother, and I never thought of him as a boy and me as a girl. I mean, obviously, I was aware of the anatomy difference, but when it came to doing things, I could do anything he could do, and I wanted to do anything he could do. It wasn't because, "Well, he is a boy and I am a girl, so I've got to show that I can do it." It was just because I wanted to. Then when all this movement came about and I heard about the burning the bras, I thought, "Why would you do that? That would hurt." So I was aware of it.

[I was also aware of the Vietnam war demonstrations.] We had a little bit of demonstration on our campus, and I was just curious what a demonstration looks like. I went down to—it was our armory, which is where the ROTC [Reserve Officer Training Corps] people met and trained. I just stood in the distance and just watched a little bit of the clashing. It wasn't that violent. I know the police were there. A couple of years ago, I ran into one of them where I live in League City [Texas]. We started comparing notes. He was from Minnesota, and I said, "I went to the University of Minnesota." He said, "Well, I was a policeman on campus in such-and-such years." I said, "Oh, my gosh. I was there then." I said, "There were some riots and whatnot." He said, "Yes, I was there." Isn't that weird?

ROSS-NAZZAL: That's funny. To think, of all places to meet and compare notes.

BREKKE: I loved Minnesota. The University of Minnesota, it was an outstanding education and environment. I got tons of stories about all the value that I got out of that education. Plus, I got to play volleyball.

ROSS-NAZZAL: I was wondering about that.

BREKKE: Yes. I didn't play my first two years, because the first two years in engineering, it's all math and physics. You are going to die when you hear this, but I was not a very good student.

ROSS-NAZZAL: Well, you are away from home. It happens.

BREKKE: I wasn't a good student even when I was a kid. I got Cs, because I knew I had to get a C to pass. That was my goal, to pass. I was too busy playing sports, doing other things with my friends, riding my bike. We played sandlot baseball, which, I grieve for the kids of today that they don't have the opportunity to play what I call "sandlot baseball," where they have to learn how to negotiate and how to solve issues without grownups around. Nowadays, all sports are organized. There is always an adult around.

My goal was to pass and pass I did. I was fortunate to get into the University of Minnesota, because I had maybe a C+ average. In high school, I was not on a track of classes to go into any kind of technical field. Back then, girls were pretty much [expected to become] homemakers. I remember taking flower arranging and some other things like that. So when I did finally decide to go into engineering, I had to take summer school; I had to take chemistry in summer school between my junior and senior year, squeeze that in so I could take physics in my senior year. I never did get any calculus in high school, so [I] get to the University of Minnesota, and the whole curriculum in freshman calculus is based on having some calculus in high school. I wasn't starting from ground zero—I was starting from ground -10. It was tough. It was tough. I had to really do something that I wasn't used to doing, and that was studying and working hard

just to pass. But still, it was like, "Okay, I've just got to pass." Because I did play some—not sandlot volleyball, but non-competition volleyball, and I just loved it.

So it was tough the first two years, and I did get to one point—I think in the second half of my freshman year—where I thought, "You know what? I don't think I can do this. It's just too hard. I don't understand this stuff." What could I do? Well, before I decided to be an astronaut, I wanted to be a math teacher. Even though I never had any high-level math, I liked math, because it's logical as opposed to English, which has so many exceptions. So you could see definitely I was cut out for a technical field, because the logic was what I had fun with and enjoyed. So I thought, "You know what? I'll just default back to being a math teacher."

I actually went and talked to a guidance counselor at the University of Minnesota. I think God sent him to me, because I remember him saying, in so many words, "Yes, engineering is really, really hard. You have to learn all those theories and equations, and you've got to memorize all that stuff. Then you have got to figure out which equation to apply to figure out the real-world problem to solve real-world problems. Yes, we here in math, we just memorize everything, and then we regurgitate it, and teach the kids." I think, "Well, wait a minute. I don't want to do that. I want to do that first thing you talked about that was really, really hard." So, darn. I said, "Thank you very much." I went back, and I never looked back again. I went back to hunkering down with the engineering classes and I never looked back again, because I knew if I gave up I would not be happy. I would not be satisfied.

ROSS-NAZZAL: You obviously ended up doing well, because you ended up going for a master's degree right after you finished, which I thought was kind of unusual.

BREKKE: Yes. So I get to the University of Minnesota, I am 18 years old, and I am in these classes that I could hardly even spell or pronounce, and I heard about master's degrees. I thought, "Wow. That must be for the really, really brilliant people," because I didn't think of myself as being very smart. I was determined, and I am the kind of person—I don't give up very easily, sometimes, never give up. I just thought, "Wow. I am so lucky to have gotten into a bachelor's program. Master's? I can't even think about that."

You go through the learning process, and a lot of college, I think, is teaching you how to learn. Obviously, you have to learn the content, but it's also teaching you how to learn. I started to learn how to learn. I started to learn how to study effectively, and how to ask the right questions, so that I was efficient, because I wanted to get out and play volleyball. I had to hurry up and figure this out. It taught me how to learn and then eventually, when I got into the upper-level classes, it's applications of the general physics and calculus, that's where you solve real-world problems, and that was fun. Still challenging, but I went from getting mostly Cs in the first two years to getting Cs and Bs, and an A here and there.

Then in my senior year at the U, I had a professor, Professor Heinrich, Helmut [G.] Heinrich. He came over with [Wernher] von Braun after the war, and there were actually many scientists that came over with von Braun. Of course, von Braun ended up in Alabama, that's Marshall [Space Flight Center, Huntsville] and Redstone Arsenal. Well, Helmut Heinrich [served as Chief of Aerodynamics at the Graf Zeppelin Institute in Germany during WW II. He joined the faculty of the Aeronautical Engineering Department of the University of Minnesota in the mid 1950s.] He was a wonderful old guy. He was quite old even when I was a freshman, and he became my advisor.

And so senior year: "Michele, it's time for us to talk about what you are going to be doing after you graduate." (I am not going to try to mimic the German accent, because I slaughter it.) He says, "You need to stay on and get your master's." "Why do I need to do that, professor?" "Because it'll set you apart from all those men that you are going to be competing with for jobs."

ROSS-NAZZAL: That was good advice.

BREKKE: That's what he said. It turns out I had met a guy that I ended up marrying, and he wasn't going to finish for another year, so staying on at the U actually made perfect sense. So it was from that advice to stay on and get a master's to set me apart—and by this time now, I had come to realize I could probably get a master's. I actually had that same feeling about flight directors when I first started working at NASA: "Oh, flight director. Wow! They have got to be the most brilliant people on the planet."

Dr. Heinrich, I have got to go back to him. What a character. He shaped a lot of who I became further on in my technical career, in my life. He ran a lab in the aeronautical engineering department, and it had a wind tunnel, and a water table, because air is a fluid, and a lot of times we do testing in water similar to the way we do testing in wind tunnels. When I got to know about this lab—I think they took us on a tour of it in our freshman year—I thought, "Wow! I'd like to work here. I want to push buttons. I want to see how those things work." So I went up to Professor Heinrich in probably beginning of my sophomore year, and I said, "I'd like to have a job in the lab," because I knew that some students worked in there. He said, "Well, let's think about that, and I'll get back to you."

