

# ORAL HISTORY TRANSCRIPT

CATHERINE T. OSGOOD  
INTERVIEWED BY REBECCA WRIGHT  
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WRIGHT: Today is November 15, 1999. This oral history session is being conducted with Catherine T. Osgood, who is known as Cathy to her friends and colleagues, for the Johnson Space Center Oral History Project at the offices of Signal Corporation in Houston, Texas. Interviewer is Rebecca Wright, assisted by Carol Butler and Sandra Harvey.

Thank you for taking time to visit with us today. NASA space program has benefitted for almost forty years from your mathematical, technical, and analytical skills. Did any of the ambitions you had as a child lead you to the career that you have today?

OSGOOD: Yes. I don't think that as a child I had any inkling that I would be doing what I'm doing today. I grew up in rural South Florida, and I had no idea that I'd be doing anything like this. [Chuckles] My father was a farmer and a general contractor after that, and he did reasonably well, but as a farmer down there, he'd farm for seven years and lose money, then farm for the next year and gain it all back. My mother had said she really wished he'd go up to Hialeah [Race Track] and just lose it all in one day. [Laughter] She was a very practical person, and her time was spent taking care of five kids and the innumerable tasks in taking care of the home...

So my main contacts were with school and with word of mouth and radio and so on, and way back then wasn't even any thought of space work. I hadn't thought of space work or anything of that sort. But I did have a fairly strong urge to get out of the country, countryside. [Laughter] We lived south of Miami, and Miami's glitter and neon lights and so on were there, so I knew there were other worlds, but mine had to be quite narrow. We didn't have TV until after I left for college...

Then when I did get to college, I decided to major in chemistry mainly because I thought it would be better income and I might be able to get a better job that way. I didn't really feel that—I wasn't such a good student that I was out to conquer the world or anything of that sort. The college was Florida State University [Tallahassee, Florida]. It was no problem getting into Florida State. The situation at the time I went there, it had changed from a women's university, the Florida State College for Women, about three years before, so there were quite a few men there who had gotten out of the service, but it was about what I was expecting college to be. I studied as hard as I could, but I wasn't a spectacular student. [Laughter]

WRIGHT: Did you have any funding assistance or did you put your way through school?

OSGOOD: No, I didn't. In fact, I worked an extra year after I got out of high school and saved a little bit of money that way. I'd worked for a fruit shipper—it was mangoes, avocados, and limes—during the summertime for quite a while...and then I also worked in a service station. I cleaned a whole bunch of windows. There was no self-service at that time. So that was interesting. But it was mainly to get money for college. The tuition was really, really reasonable... You wouldn't even believe it these days, how low it was.

Then once I got to college, I did get a job in a restaurant. It was called the Dutch Kitchen. Oh, their food was good. [Laughter] That was the main reason for working there. Then I was an assistant in the chemistry department, which was really quite interesting, a fair amount of typing and general clerical work, typing up tests and all that sort of thing. ...When I was in college, I never felt really pressed for money. Movies were 44 cents. [Laughter]

WRIGHT: That's a good price.

OSGOOD: Right. And then the activities on campus were always either free or extremely reasonable; they were part of the student activity fund... So in general, with any of the free time that I had, I felt I was richer than I'd been before. [Laughter] So I really didn't feel deprived having to work through college.

WRIGHT: At some point you changed from chemistry to math.

OSGOOD: Oh, yes. As a junior, I got into organic chemistry, and, oh, nyaaa. [Laughter] It just wasn't the chemistry for me. I finally sat down and took stock, and said, well, golly, I've got enough time in math, and I always had loved math. It was something that would never throw you a curve. Once you learned a particular part of math, it was yours, you know. So I thought, it's really silly of me to be putting in all these hours in lab, see, where for each hour that I would put in on math, I'd get credit for, but all the labs were three and four and five hours. I thought, "Boy, this is enough for me. I'm outta here." [Laughter] So I changed to math, and that was the right decision.

WRIGHT: Were you one of the few women that were majoring in math at that time or were there other classmates of yours?

OSGOOD: No, it was more that there were fewer men, because it had been a women's college before this. I'd say in college it was more that there were too few men around, you see. So then I was quite lucky in that one of the graduate students, he'd just graduated from M.I.T. [Massachusetts Institute of Technology, Cambridge, Massachusetts], and, of course, I had looked over all of his application and so on. [Laughter]

WRIGHT: Checked him out. [Laughter]

OSGOOD: Yes. But I didn't know exactly who he was. One day I was working around the chemistry department, I came across this person who was working on the first-aid kit. He was putting the red cross on the first-aid kit in the hall. I stopped and chatted with him, wanted to know what he was doing. Later on he said that I informed him that the cross that he painted was crooked and that he took the masking tape off too soon. [Laughter] But as you might know, we've been married for forty-five years now. He's been able to put up with it. [Laughter]

WRIGHT: Maybe he agreed with you. Maybe it was. [Laughter]

OSGOOD: He was glad to get the attention, I think. Actually, he had come to Florida State, he had graduated from M.I.T. and it was pretty grueling activities that he'd been in, so he looked up and he'd seen that Florida State had been a woman's college and he decided, "Man, I can study and still have fun," you see. So in general, I said that I got two degrees from Florida State. I got my bachelor's and I got my "Mrs." degree. [Laughter]

WRIGHT: What did you want to do with your math degree? Did you have any idea where you wanted to apply that?

OSGOOD: No, not really, because once I had started with chemistry, you could see all the things that Dow Chemical was doing...[but] once I changed out of that, well, I didn't have any real idea. I was just hoping I could put it to use.

But when I graduated, my husband, or my fiancé at that time, he was accepted at Duke University [Durham, North Carolina] to work on his doctorate degree, but his field now

had changed to philosophy. He'd graduated in chemistry from M.I.T., physical chemistry, and he'd been in the Navy and picked up a lot of electronics. All of his career in the Navy—he would have been drafted into the Army, but he elected to go in the Navy, so he was there for, I guess, a little bit less than three years. He was there until the end of the war. He was in the Navy at Bikini [Atoll] when they exploded the bomb. That was all just great, as far as he was concerned. The Navy was some of his best experiences, you see.

So he started on his doctorate degree, and I went on to Durham with him. I got a job in the parapsychology laboratory. I was working basically with Dr. Louisa Rhine. [Dr.] Joseph B. Rhine, he was the person who—I don't know if he called it invented, but he came up with the ESP concept, extrasensory perception, and that was the parapsychology laboratory there. So it was really interesting. Don was into—my husband's name is Don, and Don was greatly interested in that, too. Actually, we were in the same building. The parapsychology laboratory and the philosophy department were in the same building.