A little while later, he comes up to me and he says, "Michele, do you know how to type?" "Well, as a matter of fact, I do." My dad had recommended that I take typing in freshman year, because everybody will always have to type. We didn't have computers then; it was just typewriters. He said, "You are always going to need to type, no matter what job you have, and it would be good to have a little fundamental skill in typing." So I took typing in my freshman year as one of my electives. "Yes, Doctor. As a matter of fact, I just took typing last semester." He said, "Well, I need a secretary." I said, "Oh, okay. Then will I get to work in a lab?" He says, "Well, let's just take it one step at a time. For now, we'll start being a secretary." "Okay." I know how to type; I'll be a secretary.

I worked—I don't know—maybe 10, 15 hours a week, and my typing was terrible. You know Snopake? Back then, when you made an error, you had to take the paper out, Snopake it out, and put it back in. I used so much Snopake when I'd put the letter down at his table, it would crack, but he would sign it. He didn't get calls very much, but I'd answer the phone. Periodically, I would approach him—because I didn't want to nag— and I said, "Anything open up in the lab?"

"Well, as a matter of fact, the guy that sews our model parachutes is leaving. Do you know how to sew?" "As a matter of fact, I do." My mother sewed almost all her clothes and a lot of mine, so she taught me how to sew as a little girl. "I do know how to sew." "So, okay. You'll be our seamstress to sew the model parachutes." The good thing about it is the sewing machines were up in the lab.

ROSS-NAZZAL: You moved a little closer?

BREKKE: I got into the lab, and I am a good sewer. It's very logical. These were small, 10-inch-diameter parachutes, so they were small. Parachutes are made up of triangular sections, they are called "gores." So I had to cut the gores, sew all the sections together with the tiniest of seam, and then string the strings for the parachutes. These parachutes were used in the wind tunnels to test—Minnesota had contracts with Honeywell, DoD [Department of Defense]; they had some foreign contracts. Some of the things were the Saab Viggen, which was [Sweden's] fighter jet, so there was a contract to test the ejection seat parachute for that. There was another contract to test spin-stabilizing parachutes. When an airplane gets into a flat spin and you can't get any control of the airplane, you punch this spin-stabilizing chute out and it causes the nose to dip, and the plane is controllable. That's just an example of some of the purposes of these parachutes. I got to sew these model parachutes, and I was good at it, and I was fast at it.

Then in comes a contract for 200 model parachutes, and Heinrich put me in charge of it. I still have the letter that I wrote to my parents. I said, "You are not going to believe this. I am in charge of making 200 parachutes, and they are worth $100 apiece. That's a lot of money I'm in charge of." So a parachutes seamstress I was, and eventually I did go up—the wind tunnel was actually a floor up, so I went up to the wind tunnel when the guys were [working]—and I was the only girl. But I didn't look at it that way. I was one of them. I was just doing my job as one of the guys. We would go up, and I'd see them operating the tunnel, pushing all the buttons. I said, "Dr. Heinrich, can I learn how to operate the tunnel?" "Yes, Michele, I think you can learn how to operate the tunnel." Long story short, I ended up running the tunnel, testing the parachutes that I sewed.

ROSS-NAZZAL: That's great experience as an undergrad.

BREKKE: Yes, I actually stay in touch with the University of Minnesota. They have kept in touch with me over the years. I think I am one of their daughters, their precious daughters. I just did an interview with their alumni magazine early in the year. That's why the story is a little fresh, because I told the story about Dr. Heinrich. He ended up dying two years after I moved here. He died in '79. He actually was in Houston when he passed away.

ROSS-NAZZAL: Was he?

BREKKE: Yes. He was doing some conference. I didn't see him here.

ROSS-NAZZAL: [That's] kind of unusual. So what sort of work were you working on once you decided to pursue your master's degree? Were you working on something different?

BREKKE: Move on to master's. I chose what they call option B.

ROSS-NAZZAL: What's option B?

BREKKE: Option A is you write a huge thesis—no class time. Option B is you take 44 hours of class and you do—I call it a "mini thesis"—a smaller thesis. I did option B, and another professor in the department arranged a part-time job with Honeywell for me. So I worked part-time at Honeywell, went to class, and then worked on the thesis. It was a two-year program, so I

took two years. It worked out good, because I ended up getting married, and he didn't finish up until one year into it. Then we had one year to be married, live, and so on.

The most peculiar thing happened in 1977, which was when I finished up the master's, NASA decides that they will open up applications for women to be astronauts. It was meant to be. Talk about the timing! I was just finishing up my master's, and there were some NASA people that I had been in touch with. I was a member of AIAA [American Institute of Aeronautics and Astronautics]. It's a trade association for aerospace engineering. It turns out I wrote a paper on a parachute that I designed and tested in the wind tunnel, a student paper, and entered it into [the AIAA student papers] competition and ended up winning that competition. That competition was in Kansas—it was regional—winning qualified me for the national competition in Washington, DC. I think it was in 1976, so it was halfway through my master's. Along the way, some NASA people had come to [Minneapolis] to give talks [at AIAA meetings], and I always went up afterwards and talked with them. So I make a connection with some people; I didn't know position names, but this one guy was called the "Associate Administrator."

ROSS-NAZZAL: Was that John [F.] Yardley?

BREKKE: No. Jesse [W.] Moore?

ROSS-NAZZAL: He ended up being Center Director here for a while.

BREKKE: And Rocco [A.] Petrone—which sounded to me like a boxer, he [is one that I remember] came and spoke. [He was Director, Launch Operations for Apollo 11.] I went up and talked with him afterwards, and he said, "Oh, I'm going to put you in touch with some people." Then I got letters from a Marvin L. McNickle who said, "I am going to put you in touch with Gerry [Gerald D.] Griffin." All these names and positions just didn't connect, but the fact that I was connected—and I had written to the Manned [Spacecraft] Center, which is what we are now.

Actually, back in 1971, when I first got to Minnesota, I wrote to the Manned [Spacecraft] Center saying, "I want to be an astronaut. I am in aerospace engineering. Anything else I should be doing?" That kind of thing. I got a letter from Bob [Robert R.] Gilruth [a University of Minnesota grad], who was Center Director at the time. I have that letter.

ROSS-NAZZAL: I was going to ask, "Do you have that?"

BREKKE: I have it. "[Your desire to become an astronaut is] commendable"—this is 1971—"[the very stringent requirements] to be an astronaut [make it extremely difficult for women to qualify]." It read a lot like what the congressman [responses] read, because he probably contacted them. It said, "astronauts [have been drawn from Armed Forces Test Pilot Schools], and [there have been no women graduates of these institutions]." Also, "the [equipment on board the spacecraft, such as for personal hygiene or waste disposal, has been designed for men]." I am thinking, "Well, wait a minute, this is NASA. Doesn't he watch *Star Trek*?" He did say in the letter that he did envision women [qualifying for the role of "medical doctor or scientist]" at some point in the future. [He recommended pursuing a Ph.D. in science,

engineering, medicine or mathematics to qualify for these types of roles.] He was a visionary; he just didn't see it in the real near future. [I just found out in March 2019 that George W. S. Abbey wrote that letter for Dr. Gilruth to sign. This letter is mentioned in book *The Astronaut Maker*.]