So in working with Mrs. Rhine, she worked with what's called spontaneous experiences, and so people would write to her about their spontaneous experiences, like telepathy. One thing that stands out in mind would be one woman wrote that she woke up in the middle of the night and she heard her sister screaming... She found out later that her sister had been in Nepal and the vehicle that they were in went over the edge, and she was killed there. So all that type of thing, you'd just get those day after day after day. You'd transcribe them and so on.

Well, Mrs. Rhine, her way of handling it was not to try to prove every incident; it was to collect it and group it and see what types of experiences people were getting...

Then we also had some scientists that came over to test homing pigeons, to see if they were homing by extrasensory perception...

WRIGHT: Never a dull day.

OSGOOD: No, there was always something to be done. I was always interested in these things, and then Don was real interested in it, you know, so it was just a very vital sort of atmosphere.

WRIGHT: Made for interesting conversation at night?

OSGOOD: Oh, yes, it did. And we met a—one of our best friends there was Ursula St. Paul. In fact, when we were in Italy just this last month, we all got together there. We enjoyed two weeks with her. And we've done that frequently. One time we went to Germany with her and another time to England. She did come back to the U.S. one or two times as well. She was the one that was working basically with Dr. Kramer with the homing pigeons. What we'd do with those, we'd put them in cages and take them out to let them go. Take them out miles away from their cages, from their coops, I guess you'd call them. We'd cover them so they'd have no sense of what direction they were going or anything of that sort, and then climb up on the big fire tower...[to] let them go. Well, we put in, I think it was more than a year doing that, and they never really found anything at all as far as extrasensory perception was concerned. I'm not absolutely sure they still have learned how pigeons home.

One thing they did find out, that a pigeon when it take[s] off from the ground...tend[s] to circle... They were thinking they were trying to get their bearing, but they really were just trying to [gain] altitude. On the fire towers, most of them would just sit there for a little bit, take off. And they'd get home before we would. It was interesting.

WRIGHT: Then eventually you moved, or became part of the task force at Langley. Could you tell us how that transition happened?

OSGOOD: Let's see. We went back to Florida for a while, and my husband was working with the [U.S.] Fish and Wildlife Service. That was real interesting for him. I worked in a private chemical plant for a while as just a general flunky, I guess you'd say, and secretary and whatever they wanted you to do.

So I left that fairly soon and got a job with the VA [Veterans Administration]. That was the beginning of my government service there. The doctor that I worked with worked on the diseases of the chest ward, or floor, and I did a good little bit of the chemical analysis there and the blood studies and gas studies and so on. We were using a Van Slyke apparatus, which was terrible to try to keep clean and to use... So when I finally got through with that job, I said, "I'll never, never, never put on any of my applications that I know how to work a Van Slyke machine." [Laughter]

WRIGHT: Probably a smart move.

OSGOOD: Yes. So I'd been with the government there about three years, and my husband was—well, actually, he started there at the VA as well...in the dental research area, but then he moved up as far as he could move up, and he looked around and he got the job at the Fish and Wildlife Service. Then that one was there in Miami for quite a while, but [later] the government decided to change the whole station to Pascagoula, Mississippi. He'd been in Pascagoula in the Navy, and so he said, "Well, we'd better look at all of our options."

So when we did that, well, he looked at NASA. This was in '59. Also there was the San Diego—the Naval Research Laboratory wanted him out there for—they called it human engineering. It would be on submarines, and they wanted to try to make life on the submarine more amenable to the humans that had to live there... We almost took it. We had a long list of things that made a difference to us. It was only those two, NASA or the one out in San Diego.

We had a long list of things of things that were important to us, and we said, well, the two jobs have to be 10 percent different for us to make a decision, you see, so we went through it. No 10 percent. And we went through it again. No 10 percent. [Laughter] So I finally said, "Well, I've lived in Florida all my life. Let's go to California." Don says, "Well, let's go on to Virginia and look at it." He really wanted to go there all along.

So we went up, and he liked it, and so he got his job there with the—let's see. I've forgotten exactly what it was called, but it was in instrumentation. They were just starting up Mercury at the time. So all the tracking stations hadn't been—there were no tracking stations at all. His group was in charge of writing the specs and getting these tracking stations set up. Goddard [Space Flight Center, Greenbelt, Maryland] had an awful lot to do with it, so he had to work with Goddard Research Center. But we were stationed there in Virginia, so he did a lot of traveling back and forth...

They installed stations in Canary Islands and in Woomera, Australia, and over in Hawaii and in—I think it was called Guyamas, Mexico, and so on. In fact, I think he was just flying back from Guyamas when [John H.] Glenn [Jr.] was making his last orbit coming back through. So they just put him right to work. He was with a group that included [Howard W.] Bill Tindall at the time. So that was a go-getter group. In fact, they always felt if they weren't working on Saturday and maybe Sunday, that they really ought to apply for leave, that they should say they were taking vacation time.

WRIGHT: What were you doing at the time that he was getting—

OSGOOD: I didn't apply for work right immediately. I think it was two or three months, then I applied. I tried to get him to look around on Langley Research Center, and nothing they were doing there seemed to be exactly like what I was really qualified for. I was sort of



afraid, you know, I'd be in with people that had been there for years and really knew what they were doing.

Finally we heard about the Space Task Group that was just being formed, and so I went over there and applied. Then they offered me the math aide job. Later on I had the feeling that if I'd gone ahead and applied for a professional job at that level, I probably would have gotten it. They were looking for people that had any physical science background, a degree in physical sciences. But I got the math aide job, and I was pregnant at the time and I had one child already, pregnant with my second child, so I was fairly busy.

WRIGHT: Yes.

OSGOOD: So as a math aide, we didn't have computers assigned to us, we had desk calculators that didn't have anywhere nearly the capability that our little hand calculators have now... We would get a computer printout that other people had done. Some of it would be the ascent trajectory that they were working on at Marshall [Space Flight Center], and they'd compute what they thought the trajectory was going to look like for ascent, then send it to us, and we'd work with it. We'd take the data from it and plot it up by hand or calculate more things from it... We'd have some formulas, and with a spreadsheet sort of method we would come out with another parameter that we needed, and we'd plot that...

So it was interesting, and you really found out what was going on that way. It always seemed like about every Friday that it was not exactly Black Friday, but the management was always trying to collect everything that had been done, and they were on their way to Washington because they had another big meeting. [Laughter] So it was that way just on and on and on...

We'd been there almost exactly three years when they actually acquired the—it was then the Manned Spacecraft Center, and they acquired the land there from Rice [University,

Houston, Texas], and had decided to go there. In fact, I have a few—I didn't bring it with me, but I have a few memos that I looked at, where just a month or two before we were supposed to move, we didn't know where we were going... For about three months before, we knew we were going someplace, but we didn't know where we were going. So finally it became clear that we were coming down here to Manned Spacecraft Center. You know, they hadn't even clinched the deal on the Manned Spacecraft Center until we were just about ready to move down.