ROSS-NAZZAL: But he gave you a little bit of hope there at the end.

BREKKE: Yes. I figure, okay, I am on the right track. Where were we?

ROSS-NAZZAL: We were talking about '77 and the announcement.

BREKKE: The announcement comes out, and I apply. I can't remember when the application [was due], probably in the late fall of '76, because I am sure they allowed a lot of time to do the selection process. But anyway, I applied, and in I think February or so of '77, I got a call from Bob [Robert K.] Holkan at Johnson Space Center. "Oh, yes. Hello. This is Michele." "Yes. Hi, Michele. This is Bob Holkan at the Johnson Space Center, and I have your application here for astronaut. I wanted to let you know that NASA has been processing these applications not only for astronaut selection, but also for other positions on the ground. I am in the Crew Training Division, and I would like to offer you a job in Crew Training, to train the astronauts." Whoa. I am going to train them? Who is going to train me? I remember asking him, "If I accept this job, will that eliminate me from the astronaut [selection]?" He said, "Oh, no. Your application will still be processed, and if you come down here and get the job, we look at it as getting your foot in the door and having a leg up to becoming an astronaut."

"Okay. Let me talk it over." Not that I had anything to talk over. I did get some other offers—I think McDonnell Douglas and Rockwell—because I had to apply around, and even though they offered more money, there was just no way I was going to turn down a job at Johnson Space Center.

ROSS-NAZZAL: Did you know what Houston was like?

BREKKE: Never been here.

ROSS-NAZZAL: You had lived in Minnesota. It's so different.

BREKKE: Never been here.

ROSS-NAZZAL: The heat and the summers.

BREKKE: Knew nothing about it. We didn't even have air conditioning in our cars up there. So I am on the phone with Bob Holkan, who is just a wonderful guy. Do you know him?

ROSS-NAZZAL: No, but he has been on our list. We would like to interview him.

BREKKE: He'd be good.

I said, "Okay. Let me think it over. And, I have another thing here. I have a husband, you see, and he is going to need a job." Holkan says, "What does he do?" I said, "Well, he is

graduating with a degree in electrical engineering." He goes, "Oh, I know somebody down the hall that needs electrical engineers. Let me go check with them and get back with you." So they offered my husband—I am divorced now—but they offered him a job. We became a package deal. We loaded up our single-axle U-Haul with all our stuff that we had. We never had a house, so it was just apartment stuff. Our start date was July 5 of 1977.

ROSS-NAZZAL: Welcome to Houston.

BREKKE: We head down here in late June, and we had a van and no air conditioning. I remember getting to about Oklahoma, thinking, "Wow, it's getting kind of warm. Roll all the windows down." Then we cross the [state] border, and we stopped in Denton, Texas, to spend the night, because we had driven all day. I think, "Wow! It is hot here. They must be having a heat wave." We get down to Houston. I still remember driving down NASA Road 1, and I was looking to the right, and Bob was looking to the left. He goes, "And there it is." I go, "What? What? What?" "Over here." I look around, and I saw whatever the entry sign was at the time—it probably has changed—for Johnson Space Center and the big, tall Building 1. I said, "Wow. We are here."

ROSS-NAZZAL: So what was it like your first couple of days? You knew you were going to be training astronauts, but any idea of what that entailed until you got here?

BREKKE: My one memory is, I think we probably got here on maybe July second or third, and we spent the Fourth of July at Galveston. No sun block, nothing. We came home, and we were

like lobsters, skin peeling, the sting, and the pain. I remember that very vividly. Work started the next day, and I show up. Of course, the first—I don't know—few days or so is processing: getting badged, and doing all the processing stuff. I got introduced to Frank [E.] Hughes. You have probably talked with him.

ROSS-NAZZAL: We have interviewed him. I was going to ask you if you worked with Denny [John D. Holt] or Anne [L.] Accola as well.

BREKKE: Oh, all of them.

ROSS-NAZZAL: All of them?

BREKKE: All of them. Yes, Bob Holkan was the branch chief. [James W.] Bilodeau was the division chief; he [passed away some time ago]. Frank Hughes was my section head or group lead. They have changed terms over the years. Frank Hughes was my boss. I remember he took me around for a tour, took me to Mission Control and the simulator, the Shuttle Mission Simulator. I remember asking him a question about the NASA air traffic controllers, and he corrected me. He says, "We call them 'mission controllers.'" I didn't know. I just remember saying, "Air traffic controllers."

So he introduced me to the concept of Mission Control. Of course, I had seen Mission Control on TV as a kid. I was given some stuff to read and then given some assignments. Obviously, whenever you bring in a new hire, one of the important things is to give them something to do fairly quickly, or they'll get bored. [I got assigned to learn about redundancy

management] as well as ascent, guidance, nav [navigation], and flight control, which, I know one of your questions was "How did you learn about it, since you were one of the first ones in? Nobody had written anything about it." We had to read the software requirements documents. That's what we read to understand how things worked. We read the software requirements documents.

ROSS-NAZZAL: So that work with Honeywell came in handy, I guess?

BREKKE: Yes, I didn't tell you about the job at Honeywell, which was kind of neat. I did some programming. I hated programming. I knew I did not want to be a programmer. But I knew Honeywell built the IMUs [Inertial Measurement Units] on the [Space] Shuttle and the hand controller on the Shuttle. Singer-Link was also involved, because Singer-Link built the software for the simulators. So we worked a lot with them, because they were building the simulator to simulate the system that we were trying to learn and write manuals and instructional documents about. It was challenging to gather enough data and then to figure out, well, what do the astronauts need to know.

ROSS-NAZZAL: Did you look at Apollo documents prior to that?

BREKKE: No. As a matter of fact, they really didn't go back to Apollo; and Skylab was just finishing up. I think we might have already brought the last crew back. Then, of course, Skylab's splashdown was later. …

The other assignment I got was redundancy management. What is redundancy management? On the Shuttle, you had parallel systems. There were four computers that ran in parallel, and each computer had a string of avionics and electronics. Then when you got out to sensors, there were multiple copies of the same sensor. In case one fails, you still have a sensor. The software had to manage all those copies and all those parallel systems. The term that's used is "redundancy management." How do you manage the redundancy of all this stuff? That was another one of my assignments, to write a classroom briefing and a learning manual. Our products were classroom briefings, which were PowerPoints but not in the PowerPoint we know today.

They were those viewgraphs, those slides that you put on an overhead projector. You had text and graphics and draw pretty pictures. So our products were classroom briefings, the workbooks, and then there was a Flight Ops manual, which was a large, multivolume manual that was pretty much the bible of all the Shuttle systems. It was broken up into systems and sections. I had a section of that, and I had ascent, GN&C [guidance, navigation, and control], and I had redundancy management.