So when we did move, well, first of all, my husband was working for Langley Research Center and he wasn't working for the Space Task Group. They were not moving. Most of their work was with Goddard, anyway. So he wasn't really sure he wanted to move. I could either go over to Langley Research Center, but I didn't know exactly what that was, or go to Goddard, and I didn't want to do that, you know.

So I decided, well, I'll just wait. [Laughter] And they really didn't pressure us to move immediately. People came down in groups. One of the reasons was they really didn't have a place to put everybody. So what they did was rent buildings all around along the Gulf Freeway. When I finally did come down, we were in what was called the HPC, the Houston Petroleum Center.

But at any rate, I finally waited and waited, and they were moving all the furniture out. [Laughter] Most of the people had gone, and they were moving the furniture out, and my husband got a transfer down here to the Instrumentation Division. I think he was happy he did it, but at the time he really wasn't as strongly motivated to leave as I was.

WRIGHT: That must have been quite an adventure and experience all at the same time where you took a job and then now you had an opportunity to continue, but you were going to have to pick up your family and go again.

OSGOOD: Yes. By this time I had three children, so it was—

WRIGHT: You were busy.

OSGOOD: I was busy. But before the second child was born, we got a live-in nanny, and that worked out quite well. Prior to that, my daughter had gone to a nursery right on the—it was one on the [Langley] Air Force base. So that was nice. She went with us when we went to work and came back with us.

WRIGHT: Close by.

OSGOOD: Right. So all of that worked out great. But then with the second one, well, that was going to be too much, so we got somebody to stay with them. So she was with us for about ten years. In the wintertime, Grandmother would be down there, so we didn't feel that they were ever neglected. They always had plenty of people around.

WRIGHT: You built an extended family.

OSGOOD: That's right. Then for a while we even had two—not while we were in Virginia, but later on sometimes we'd have two grandmothers. Sometimes that didn't work out just right. [Laughter]

WRIGHT: A full house. [Laughter]

OSGOOD: My mother was a very determined type, and we found it was better that she came in the summertime and Don's mother came in the wintertime.

WRIGHT: Everybody got wiser as the children got older. [Laughter]

OSGOOD: Yes. Don's father died while we were at Langley, still. But they had always lived in—after his father had retired from teaching high school, they lived in Maine. They would live in Maine in the summertime and St. Pete [St. Petersburg], Florida, in the wintertime. So after his dad died, then his mother would just come down to Virginia and stay with us. So it worked out pretty well.

WRIGHT: What year did you move to Houston?

OSGOOD: We came down here in July of '62. As I say, everybody else in my group was already here. [Laughter]

WRIGHT: They saved you a place.

OSGOOD: They certainly did. In fact, one of the ladies that I worked with, she went over to Langley to do the same general type work I do. Her husband had worked with Sears. When he got a transfer down here, she came down. She came down about a number of months later. We were still at HPC. This was Mary [Shep] Burton. If you ever get a chance to interview her, she's an interesting person. She did stay mainly in the math aide-type work and then later on she went into office management and—I probably don't have the name of it right, but the office services for all of JSC [Johnson Space Center]. So she worked her way up in that type of management. But she always knew exactly what was going on. I really wish that you'd be able to interview her. She'd be good.

WRIGHT: It must have made the move easier to know that you were moving to a job that you already had friends and your task were waiting for you to get there.

OSGOOD: Right. In fact, before I left Langley, well, I was saying to my husband, "I could do that kind of work. I'm doing the same type work those people are," you know. And he said, "Well, you really have to apply. You have to make out a Form 59 and apply." Good idea! [Laughter]

WRIGHT: So simple but so good. [Laughter]

OSGOOD: And so I did that, and I was really kind of amazed that I got it. I thought there would be some bureaucracy that would keep me from it. At that point we were called aerospace engineers, even though we didn't have an hour of engineering course work, you see, but the government position description, they'd come up with something called an aerospace engineer.

I think my husband was also classified as an aerospace engineer as well, and his work was mainly in electronics...all of his work was in electronics, that he'd picked up in the Navy. So the work that he did for dental research was about the only chemical work that he really did. And this is [an] M.I.T. education, too. [Laughter] Because I've got a son that went to M.I.T., and he's doing about the same thing. He's doing software engineering now, but he didn't—well, he did do his work in computer science.

I got off the subject.

WRIGHT: We were talking about your task and the fact that you applied to become an aerospace engineer.

OSGOOD: Yes, and then I actually got it. I was really surprised to get it, but there was no rough transition. It was just that everybody seemed to do everything that they could possibly do... If they were capable of doing something, they'd do it, regardless of what their positions were. So then I just sort of slid into it.

Bill Tindall had transferred into our group before we came down. The branch chief was John [P.] Mayer, and he seemed to collect talent. Whether there was a particular job for them to do right up there at Langley or not, he was collecting people, getting ready for the big move down here. So Bill Tindall was one of them, Glynn [S.] Lunney was another, and [Lynwood] Lyn [C.] Dunseith. There were some engineers from AVRO that had come down. I think we only got one of those, but that was a big talent group that came in. That was a Canadian aviation company that let a whole bunch of very good engineers go, and [Rodney] Rod [G.] Rose was one of them. I don't know if you got a chance to interview him or not. He's a talented person. But anyway, Bill Tindall was...[transferred to the Space Task Group.]

So he started working on rendezvous, and we'd have weekly meetings and we'd put out rendezvous notes. I've got a few of those left. A lot of them were handwritten, and it was "What have you learned this week?" type thing. For one example, the way he put the notes out, the secretary retyped one of them for him to get it all nice and pretty. "No, no, no, no. Where's that original?" Well, it was in the trash. "Well, that's the one I want sent out." Because that's just the way this work is. It's a work in progress, you see.

At one point I remember him, he came out with a great big sheet of paper, like blueprint paper, and he just plopped it down on Bill Reini's desk, and he said, "Here. Code this." [Laughter] It was just all full of a flow chart, you know. It ended up being the rendezvous program that we were working on. So Bill [Reini] started working on it, and it was first called, I think, TQ10. No, we called it DKI first, the Docking Initiative Program,

and then that became part of a bigger program they called TQ10, and [rendezvous] was just one of the options in the program... Then it grew on and on from there.

So I started working in the rendezvous part. In fact, when we transferred down, we were the Rendezvous Analysis Branch... Bill Tindall was our assistant branch chief. I had the feeling he always made sure he stayed in an assistant position, because then he had the authority to do the work that he needed to do. He could call on people he wanted, but he was unencumbered by all the management-type things. So he was really a free spirit and a troubleshooter. He got a lot done.

So he started holding these rendezvous meetings, or weekly meetings, turned into what was—I think he first called it the data priority, and we had something called a T&O Panel, Trajectory and Orbit Panel... Then that later became the Flight Techniques, which still goes on today. But that type of work was done not as one branch doing it, but as this one talented individual coordinating other talented people to get the job done... And he was one that would—he'd just dive right into a knotty problem, and when he just barely got that under control, he was into the next one. Like the onboard software was just stumbling along, and he decided that that was his next project... He called it a big bag of worms. He just got into it. [Laughter] It was really fascinating to be in that sort of a situation.

WRIGHT: Tell us about the actual work environment during that time period. Were you all in one room? Did you have separate offices? How were you involved with the day-to-day operations of all of those bags of worms that Mr. Tindall found?

OSGOOD: When we were at Langley, we were all in one room. Our particular group was all in one room. There must have been thirty desks in that one area. It really wasn't bad. People kept their conversations down, and they were working hard, so, you know, just thought that was the way it was supposed to be.

When we were at Langley, we were at one end of the building, and the original seven astronauts were at the other end of the building. It was always a real curiosity to us, at least the girls, at any rate, as to what was going on down at the other end of the hall. I was still a math aide at that time. But anyway, the supply room was down there, so we'd always have some need to get some supplies. [Laughter]

One of the days that I was going down in that direction, I walked past this room. It was full of all seven astronauts...with this real worried look on their faces, like this. I went by—"What in the world is going on?" A whole bunch of worried astronauts, you know. And later it dawned on me there were a lot of bright lights and they were taking the pictures, the original pictures of those astronauts, so they were squinting because they'd been in this hot room with all these bright lights... They were sitting there and they were really uncomfortable, you know. But that was just a picture that I would have loved to have gotten, a room full of worried astronauts. [Laughter]

We didn't have any real first-hand contact with them. We'd see them and speak to them and all that stuff, but they were a real curiosity to us. The way that building was set up, the men's room was downstairs, right across from the stairs, and the ladies' room was upstairs. So I've got the unique relation with all the original astronauts, that I'd meet them coming out of the rest room as I was coming down the stairs from the [ladies] room. [Laughter] Maybe Mary Shep has the same relationship. I felt I was a little bit different from the rest.

WRIGHT: Everybody knew where everybody had been.

OSGOOD: That's right. You don't need to keep this, but they were like all men, they'd check their fly to make sure it was closed. I figured they were like any other men. [Laughter]



WRIGHT: That's right.

OSGOOD: No wonder. They were faced with a woman coming down the stairs looking at them.

WRIGHT: I'm sure there weren't too many women working at that time, so maybe they just didn't expect to meet anybody on the stairs.

OSGOOD: That's right. I would say it was about a ratio of maybe ten to one that way...

WRIGHT: And did you feel that personally, that you were one of ten women in—

OSGOOD: No, not really, because as a math aide, it was all women. We'd do things that engineers needed, and they treated us very nicely. Then as I started seeing the type of work that other people were doing, then I just worked into it. I never felt any real competition. All the other engineers, they treated you like a lady, and I was just real pleased with it all.

Then when we got down here to JSC, that was pretty much what it was like there at Langley. [At Langley, the Space Task Group was] in two big old Air Force administration buildings. The management was over in one building and we were in [the other]. I think Landing and Recovery was in our building, and then our Mission Analysis, I think it was called at that time—[our group's] name has changed over and over, but the work has stayed the same...

When we came down here [in '62], we were in individual buildings [in Houston]...and we didn't move to what we call the site [until '65]...when we moved into Building 30. I think it was September of '65. See, my husband was working in the instrumentation, still in the tracking. Well, I guess he had a slightly different job when he

came down, but it was working with onboard instrumentation and things like that. He was in a building called the Office City. It was just about where there's a school now at the intersection of [Interstate] 610 and the Gulf Freeway. My building was on the Gulf Freeway. But there were people around on Telephone Road. Goodness sakes, you've probably got a lot of people talking about the various installations.

Then my husband, his work moved out to the site before mine did. He got out there while Building 12, the computer building, was already constructed, but it was a sea of mud all the way around that. So he was out there [at the site] about—he may have been there a year before I was, maybe six months.

Then our group moved out in '64, September '65. So that was great, you know. We had probably two or three people to an office. We didn't have our own computers on our desk or anything of that sort, but we started submitting our jobs to a mainframe that was over in Building 12. They were working on getting the [Mission] Control Center set up, the Instrumentation and Control Center. My husband had worked on the Mercury Control Center, too, when it was at the Cape, and then he was working on instrumentation in the Control Center here.

But at any rate, we would be working on trajectories and some of Bill Reini's programs. We would punch our own cards. We actually had a group of people that would keypunch the cards, but we were usually a little too impatient, and there was a keypunch right there. We knew exactly where we wanted the information to be punched on the card, so we'd have big stacks of IBM cards, take them over to Building 12 and submit them to be run on the mainframe. You'd get about one run a day back, so if you'd made a mistake, well, then it's the next day and the next day, or if you'd learned something there and you wanted to add something to it, well, then it would be another day and another day, and that sort of thing. It was quite a while till we got off the mainframe and onto smaller computers that we could have control of ourselves. It was quite a few years, in fact.

But while we were on the mainframe, Bill Reini was constantly working on his program, and we'd come up with programs of how to compute the tracking information, when a station at a particular location would get acquisition of signal and loss of signal, or when in orbit we'd enter the shadow, when we'd be in the dark, when we'd be in the light, what the ground track looked like, what the trace over the earth looked like, and so on.

At this point we were still doing all of the plotting, even, by hand. Mary Shep's group did our plotting for us, you see, and they were real good. They got some draftsmen and so on. But when we were at Langley, we just learned how to do it ourselves. "This is a French curve. Okay."

WRIGHT: So you had training on the job?

OSGOOD: I was not a draftsman of any description, but you just learned to keep your pencil sharp enough. We came out with some pretty good-looking plots.

At any rate, this program, the software, I did a lot of flight work, but I really felt the software work I did was important as anything that I worked with, not in doing the coding myself or the equations, but in writing requirements for what needed to be done and working with the program once it was just barely limping along, and trying to find the bugs in it and so on. So, in general, Bill did the coding and worked on this thing that became called the Monster, because it had a whole bunch of different flags in it that you could do all the things that I'm talking about with one program, you see.