The first class I was ready to teach was this redundancy management class. It was fairly soon after I started—I'd say within three or four months.

ROSS-NAZZAL: That is soon.

BREKKE: Yes. I like that, because you have got to put some pressure on these kids, me, to not let them lollygag. I guess I was able to compile the information that fast. I remember walking into the classroom, and some of the astronauts were already there. Some were still walking in. I

walk up to the front of the class, and I turn around, and who is sitting in the front row? John [W.] Young.

ROSS-NAZZAL: Did you know who he was at that point?

BREKKE: Yes! I [had] seen his picture. Here I am, I was 24, fairly still new to Houston, and I'm like, "Oh, my gosh! John Young!" And then there was other—Vance [D.] Brand [I saw the Apollo-Soyuz launch, Fred [Fred W.] Haise, (Apollo 13)], Ken [Thomas K.] Mattingly—who weren't as visually familiar to me, but obviously, once I got all their names, I knew. That was a "ah-ha" moment for me, to realize I am standing in this classroom—at the front of the classroom, not in a chair, but up at the front—and I am going to be teaching these guys. It was all guys then, and one of them walked on the Moon. Yikes! It was just a very memorable moment for me, and I would do it all over again just to be able to experience that moment again. I have several of those kind of moments. I would do all this all over again. I wouldn't change anything, because I have so many moments that happened because of decisions I made that ended up being wonderful moments.

ROSS-NAZZAL: Your kids will like hearing that.

BREKKE: I will tell you a little bit about my kids, but we'll save that for later.

So I teach redundancy management, and I remember when I did the cover page—I have a little bit of a sense of humor, just a little bit. I did the cover page of the presentation, and this is how I did it. [Writes it out] [My] spelling [is not as good as it used to be].

ROSS-NAZZAL: Well, luckily, we are not going to put it up on the web.

BREKKE: Yes. I wrote it [redundancy] twice.

ROSS-NAZZAL: Just so it was clear.

BREKKE: Well, it was redundancy management, so that got some chuckles. It broke the ice and got some chuckles, and we got started.

So ascent, GN&C, and then I eventually moved into all the ascent activities. Flight control [includes] ascent, orbit, and entry. Then I became—I forget the terms; I think a "training lead?" I know [I] became a "team lead." Once we graduated from the classroom training and the workbook training—which we still had to do—then the simulations started in the SMS [Shuttle Mission Simulator]. I never did any training on the single systems trainers, because those were systems, as opposed to flight control, and I never was a system trainer. The only time I was in the single systems trainer is when I was a flight director, and I was being trained on the system.

So we started doing simulations in Mission Control, and I became a team lead. We had a team of about five people that covered the gamut of the Shuttle systems. Usually, there was a propulsion person, an environmental systems person, a computer, a DPS [Data Processing System] person, flight control, and then whatever other systems there were. [A team was] about five people. I became a team lead, and then I did training management, which was working up the lesson plan and making sure that the lessons connected and built appropriately, because it's

all about bite-size chunks getting to the crew. You can't just throw them in and throw everything at them all at once. You have to introduce things gradually, so we had to build training flows for the crews.

I was ultimately assigned as the lead for STS-3. I still worked [STS]-1 and [STS]-2 as an instructor, because we were actually running the simulator at least two shifts a day, and on Saturdays, because I remember there was a time where I had to work every sixth Saturday. We probably had six training teams, so every sixth Saturday I had to work. We were running the sims for STS-1, STS-2, and STS-3 all in parallel, because they were all fairly close together. Then I became the STS-3 lead.

ROSS-NAZZAL: How did the SMS work? From what I understand, it wasn't working very well initially; that it was sort of problematic.

BREKKE: Well, first of all, it worked quite well, actually. There was a fixed base, and there was a motion base. On the motion, it did just what it says it is. It flew to whatever was happening with the machine, with the vehicle. Then the fixed base, obviously, was fixed. The nice thing about the fixed base is it had the aft panel mocked up, so they could do training on the aft panel. The motion base just had the forward cockpit.

Initially, yes, there were some software glitches, mostly in the operation of the simulation. I remember when the sim [went] down, the cursor would flash purple. Instead of an hourglass, which we have now, there was a cursor, where, when you were typing, that's where the typing was, obviously. It's like when you move the pointer to click on something, that puts the cursor there. In these old machines, there was a flashing cursor—these were the old green

screens. They eventually got color. So you had the green background with white text, and the cursor flashed white. But when the simulator—when I say "crash," I mean the software stopped. It didn't physically crash.

ROSS-NAZZAL: The nose didn't [come down].

BREKKE: Right. The cursor would change to purple. So it became known as the "flashing purple cursor." You can imagine the graphics that spawned from the flashing purple cursor. It was growing pains. It was a complex simulator, a very complex simulator, but it eventually got pretty reliable.

There was one area that I knew there was something wrong. When John Young and Bob [Robert L.] Crippen were in there, it was STS-1 training. After the external tank separation—so the Shuttle launches, lose the SRBs [solid rocket boosters], continues, and then loses the big external tank. The Shuttle was upside-down, because it allowed the crew to see the horizon and the tank. I think that's the way it was. John would take over manually and fly the orbiter away from the tank, and I knew that the automatic software was supposed to do that. I would question him: "Why are you taking over manually?" He would say, "Well, [if I don't, we will recontact the tank], and I know that's not right, so I had to fly it." So I thought, "Okay. Something is not right."

I contacted Engineering—you were asking how much [I was] working with Engineering. I remember the guy was Barney [B.] Roberts, and he was the Technical Lead on the control system for the ET separation. So I explained to him; I said, "John Young keeps taking over manually, and I know there is automatic software, so something is not right." "Okay. Let me

come over and see what's going on." He came over to the simulator, and he watched a couple of runs and saw what was going on. It turns out there was an error in the simulation of the jet firings of the Shuttle, such that when the Shuttle fired the jets to separate from the external tank, not all jets were simulated to be impinging on the external tank. The dynamics of it was not correct, and the [orbiter] was pitching down. It shouldn't have been. That ended up getting corrected. It was just an error in the simulation of the impingement of the jets on the external tank.

ROSS-NAZZAL: Did that happen very often, where you would touch base with Engineering or Rockwell engineers?

BREKKE: It must not have happened very much. That particular one I just told you about was very vivid. I don't think there was really anything else in my area. There might have been some other areas that had some errors, but that was really the only one I remember.

There was one time where we were calibrating something, and we needed one of the pilots to get in the simulator and put in pulses on the hand controller to generate a square wave.

ROSS-NAZZAL: I'm not sure what a square wave is, being a historian.

BREKKE: Oh, you'll get this. You can have something that goes like that—that's a rolling wave—or you can have something that goes like that. [Demonstrates] So we need somebody to generate this. This would be pretty easy. You just [makes buzzing sound with a long duration followed by a shorter one]. This had to be very—

ROSS-NAZZAL: Very precise?

BREKKE: Have you ever watched air shows where the guys do the flips?

ROSS-NAZZAL: Yes.