Bill was sort of a reticent person. He wouldn't write anything down if he could help it, and he wouldn't talk very much either, so I wrote his users' manual for his Monster... But there weren't very many people running the Monster, other than me, because it was really a chore. But, you know, I'd gotten accustomed to it and had a real good working relationship with Bill. The thing was, you could get things done immediately. It wasn't as if you had to

wait for years and years for somebody to decide that they were going to work on that piece of software... You'd find problems, you'd take it to the programmer, he'd grumble a little bit, and a few hours later he'd throw some cards on your desk and say, "Here. Try this."  
[Laughter]

WRIGHT: And you did.

OSGOOD: Oh, yes. He was great. But, unfortunately, he died early. He must have only been in his fifties when he died. I guess he died in about '87 or so, '86 or '87. But he was real talented. We really miss him. But that program was his whole career.

Then before, we would be submitting our jobs to the mainframe, and then after a while we did get some terminals where we could remotely submit the jobs. You didn't really have to punch the cards; you could enter it. But most of the time I already had my decks that were running and everything was working right, and you just had to change it in a couple of spots here and there, and it was just as easy to go on.

But the branch chief at that time was Ed [Edgar C.] Lineberry, and he was a very talented mathematician. His main contribution—well, he did an awful lot of things, but in my mind his main contribution was working up what we called the AEG, the analytic ephemeris generator. That was the engine that would let you know where you were in orbit. You could get your position and your velocity from this program. So you had to know where your vehicle was before you could learn all these other things about when you were over a station or when you went through the shadow, so on and so forth. So that made it possible.

He took some equations of [Dirk] Brower and [later Yoshihide] Kosai equations and simplified them. Between Ed Lineberry and Bill Reini, they worked up a program that was small enough to go on a mini computer. It went on a very small computer at first, and we were writing requirements...[but] not really doing our normal work on it. It was a bench-

type program. Then as soon as that got into pretty good shape...we put it on the minis. Once we got started on that, we actually did our work on it.

So we had a terminal. We had, I think, three Perkin-Elmers, and they would be the same as a server now. They were excess equipment, I think. We had a study as to what this program should go on. It was called the flight design system. They gave us some advice. It was very expensive, so they used the Perkin-Elmers that were right there. We had Techtronics terminals, and they used sort of photographic paper and so on. But we did have a plotting routine in there, and you could get a good little bit of your plots done that way. But the thing was, it wasn't a day in between every run. In fact, you could start a program that you knew wasn't going to work quite right and the machine would tell you where you were having your problem. Then you'd fix that, and you'd just keep on going.

So that flight design system just opened life up. We didn't really get onto that system until we were in Shuttle. So all of Mercury and Gemini and then the Apollo part, all of that was done, any of the computing that was done was done on mainframes...

In Apollo, I had very little—the only contact I had with Apollo, I was working with all the people in there, so you knew exactly what was going on and it was all extremely fascinating, but as far as working on flights, Apollo flights, I wasn't. I did work on Apollo 8, and it was exciting to us when it became "8 to the Moon," I think they called it, or something of that sort.

But the job I was assigned was one that was sort of a thankless one. It was to work on the various alternate plans that you would need as you had problems throughout the flight. Everybody was so success oriented during that time that they didn't pay very much attention to it. It was just a job that really had to be done. I didn't feel like I was mainstream-Apollo in any way.

I had worked on Gemini all the way through. Then we had what was called the Apollo Applications Program, and that eventually became Skylab. But the planning...had

started on [Skylab] six years before it actually flew. Of course, we did have delays...it wasn't supposed to be six years... There was a workshop which was launched first, and then three visits to it.

The first flight was a month-long flight, and then two months and then three months, just to prove that you could live in space and the various things that you could do. They learned a lot about the medical makeup...and how people live in space. We had a lot of earth resources programs or experiments that were going on, looking at various places on the earth...

WRIGHT: At some point in your earth resources mission work, you are responsible for a unique acronym. Would you like to share that with us?

OSGOOD: Let's see. I don't know as I—my husband brought that up. [Laughter]

WRIGHT: Well, you'll have to bring that up with us now. We want to hear that story.

OSGOOD: I still don't tell people these days about it. They wanted to know what type of orbit we'd have to fly in order to come over the same spot every day, with the same lighting conditions. It was one that we told them...we could fly, because it was going to have to be one that compensated for the earth's motion around the sun. It turned out to be one that you had to have a—it was not a geosynchronous orbit, but it was a retrograde orbit, one that was more than 90 degrees in retrograde orbit, with exactly the right altitude so that you'd have the right period.

...It was assigned to us, so we worked on it. So Ken [Kenneth A.] Young was my supervisor at the time, and we were saying, "What in the world will we call this thing?" So we decided that—we gave it a name and we called it the GOTSPOTEWILD orbit. It was

going over the same spot on the earth with identical lighting daily. We decided, well, it looks German, so let's put a couple of umlauts on it. [Laughter] But we didn't get into trouble for it. I don't know why. It was just because we weren't going to use it. We knew we weren't going to use it.

WRIGHT: But it goes right along with the rest of the acronyms. It definitely has its own meaning.

OSGOOD: Oh, we thought it was just great.

WRIGHT: We do, too.

OSGOOD: But we really didn't let that out as what it was. I don't remember ever really telling people what it was. I would give them the memo and show them, and if they were talking something about that type of orbit, well, I'd very seriously give them the name. "Johannes Götspötewild. You know, it's one of his orbits." [Laughter]

WRIGHT: And no one questioned?

OSGOOD: No.

WRIGHT: What respect you had. [Laughter]

OSGOOD: They did. They were afraid to fool with me after a while.

WRIGHT: That's a good respect to have, I think, especially in your environment. Things were going so fast every day that—

OSGOOD: That's right.

WRIGHT: —you moved from one task or project or doing many of them. Did you find, especially during the Mercury and Gemini days, did you find one to be more challenging than the other to accomplish in the time that was given you?

OSGOOD: Not really. You just sort of felt you were in there grinding it out. The managers would try to give people work that they knew they were capable of doing, because they wanted it done. Then I would see it as the real work was being done many grade levels above me, you see, but I could observe what was going on. It was fascinating.

WRIGHT: Did your work take you down to the Cape?

OSGOOD: Yes. I can't really say I was working, but John Mayer was our branch chief, and as we were all constantly under the gun, one of his ways of thanking us was to take us down to the flights. Ostensibly we were working, you know. Actually, we would, I suppose, if something had gone wrong and you needed to come up with another plot or something of that sort. But I was able to go down on [Alan B.] Shepard's [Jr.] flight, his first flight. Then also [M.] Scott Carpenter's.

On Shepard's flight, there were delays in that, and it was mainly bad weather... So I was able to get a rental car. The rental cars were piling up at the Cape, and they needed to be ferried back to Miami, so I picked up one of the cars and ferried it back, and stayed and



visited with my family and kept the car till I was ready to come back, then...turned the car in and came on back just in time for the launch. But [the launch] was fascinating.