BREKKE: I look at that: "They are doing square waves." So we needed somebody to [input] square waves. I don't remember what we were doing, calibrating something. Vance was selected; I don't remember how. I just remember when I looked at the strip chart of the hand controller inputs, and it looked exactly like that, a perfect square wave. You would think a computer would be the only thing that could do such a perfect square wave input, but Vance did it. As pilots, they had to be the best of the best.

ROSS-NAZZAL: One thing we didn't talk about—I just want to go back—I was curious if you wanted to talk about getting the letter saying you hadn't been selected as an astronaut.

BREKKE: I actually got that after I had moved down here, so I was already working here. I get this skinny little letter—which I did not keep—saying, "You weren't selected." I was having so much fun doing what I'm telling you about that I thought, "Well, that's okay, because I am staying busy. I am having a blast, and I am working with the astronauts." I actually didn't apply again for quite a while. I did apply again many, many years later, but I just thought, "I am just having so much fun on the ground." The idea of starting a family at some point was—it wasn't

immediately on the horizon, but it was there, and I didn't know what it would be like trying to combine family and a career. So I thought, "You know what? Let me give this some more time, and see how this goes.

I wasn't that disappointed. Looking back on it now, it's truly about the journey, not the destination. From 16 through 24, that was preparing me for this journey, and that destination itself, it was something out there, but it was just all about the journey and the preparation, getting ready to be able to do what I did.

ROSS-NAZZAL: And you have had a pretty amazing career.

BREKKE: It's just been fun. I tell people I just did my job, and I love doing it. There were some jobs that were just particularly satisfying. I know you were asking about the interfacing—I am jumping ahead—with the payload customers. Oh, I loved that. I thoroughly enjoyed that. What I liked about it is I had to explain my side of the information at a level they could understand it. I wanted to be a teacher, and that whole challenge of knowing information here and having to get it across to somebody who doesn't have the same basic information that I have. I just really enjoyed that. I loved the variety, all the different types of payloads that we flew, and the different customers.

I always thought of the payloads person as being somewhat of a salesman, where you are having to sell the capability that the Shuttle has, and getting that to match up with what the requirements are of the customer. A lot of the customers would say, "Well, how high can you deploy me?" We'd have to say, "What's your requirement?" "Well, how high can you go?" I said, "What's your requirement? And I'll tell you if we can do that or not." So having to sell,

"This is our capability; you have got to tell me what your requirements are." I just really enjoyed [that], and I got to do that as payload officer, and then in my job in the Shuttle Program when I became a payload integration manager, and then also as the flight manager.

ROSS-NAZZAL: You have quite the career. I am looking forward to hearing more about all of those things.

BREKKE: How are we doing here? Holy smokes.

ROSS-NAZZAL: Yes, it's amazing. We have had people we have invited them in, and we'll ask one question, and three hours later, it's like, "Well, time's up." You never know. People say, "I don't have that much to say." "No, we think you have a lot to say." You never know.

I did want to ask, though: were there other women besides Anne Accola working in flight control at that point?

BREKKE: Susan [L.] Creasy. Susan is a very good friend of mine. She was a co-op here before I came on board. She was a co-op, I think, in Engineering and then she was hired into Crew Training maybe a month or two before me, because she was physically already down here. I came on board July fifth, and we became best friends probably on July sixth. She has a wondrous career here also. She retired a couple of years ago.

ROSS-NAZZAL: We'll have to see if we can put her on the list.

BREKKE: Yes. I think it would be good for her to come in.

ROSS-NAZZAL: Yes, absolutely. And like you said, it would be nice to get more female voices.

BREKKE: Yes, so, Susan Creasy. I am sure if I give some thought to it, I can think of some other ones.

ROSS-NAZZAL: Oh sure. I am always curious about it, because Sally [K.] Ride mentioned when she came to JSC as part of that new group of astronauts.

BREKKE: The Thirty-Five New Guys?

ROSS-NAZZAL: Yes, she said the number of technical women at JSC just doubled, and I thought that was kind of humorous. I know there were probably a lot more technical women than that, but that really just speaks to the fact that there weren't a lot at that time.

BREKKE: Yes. They did bring in, I'll say, a significant number of women in '77, because that was when, from a funding standpoint, funding codes opened for Shuttle. They brought in a lot of new hires then. I didn't really take note of how many women—and I mean, it was, "Okay, there are some women here." When I was in college—and you had asked—in the first two years, it was general engineering, physics, and calculus, and there were women in those classes, not very many, but there were. Then in the aerospace engineering, I was the only one until, I think, in my

junior year, one other gal came in. That was that. I think I was the only woman doing a master's at that time.

ROSS-NAZZAL: That seems to be a common thread for a lot of women who work at NASA, at least during that time period. They were used to being the only one, and it was no big deal when they came here.

BREKKE: Yes, when I came here and I was sitting in meetings, and it was mostly men, no big deal. One thing I really took note of—and this was maybe 10 years ago, maybe a little more—I walked into a meeting, and I looked around the room, and it was all women.

ROSS-NAZZAL: That's unusual.

BREKKE: Now that I noticed.

ROSS-NAZZAL: That's quite a change.

BREKKE: It was all women, and it was the women representing whatever the system or the element was that the meeting was about. I thought, "Well, pretty cool."

ROSS-NAZZAL: I wanted to ask you about STS-1. I always like to get people's remembrances of that first mission. What are your remembrances of that?

BREKKE: The actual mission, I was nine months pregnant.

ROSS-NAZZAL: Oh, my gosh. So you were on baby watch.

BREKKE: I was pregnant, and I was due on April 17th. Of course, back when I was pregnant, the launch was probably closer, and then it slipped some. I remember on the SMS, we did something—I don't know if you remember this. The T-38 pilots, when the Shuttle was coming in for a landing, they would fly next to them. They had these T-38 chase pilots. The chase pilots would call out the distance from the [main] landing gear to the ground, to give the commander an idea of how far he is from the ground.

We simulated that. We had a strip chart recorder, and one of the instructors would stand and watch the recorder and call out on the loop to the crew the distance, because you could read it off the strip chart. I was the T-38 pilot on one of the sims. Denny Holt was there, and I remember him saying, "That's probably the only pregnant T-38 pilot we'll ever have." My son was born one week after STS-1 landed. He was born on the 21st.

So my memory of the actual flight, well, I didn't have any role during the flight, because I was an instructor. I probably listened to the loops some of the times. I really don't have much of a memory of the actual mission. I know it was short.

ROSS-NAZZAL: Very short, yes. But, you know, you were pregnant, and expecting the birth of your first child.

BREKKE: Yes, but I was still working. I worked right up to the day I delivered, because why not? I wasn't sick.

ROSS-NAZZAL: Did they have maternity leave at that point, or did you take much time?

BREKKE: Well, you had to take sick leave. I could take sick leave or vacation time. You could combine whatever paid leave you had. There wasn't specifically maternity leave.

ROSS-NAZZAL: How long did you take off?

BREKKE: I took three months off.

ROSS-NAZZAL: Three months? That's nice.

BREKKE: Three months. I had three kids, and three months for each of them. After three months, I was ready to go back to work. I had my bonding time with the baby, and I always arranged childcare that I was fully comfortable with and happy with. Do you have kids?