WRIGHT: Tell us about all that was going on, where you were standing. Were you involved with the people?

OSGOOD: John had a place for us to actually watch the launch, but we were just barely out and then rushed right back in to where we were supposed to be working, you see. But it was the first launch that I'd seen, and it made a lot of noise. It was fascinating. I can't remember exactly where [we were] on the Cape. In fact, while we were there, I didn't have a real good orientation of where I was located on the Cape. They would tell me, but somebody else would be driving the rental car and I'd be going along with them. But he had arranged a spot for our group to observe the flight.

WRIGHT: It was shortly thereafter that President [John F.] Kennedy announced his goal to having man go to the moon and return safely to the earth. What were your thoughts of being able to do that?

OSGOOD: It was frightening. There again, I sort of felt my grade level was down below those that were really making the decisions, and if you get in there and work as hard as you can. Well, the thing that really, really made a difference is that if you were working on a team and you had a goal, it was great. That was better than not—before he really announced exactly what we were going to be doing, well, it was hard work, but every so often I'd wonder, "Is there anybody up front driving this juggernaut?" [Laughter] But once you had a discrete goal, it was just everybody would get in there and work towards it. But it was like climbing a mountain.

WRIGHT: And Carpenter's flight, I imagine that was a memorable time for you as well.

OSGOOD: It was slightly anticlimactic to the first one, I mean the first one that I'd seen, but he orbited the earth I don't remember how many times, whether it was three or not, and he had a fair amount of trouble during the flight. Then he overshot his landing by about 300 miles. So, you know, you had this feeling, "Boy, I hope we can find him. He's just in that little thing bobbling around out there." But it was about three hours, I guess, or so before they actually located him.

During that time, John Glenn was coming into the office where we were working. We didn't have anything really to do there because it was recovery area's type work, but we were to stay exactly where we were. We weren't to be doing anything or talk to any press, you know, or let anybody know what was going on. Well, John would keep coming into this room, which was out of the sight of the press, and reassuring the family that everything was all right, that recovery was on the job and they were proceeding on, that we knew what the trajectory was and it was just a matter of getting there. So that seemed to be the high point of that one.

Then I didn't go down—the last launch that I observed was Apollo 17. I went down with a group, a group from NASA, and that was fascinating. That was a night launch. The whole area shook, you know, and it lit up the sky. It was really something. And that was the last Apollo flight, too.

WRIGHT: When you were working in the rendezvous area, so many of your contributions led to decisions that were going to be made for lunar orbit rendezvous. Can you tell us about that time period and all that work, how it affected Gemini V and as it worked on to the Apollo time?

OSGOOD: We had been working on rendezvous. Bill Tindall had been working up the rendezvous. We had first said—looked at, well, just launch directly into the orbit and rendezvous on the first orbit... Oh, no...if your launch is delayed, your plan has gone... So then we decided, well, we looked at the tangential method, where you'd come up and the orbits would meet at one time, but then it turned out...that the closing rate then was just so fast that it would be a dangerous final approach.

So then we came up with the co-elliptic orbit. That was one where the chaser vehicle would be in an orbit that would maneuver until it got into an orbit that was about ten miles below the original orbit and the target orbit and catch up slowly on it, and then at a certain time transfer from that slower orbit. That was more or less the method that they used for rendezvous from the surface of the moon to the orbiting CSM. But all of this took many [unclear] studies and many runs, and what should our elevation angle be, TPI, when we do that last burn, and so on.

With this co-elliptic, we came up with what was called the CSI/CDH. No, excuse me. It was the NSR, the NCC/NSR burn, and that would be one—let me go back a little bit. When [Edwin E.] Buzz Aldrin [Jr.] came aboard, he was among the third group of astronauts. He'd just graduated from M.I.T. and he'd done his work in guidance for rendezvous, so Bill Tindall got a hold of him right away. He was going to get any talent around. He just put Buzz to work. Buzz found that we had neglected to align our line of [apsides of the] two vehicles... the apogees and perigees of each one would be lined up. If we hadn't taken care of that by the time we got to terminal phase, we'd have to do it all in the terminal phase, and it should be done way before that.

And so that's when we came up with what was called the NCC and the NSR. NCC was a corrective combination maneuver, and the NRS was slow rate maneuver. The "N" is just to indicate that this is one of a group. So I hear people today asking, "What in the world

is NCC and NSR? Some people said that was slow rate, but I don't believe it." [Laughter] But that was what it was for, was to slow down your approach. That was called a two-impulse solution.

Then that two-impulse was just about the only soft[ware]—there wasn't a lot of room on board on the LM [lunar module] for rendezvous software, and so this two-impulse system became CSI/CDH in the—that's what they called it, but it was the same as our—it didn't fit in exactly the same point in the system of maneuvers, so it sort of stood out by itself. The two-impulse software was about all that they had onboard to work with, which was good. It had everything in it that you needed, but it wasn't exactly the way we did the rendezvous from the ground up...

There again, you know, I wasn't the only one that did this. There [were] a lot of people, a whole big team working on this type of thing. It was fascinating.

WRIGHT: I'm sure communication was a big factor in being able to share that information with your whole team to pass on.

OSGOOD: Oh, yes. We'd have these—Bill Tindall's, his T&Os and data priority and so on. There'd be some head-banging times going on in that, you know. Somebody would have an idea that it really should be done this way, somebody else had an idea it should be done another way, and you'd get it sorted out. You'd run trade studies. It would eventually get worked out, but every little detail had to be done. Bill would put out his [memos] that people called "Tindallgrams," you see. You probably have heard a good little bit about his Tindallgrams. They were written just the way he talks, but he left out the swear words. But the way Bill talked was, a swear word was an adjective. It just flowed with the rest of his conversation, you see. [Laughter] But his Tindallgrams didn't have the swear words in them.

WRIGHT: Do you remember one Tindallgram more than the other?

OSGOOD: No, not really. Not really. That was quite a while ago.

WRIGHT: I'm sure they all had an impact.

OSGOOD: That's right.

WRIGHT: What was the mission that you remember when your rendezvous work actually took place, that you could see your efforts become reality?

OSGOOD: Well, let's see. With Skylab, we had to figure out which vehicle to launch first and what the altitude and inclination should be, so we started out from the ground up. Then when it looked like things were working, well, it was amazing. But the workshop, we decided that the workshop needed to go first, so when we launched it, it had some problems. I don't know whether it was ice, or something damaged the workshop, and it took off one of the panels that was supposed to go up. So once it was in orbit, well, then we had to stop and think, "What are we going to do?"