ROSS-NAZZAL: I have a son, yes.

BREKKE: Yes, so you've done some childcare. You know what it's like to leave your precious little miracle with some stranger. You want to make sure it's a good place. I did the homework and made sure that they were staying in good places, and it worked.

I do have one interesting story. Joey was born April of '81, and he must have been about one and a half or two. This is probably after I moved into payloads. I'm jumping a little bit ahead, but I remember this because it's relevant to what we were just talking about. It was early in the morning, and he came running into the bedroom. I was still in bed. He came running into the bedroom. He tripped and fell and hit his head right on the edge of the bed frame and split his forehead open. Of course, it bleeds like the dickens. Well, I was supposed to be on console. I forget the time, but it was a little bit ahead, and oh, my gosh—got to take him to the emergency room. We took him to the emergency room, and they stitched him up, got him home. I asked the doctor, "Is it okay for him to go to daycare?" He said, "Yes, he's not sick. He'll be fine." Got him home, got him dressed, took him to daycare, and I got to my shift on time.

ROSS-NAZZAL: On time? Wow. That was really good parenting.

BREKKE: I just thought, "See? You can do it. You just have to want to." I used to say that, "You just got to want to." You really got to want to sometimes, because sometimes it's pretty challenging. I just thought, "Wow. Splits his head open, and I still get to work on time."

ROSS-NAZZAL: That was something that I did want to ask you about, because Rhea [Seddon] talks about, in her book, how they just found out they were going to have a baby. They actually released a press release, which is kind of interesting to me. She remembers all of these female engineers and flight controllers congratulating her and saying, "Well, here is some information about daycare or babysitters." I was curious if you were one of those women.

BREKKE: No. I wasn't. I saw that on your list. I am thinking that that was after Joey was born, maybe; I don't remember. I actually didn't have a whole lot of contact with Rhea. I did have a lot of contact with Sally, because we played on a volleyball team together.

ROSS-NAZZAL: Oh, did you?

BREKKE: That's another thing. When I came down here, George [W.S.] Abbey—of course, I don't know if he knew I played volleyball for the U, or if it just became known because he knows a lot. I was asked to join the astronaut/Mission Ops volleyball team. It was Sally and me—Dianne [J.] Murphy. She is another lady that was an instructor. Sally and Kathy [Kathryn D.] Sullivan. So Kathy and Sally; Anna [L. Fisher] I think was on the team; I don't think Rhea was on the team. So I kind of got connections because of that, and then later on, because of assignments, I worked very closely with Sally. I have some great memories and some stories of working with her.

I worked with Kathy [Kathryn C.] Thornton. She wasn't in the first group, but she came on [in 1985]. She did one of the Hubble servicing—I think it might have been the first Hubble Servicing mission. She was the one that threw the solar array overboard. On the servicing mission, one of the objectives was to change out the solar arrays, because they were warping. When something warps, it's hard to roll it up. One of them rolled up, and then they put it back in the cargo bay, but the other one wouldn't roll up. The only option was to throw it overboard, so Kathy Thornton was the one to do that. I still have this picture of her standing up on the robot arm with this huge solar array in her arms, and then the crew counts down three, two, one, zero,

and then she lets go, and then they pull the arm down to get some separation, and then eventually fire the jets to get more separation.

So I had some interfacing with her. She gave me some really good advice that came in handy a lot of times. We went out to dinner one night—we were at Marshall for some training—and she said, "Michele, if you guys"—"you guys," console people—"come up with a plan, please tell it to us the night before. Don't wait until the morning of to tell us the plan. Give us the plan the night before so we can digest it and maybe think of some questions." Sure enough, during the mission, when they had to figure out what are we going to do with the solar array, they radioed up, "Heads up. Tomorrow, you are probably going to be throwing this solar array overboard." "Oh, great!"

ROSS-NAZZAL: That paints an interesting picture.

BREKKE: Yes, I think Milt [J. Milton] Heflin was the lead flight director on that.

ROSS-NAZZAL: Which, by the way, I forgot to tell you, he said hello. We are doing a series of interviews with Milt as well.

BREKKE: He is a cool guy. He is a very cool guy.

ROSS-NAZZAL: He is very nice. He has been very helpful.

One of the things we didn't talk about is STS-3, and I wanted to talk about that a little bit, because you were a lead instructor for that mission.

BREKKE: It must have been unremarkable, because I don't have a lot of memories on it. Clearly, it was [Jack R. Lousma] and Gordo [C. Gordon] Fullerton. We landed at White Sands [Northrup Strip, New Mexico] on that mission—the only time—and got a lot of sand in the Shuttle, and that's when they said, "We are never landing here anymore." I just don't really have anything remarkable to say. I think all of the early crew, because of the slips in the launch dates, were trained very, very well, and it's probably okay to say they were over-trained. They just had so much training, they were ready to fly, but then the launch wasn't ready. I just don't remember really anything about that mission.

ROSS-NAZZAL: Kind of a vanilla flight, I guess, for you?

BREKKE: Yes. Plus, that's where I was starting—and I know it's one of your questions: "Why did you leave Training?" I never worked in—the SCA?

ROSS-NAZZAL: The Sim Controller Area.

BREKKE: Unless you call that the instructor station.

ROSS-NAZZAL: You know, you would be the one to tell me.

BREKKE: I thought the Sim Control area was the room over in Mission Control just outside of the front room.

ROSS-NAZZAL: Yes. Outside of the front room. Yes.

BREKKE: I never worked there.

ROSS-NAZZAL: I thought you had.

BREKKE: I didn't become a Sim Sup [Simulation Supervisor]. That would have been the progression, from the SMS team lead progression to a Sim Sup, which Denny Holt knows all about. I had decided that training was getting a little repetitive and not as challenging as it was, and that I wanted it to be. I think was probably somewhere maybe after STS-3. It was 1982.

ROSS-NAZZAL: I think that's what you had on your resume.

BREKKE: I can't remember what I said to who, with the exception of one person. I call up Gene [Eugene F.] Kranz's office. "Hi, this is Michele Brekke. I'd like to have a meeting with Gene." "What's this about?" "I would like a new position."

ROSS-NAZZAL: What was his reaction? And the secretary's reaction?

BREKKE: Well, they set up the meeting. I think by this time, I had garnered enough respect that the thought was, "If she wants some change, let's see what she's interested" kind of thing. I am sure I had talked with Frank Hughes and Bob Holkan, and maybe they suggested to call him; I

just don't remember. I just remember I got a meeting with Gene Kranz. I went in there, and I had my notes, "Hey, training is a getting a little repetitive for me and not quite as challenging. I have looked around. I found out about this payload integration activity that one of the other divisions does, and I think I would like to do that. The reason I would like to do that is because payloads change every mission and that sounds exciting to me: a new challenge every mission. You get to work with external customers, and that's appealing to me because I get to be my salesman kind of thing. It sounds like fun."

I did not know about the payload officer position. I did not know about that. I didn't understand that there was a front room position for the payload officer. I just saw it as an integration job to get all the requirements and do all the work so we could fly the payloads.

Gene, he says, "What about the FAO position, flight activities officer? That's challenging, and [so on]." I said, "I don't know. It sounds like it still might be not quite what I'm looking for." I'll tell you in a minute something I learned afterwards. "I think I really want to do the payload integration." He okayed it. What I found out afterwards is Gene was not certain that we needed the payload position. He originally was of the opinion that the flight activities officer could do that job as well.

ROSS-NAZZAL: Interesting.

BREKKE: Yes. Denny Holt explained that to me years later, and I'm sure that's why Gene suggested the FAO position, because he thought they could do it anyway. "No, I really want to do payloads," so he okayed it. I went over to payloads, and I ended up working for Jim [James D.] Shannon, John Shannon's father.

ROSS-NAZZAL: I didn't realize he had worked out here.

BREKKE: Yes, yes. Jim was, I think, the branch chief. I moved into payloads in '82, and I got assigned the area of the PAMs—I know you know what those are, Payload Assist Modules—and the communication satellites, and really enjoyed coming up to speed on all of those. The first mission, STS-5, the timing was perfect. I got over there shortly before STS-5, and so I had a [position in the] back room to [the payload office position].

ROSS-NAZZAL: Well, there are different ones, like the Staff Support Room, and SPAN [Spacecraft Analysis Room], and MER [Mission Evaluation Room], but I am not sure.

BREKKE: I think "FPSR" is what they call the back room: "Flight [Planning] Support Room"—I don't know—back room to payloads. You had two people in the back room: systems and data. The data person sent commands [to the payloads], and the systems person was the expert on how the payload operated. That was my first job there and not a whole lot of memories about that. It must have been fairly non-eventful. We launch and then two hours later, we deploy the satellite, and the job is done. Working communication satellites, it was nice in that you had a very short stint on the mission. On the other hand, it would be nice to work the whole mission, to see it end to end, which I did sometimes. So that was STS-5.

STS-7, that was Sally's first flight, and that had two PAMs on it. I had to go back and do my homework.

ROSS-NAZZAL: I was looking at all the flights, and that was one consistency I noticed on all of them, they were all PAMs.

BREKKE: Yes. I was assigned to PAMs, and then I did have one RMS [Remote Manipulator System] deployable, which I'll tell you about.

You were asking about certification. I was an instructor; back then, we didn't have certification. I think we were declared certified by word of mouth and by performance appraisal. There was no certification checklist that I remember. So when I went over from training to payloads, I didn't come with any certification. I did the back room, and my very next assignment was front room, which would be totally unheard of today. Mike [Michael W.] Hawes was the other payload officer for the other PAM, so I came in and sat front room for one of them, and he for the other. I can't remember which one I did, either ANIK or PALAPA. I eventually worked them on future missions, because I remember working with the Indonesians and the Canadians; I just don't remember which one I did on that [mission]. Mike and I kind of tag-teamed each other. He had already worked in payloads for I don't know how many years, and it was to give me some experience in the front room.

And then [STS]-41B, that's where we deployed WESTAR and PALAPA.

ROSS-NAZZAL: Were you on console then?

BREKKE: Yes, I was front room. I can't remember if I did both of them or just one of them, but I was not involved in the decision to go ahead with the second one. That was one of your questions. I was just made aware, they have decided to go ahead with the second one. I said,

"Okay." I was of the belief, "What's the likelihood of having another problem?" Well, that was a lesson learned there.

ROSS-NAZZAL: You mentioned that you got to work with all of these external customers. Were you traveling abroad to work with them, or were they coming to Johnson?

BREKKE: It was a little bit of both. I never went to Indonesia, and I didn't go to Canada for ANIK. I went to Canada for other stuff in future positions. I did go to Germany and Holland. I went to Germany maybe five or six times. I had more assignments later on in my career that took me to Germany, but for this, in my payloads position, I don't think I had any foreign travel, now that I think of it. It was later on, when I was a flight manager and a payload integration manager.

ROSS-NAZZAL: So they would just come to Johnson, and you would figure out what their requirements were?

BREKKE: Right, and on the phone. Indonesia, Canada, Germany—you have telecons, and then periodic face-to-face meetings.

ROSS-NAZZAL: How much did you have to know about the satellite itself?

BREKKE: Well, that's not written down anywhere. My answer to that is you have to know enough to the point you are comfortable to be able to deal with any what-if you can think of.

More important than having the answer is knowing where to go to get the answer if you don't have it. You had to understand the payload enough to be comfortable with it and to know where to go if you had some question or issue. The answer to that is not written down anywhere.

ROSS-NAZZAL: Did you help train the crews on those deployments, and about what it was they were working on? Or was that a separate affair?

BREKKE: No, there was a whole different group. It was the group I left. They did training. So had I stayed in Crew Training, I probably would have realized I could move over into Payload Training, but I didn't stay. There were payload trainers that would train the crew on all that. We had to understand the system, understand the interaction with the Shuttle, understand what the Shuttle services were that were being provided to the payload, understand the various positions—NASA positions—that had a stake in the activity, like the flight activities officer, the guidance and nav, because you had to point the orbiter in the right place to deploy it. We were the integrator. We were like the face of NASA to the payload customer.

ROSS-NAZZAL: You mentioned the flight activities officer, so were you working with them and the timeliner to determine when this was going to be deployed, and how long it was going to take?

BREKKE: Yes. They came up with an opening volley. Since they knew all the constraints—we had to document all the constraints: the altitude the deployment had to happen at, the apogee and

perigee—where we had to be in the orbit when we deployed the payload. They had all that data, so there wasn't a lot of negotiating.

It was mostly the FAO coming up with a day timeline that worked for the crew. The FAO had to protect the crew and make sure they are not overworked, underworked, had time to eat, had time to sleep, had some downtime to just breathe. There was a template—let's say a two-hour block—that it takes the crew to deploy a satellite. Let's say that. So they would take this two-hour block and insert it into the timeline, which still allowed time for the crew to do their dinner and presleep, and go to bed without exceeding the limits. So there wasn't a whole lot of negotiating there, and the people that worked under the FAO wrote the actual procedures, which I always found somewhat confusing, since the payload officer was the one that negotiated all the requirements and made sure they were all documented. … We just had to work closely with the procedures writers to make sure everything was coming together.

Now, one thing that I did on a mission that I worked that was not a PAM—actually, looking at the list here, that was the only one. It was the ERBS [Earth Radiation Budget Satellite]. That was my big challenge, I guess. This was a Goddard [Space Flight Center, Greenbelt, Maryland] payload, not that it was any different working with Goddard than it was working with Canada. The Goddard guys were great. This ERBS was an RMS deployable. It was another government project, so there was sometimes, "We are NASA, too, so we need to do it this way. Take care of your own," kind of thing. Not anything unreasonable.

There was a lot of communication with the Goddard Control Center for the ERBS, because they controlled the ERBS once it was deployed from Goddard. So you had Mission Control in Goddard and our Mission Control. I needed to choreograph the activity leading up to the deployment of the satellite, because Goddard had to send some commands to configure it, the

crew had to throw some switches, and then we had to send some commands. There was this choreographing, so I ended up writing this choreography for the control center communication.