So up until this time, our rendezvous had been to rendezvous the first day...after about five orbits... If you didn't rendezvous by about the fifth orbit, well, then the astronauts' work day had been so long that they'd have to be facing a docking situation when they were just absolutely exhausted. So all up until this time, the astronauts themselves wanted to get it all done the first day.

So once this [damaged workshop] was in orbit, once we had this problem, Bill came back and said, "Give me a plan [where] I can [launch] at any time." Well, I'd been working

on that sort of thing. In fact, every time we'd have trouble with such a short launch window... I would try to sell the longer one; the one where if you didn't rendezvous until the next day, you could have a longer period of time, during which you could lift off. So right at this point they had a need for it.

As it turned out, it was just a plan that they had to have. But as I remember, we didn't really use it... But I sort of had the feeling, well, I had it sitting there...and I hadn't been able to interest anybody in it before this, but I still had it there and we could use it if we really had to do it.

WRIGHT: Were your hours long that you were putting in while you were working on this?

OSGOOD: Yes. During that period of time we were still submitting our jobs to the mainframe, and I'd have priority, but it would be submit a job and wait for a few hours to get it back, and submit another job and wait for a few hours to get it back... So I did bring in my sleeping bag and sleep in the ladies' room. [Laughter]

WRIGHT: Take a little nap every now and then, huh?

OSGOOD: Yes. Well, in general, I'd be able to get a block of work done and then I'd have to wait until somebody came in the next morning to decide whether they wanted to use that or not use it... So I'd get a good night's sleep, but wasting the time to go all the way home and all the way back, it would have been an hour—if they'd call me, it would have been an hour wasted or so, you know. We still had the nanny that worked with us, and my husband was real good at filling in when there was something like this going on.

WRIGHT: It sounds like your partnership at home certainly helped you become definitely a success at your work.

OSGOOD: He even does all the food handling and everything... [Laughter]

WRIGHT: And from what you told us, his job was very busy, so it seemed like it worked out well.

OSGOOD: Yes. We could trade off. But when he got down here—he did a good bit of his traveling when we were at Langley. He didn't do anywhere [nearly] as much [business] traveling when he was here, so we could pretty well plan our schedules at that point. Then we did have a grandmother around every now and then. [Laughter] But he was great. He's never one to say, "That's a woman's job," or anything of that sort. Whatever is to be done, he's going to do it.

WRIGHT: From Skylab, you transitioned into the newest era of NASA at the time, and that was the Space Shuttle. Tell us how you were able to go from Skylab and all the work you had done from there and move into that area.

OSGOOD: Well, the Shuttle was a little different, in that we had customers now for this. The first few flights were test flights...and we had really said that that first five were going to be test flights, you know. But as it ended up, by the time we got to the third flight, we were already carrying customer's [cargo]. Then some of the test objectives would be put on a list and they were to be done as we go along flight by flight, but they weren't dedicated test flights [subsequent to STS-3].

I worked on the third Shuttle. By this time we had the Flight Design System, so we had a pretty good computing facility going... But our main objective then was to analyze the requirements of the experiments and what was going onboard. We always did work fairly much in cycles. We could take a look at a flight to begin with and see if we could meet the requirements [or] if there were any real big conflicts, and then resolve those conflicts. Then the next cycle would be one where you'd be working on the fine details and be generating a lot of information for people that needed it.

Like back in Skylab, we'd be putting out what we called super tapes, that had a month's worth of data on it. Sometimes the longer flights, they were so long we had to have two of these great big reels of data. But with Shuttle, we were on our Flight Design System, so we would run through each of the cycles and we'd have a report that would come out at a certain time. We'd have deadlines. We'd have all sorts of milestones we had to meet...

Then we'd present the plan at the Flight Operations Panel. Rod Rose ran a whole bunch of those. Then Bill Tindall—I can't remember if Bill Tindall ran them afterwards or before. I think he ran them before, and then Rod Rose ran them after that. But as you've gotten your planning done, then you would present the plan to a whole group of people. That would usually give me a good little bit of stage fright, but my husband would always say, "Well, just remember you know more about what you're talking about than anybody else sitting in there, so just calm down." [Laughter] But every so often I'd think, "I could call in sick and Ken could do the job." [Laughter] But I didn't. I had too much pride, I guess. I wouldn't do that, but I sure wanted to.

WRIGHT: Did you find the difference as challenging? You were working with a whole different type of system.



OSGOOD: Yes, I think we did, particularly if you'd have a conflict and it looked as if you wouldn't be able—like one payload really wouldn't be able to work with another payload, and if it looked like it was going to have to go to headquarters to be resolved and that time was clicking away and so on and so forth, well, you'd sort of feel like you might be in between. You'd be generating the numbers that would be saying that one payload just plain couldn't fly with another payload. But in general, we were working with a team, so it would all work itself out normally.

WRIGHT: Did your duties change during the time that you worked with the Shuttle?

OSGOOD: Well, I think it progressed on a good little bit the same, still basically a rendezvous expert and working with the software and that sort of thing, and working on the individual flights. So I worked on 3, STS-3, and then on 5. But at this point the workshop—let's see. Skylab, we landed in '74 on the last manned flight, and the workshop was up there. We had great hopes that—when we left the workshop, we boosted it as high as we could with the fuel that we had available for it, and we had great hopes that it would be the nucleus for a space station. Marshall [Space Flight Center] was giving us the estimates on what the drag characteristics and so on would be, and they said we had eight years in orbit... But as it turned out, we only had four.

Then in seventy—well, I've forgotten exactly, but we got a call from NORAD [North American Aerospace Defense Command] that the workshop was coming [down]. It had dragged down. We'd been watching it. It had dragged down, but it was under control. Then it started losing control and it was coneing. So then it was, "Okay, what can we do? Can we go up with the first Shuttle flight and boost it up?" Because we still wanted a space station. So as Shuttle started slipping, "Well, what about the third flight?" [Laughter] And it slipped some more. "The fifth flight?" [Laughter] Let's take up what's called a teleoperator and

attach it to...boost it up higher... Then before too long it was, "Oops!" [Laughter] So it came in in '79, I think.

But at that point Ken was doing most of it. He was helping me compute some things, but he was doing most of the work. I never worked in the Control Center, but he would work in the Control Center on loan, more or less. He was never assigned to that. So he was over there, and they'd be changing the workshop's orientation to try to get less drag and try to stabilize it... That went on for a while.

Then when we knew it was coming in, he was working with it, so they were then trying to say, "Okay, let's put it down in a safe spot," ...it was going to be up there for hundreds more orbits, and you didn't know exactly where it was going to come down. Then the press wanted to know exactly where it's going to hit, you know, so on and so forth. And we'd say, "Well, if it hit anywhere from here to here," and really couldn't get the idea across to them that we had individual traces, and those traces were 200-some miles apart, and on one day it could come in on any one of those traces, and the next day it would come in on a slightly different set of traces, so if you were looking at it over a long period of time, it could come in anywhere...