That was the closest I got to writing a procedure, and that's the one where I worked real closely with Sally, because she was assigned to be the arm operator to deploy the satellite. I remember one time, she had just recently been assigned to the mission, and I was already working the payload. That happened often, where the payload officer was assigned to the payload before the crew was assigned. The crew would usually come to the payload officer and say, "Hey, I am assigned to the mission. [Please] "bring me up to speed" kind of thing. So I brought Sally up to speed, and a few weeks later, she misplaced or lost her binder where she had all of her notes. She called me one day and she said, "Michele, can you do me a really big favor and collect the information that you gave me, because I have lost my binder." I said, "Sure." So I built her a care package, took it over to her.

I did travel with Sally for some training sessions, since there was quite a handshake activity where the crew had to send some commands, ground had to send some commands, Goddard. We trained together, and I think we went to Florida one time, where they had a simulator, and we practiced that choreography that I was telling you about. I have a handwritten note that I kept. She had come by my office one day, and I wasn't there. Left me a note wanting to know some question about the satellite. Then during the mission—so here is where I can give you a juicy story.

ERBS: Earth Radiation Budget Satellite. It's going to measure the amount of radiation coming into Earth—this is the Earth—and the amount of radiation going out. [Demonstrates] It had all its electronics in the satellite. It had these two solar panels that when launched, they were

to the side, like this [demonstrates], and then commands would be sent when ready to go, and the solar arrays would spring up. Then Sally would release the satellite from the end of the arm.

During the mission, they are doing the checkout, and she grabs the satellite, and—I still have the image of it—gets it positioned, and said, "Okay, we are ready to deploy the solar arrays." Well, it was a coordinated effort where the ground had to send a command, and then she had to throw a switch. We said, "Okay, you are go to do your part." And she did. After a few seconds, she calls down: "No joy on the solar array deploy." Yikes. I was front room now, and I am sitting there, my heart is going [makes thumping sound] boom, boom, boom.

You do all this what-if planning; that's what you are doing in the years, months, preceding the mission. We had what-if'ed "What if they don't deploy?" and came up with a process or procedure for her to shake the satellite with the arm. We had to coordinate this with the arm people. They didn't think it would work, but they said, "Hey, whatever." We had documented this shake procedure, so we gave her the go: "Okay, you are go to run malf [malfunction number xyz] to try to shake it," and that didn't work.

So now my heart's really [makes thumping sound again], because we had sent the command to deploy the arrays. We had a flight rule that said once you do that, you can't put the satellite back in the bay, because they [the arrays] could spring open at any time. I knew we couldn't put it back in the bay, and I knew if we couldn't get the solar arrays deployed, we would have to throw it overboard, and it would be space junk. Oh, my gosh. What do we do? So minutes seem like hours.

I have a back room of people. We actually had one of the Goddard guys here, because we always required a local payload representative. In case we had to have some real serious face-to-face meetings, we wanted to have somebody here. So he was in the back room, and I

said, "All right, everybody. Let's brainstorm. What are we going to do here?" This guy said, "Maybe the hinges are frozen. How about if we point the hinge line to the sun?" Of course. A resource that's right there. There were no heaters on it.

So I have to relay it to Flight. I say, "Flight, we would like to have Sally point the hinge line to the sun. We think maybe they are frozen." Then CapCom [Capsule Communicator] has to relay it up to her, so he relays it up: "Point the hinge line to the sun." I remember Sally calls down: "What? Over." After a little bit more explanation, she goes, "Oh, okay. I got it." After maybe two or three minutes: "Solar arrays deployed."

ROSS-NAZZAL: Yay.

BREKKE: Yes.

ROSS-NAZZAL: Relief, right?

BREKKE: So, oh, I can breathe again. Well, we did have other one on another mission; I can tell that one real quick.

ROSS-NAZZAL: Do you want to explain, though—you did get to hang that mission plaque for that mission.

BREKKE: I think that was it, is just the coordination of all the—okay, let me finish that thought. So we got it deployed. Well, on that mission we had a science payload in the bay. I can't remember; it wasn't a Spacelab or [SPACE]HAB.

ROSS-NAZZAL: Was it an OSTA [Office of Space and Terrestrial Applications]?

BREKKE: It was some science-based [payload] that would stay in the bay, and they had a ton of commanding. They were going to take up the rest of the mission, and they had a ton of commanding. With this, we had already delayed one or two orbits to release the satellite, so we were already encroaching on the time that they needed to do all this, and I was aware of that.

We get the satellite all ready to be deployed. The solar arrays are deployed, but we still are holding onto it. The Mission Control from Goddard calls and said, "Hey, we would like to take a couple more revs so we can load the new calibrations for our communication antenna." It's their science antenna. I had asked this guy a few weeks prior—it was a spherical antenna, a ball kind of thing, and I said, "What's that for? When are you going to use that?" He says, "Oh, we don't use that for a few months after we get deployed, once we get up and running." That was a couple weeks ago I had heard him say that. So now he is telling me they want to take a couple more revs to load the parameters for this array, this antenna, and I just punched my talk button. I said, "Wait a minute. You told me that you don't need that for a couple of weeks. Can't you load that after we deploy?" He says, "All right, let me check." Then he comes back and he says, "Yes, we can load it after we deploy. You are go for deploy."

So I think it was that—I'll call it "leadership"—to know when to say yes and when to say no, when to question. I think it was that. Linda [M.] Godwin was the lead payload officer for

that flight, and so they actually selected both of us to hang it—maybe it was just me. I was uncomfortable hanging the plaque not being the lead. So I said, "I would like Linda to climb the ladder, too, and we can hang it together." They got two ladders, and we climbed it together. I didn't feel right, because I wasn't the lead payload officer.

ROSS-NAZZAL: I thought that's kind of a big deal. You should mention that honor. Not many people have that opportunity.

BREKKE: Yes, it was cool. I was very, very humbled. Another question you had asked is "When did you want to become a flight director?" That mission is when I started thinking, "Wow! I can do this. I must be doing it pretty well, and it's fun." It was probably that moment when I thought, "Maybe I could be a flight director." It was back when I was a freshman in college, and I heard about these people getting master's degrees, "Wow. They must be brilliant. I could never do that." But now it was like, "Well, maybe. Yes."

ROSS-NAZZAL: Yes, you had proven yourself in different ways.

BREKKE: Yes, but you know I just never thought what I did was anything special. I just was doing my job and having fun at it.

ROSS-NAZZAL: This might be a good place for us to stop I think.

BREKKE: Yes. And I will tell you about the stuck sunshield on the next time. There was a sun shield—a clamshell—that closed over the communication satellite, and then when it got ready to deploy, we opened it up—I think it was [STS]-51I. When they went to open the sunshield, it got stuck on one of the antennas, so this side came down, but this side got stuck.

ROSS-NAZZAL: Well, that sounds good. We have more to cover.

BREKKE: So, stay tuned. Same channel.

[End of interview]