Then as it got closer and closer, we could trim it down to a little closer estimate of where it would come down. So then it got to the place where they wanted to control it so it would come down in the Atlantic. Ken was working on it at the time. All of this detail, it didn't quite make the Atlantic. [Laughter] It skipped on over and on across into Australia. Then somebody unfortunately made the comment, "Oh, there's only a bunch of kangaroos over there anyway." [Laughter] Oh! But it didn't do any real damage. It really did just go across the desert. Then the heavy pieces went on further [past] Australia. People were picking up pieces and bringing them in as trophies. They were getting paid for any little piece that they could really identify as being part of the workshop.

But it was a real disappointment that the third [Skylab] flight was the last one. Congress just wouldn't put any more money into it. Then it was a disappointment that we couldn't keep it up there once it was there.

With Shuttle, we were saying [STS-5 to reboost the workshop]. So then we had to get back to business and then just fly [STS-]5 the normal way. Then I worked on [STS-]9 for a while. Then it was soon after that, that our branch broke up and we got assigned to a different one, but our group still did the trajectory work that we'd been doing before.

Then in '86, all of the type of planning work that we were doing was transferred over to contractors, and so Rockwell [International] got that contract. The subdivision of Rockwell was called the Rockwell Space Operations Company, RSOC. So I transferred. I retired. I had twenty-[nine] and a half years in by that time, so I retired and went to work, sort of changed the badge and kept on doing the same thing. So, to me, my work seems to have just constantly flowed. I'd just work up with what I knew.

While I was with NASA, it always seemed like the promotions just came automatically. I just got in there at the right time, was the thing, so you'd get your step raises when they were due, and you'd get your promotions when you'd gone through the steps. I didn't really feel under real strain. It was just that you had to get in there and get to work. It was great, feeling part of a team like that.

WRIGHT: That core group that you had before you left, were there many of the original members that you had come to work with? Were you all still together or had many of them gone off to different jobs?

OSGOOD: With MPAD [Mission Planning and Analysis Division], we still have a large group of those, but the ones that came down from Langley, they've retired and they've gone off in all directions. But the younger group that came in, that we worked with at MPAD, we

still get together just randomly. We'll just have lunch together. So forty or fifty of the people will show up. It's a random group of people. Some people show up one time, some people show up another time. But with the mission planning analysis and the contractors that worked, TRW and MDAC...we must have had 350, 400 people working there.

The contractors really felt they were as much a part of the group as anybody else. In fact, they weren't contractors, but we had some Air Force people that worked with us, and they just sat right in our offices and worked as if they were some of the engineers. So we had a group of people first that came..., called detailees, and they [wore] civilian clothes and did the same type of work we did. Then after that we got a group of Air Force types that were in uniform. We called those "blue suiters." They were affectionately called blue suiters. [Laughter] But they were all talented people, and they were supposed to go into the Air Force's Shuttle Program, but that didn't come about. One of the blue suiters that I worked with, later on when he left, in the Air Force he went up to general, a brigadier general.

WRIGHT: You trained him correctly. [Laughter]

OSGOOD: Yes, we were working a lot on launch windows. I probably haven't talked much about launch windows, but a lot of that, that was what we—in our branch, we invented the launch window to be able to figure out what day and what time and date and so on you could lift off. So that was one of the programs that was in [Bill Reini's] Monster program.

The ascent part now, the actual trajectory to get it off the ground and get it into orbit, that was done by Marshall [Space Flight Center]. But we'd have a program that said given the conditions that you accept once you'd gotten into orbit, knowing...its altitude, ...velocity and various components, knowing where it was, then we'd figure out what time to lift it off and [in] what direction... So we came up with the launch window which has, over the years, gotten more and more and more complicated and ornate, but with that you'd be able to tell

when you can lift off on any given day and what would happen a month or so in advance if...needed...

Whenever I go on trips and introduce myself, my husband will always say, "Now, she does windows. Maybe the people that work for you won't do windows, but she does windows," launch windows.

WRIGHT: It's certainly a term that most Americans have heard, but I'm not sure everybody would understand how complex a launch window really is.

OSGOOD: When we first started with it, Bob [Robert W.] Becker was one of the ones working with it, and he said, "You can compute the time that you want to lift off, but in order to do a launch window, you would put the date along the bottom and the time of day here." I say, "Well, the date's part of the time. You're just taking one quantity and breaking it up." And it would end up that it gave you exactly the information you needed to know, that on this particular date, this happens, you see. So it's been a tool that we just—I didn't mention it very much because it's just something we use. But it's fascinating.

Now sometimes you look at the launch window and there will be so many lines on it, you really don't know what it is. You have to have another sheet of paper that explains exactly what each line means. And then the digit's spelled out by columns. Every line that's on there, we now have the information that tells you the exact time that's on each line, so you can read it down columns in sort of a spreadsheet-like thing. You've got your plot, you've got the words, and then you've got the digits that will tell you what all those things are.

WRIGHT: Lots of important information.

OSGOOD: Right.

WRIGHT: We're going to take a break.

OSGOOD: I had worked with Mrs. Rhine for quite a while, and, of course, she had been handling all of these strange incidents...and we had worked categorizing them and studying them... But once we left the Parapsychology Laboratory and had worked for NASA for quite a while, then Dr. Rhine came over to, I think, Newport News [Virginia], to give a lecture. After the lecture, we went out to dinner with them. Mrs. Rhine was asking me, "What are you doing?"

"We're working for NASA."

"NASA?"

"Yeah, don't you know we're the group that wants to put a man into orbit."

She said, "A man? Doesn't that give you the creeps?" [Laughter] Here she's working with things that just give you goosebumps, you know. Of course, this was long before Mercury. This was right at the very beginning when we just got started. She hadn't even heard of NASA. "Doesn't that give you the creeps?" [Laughter]

WRIGHT: You were there at the beginning that it all started, and forty years later you're still involved with it.

OSGOOD: Right.

WRIGHT: Does it feel like forty years?

OSGOOD: No, it really doesn't. In fact, I probably have been putting off retiring because I probably will feel withdrawal symptoms. I could have retired long ago, but it's still

fascinating work and it's still about the same. In fact, my buddies keep pointing at me, "She's a real strange one. She's been doing this for all these years and she's keeping at it."

WRIGHT: And you're still continuing to learn today.

OSGOOD: Oh, yes. Each of the flights that we're working on, there's something new on it, you see, and it's fascinating. I'm working now with the—Rockwell was sold to Boeing, that part of Rockwell sold to Boeing, and we're now the United Space Alliance, but it's still the same thing, just continuing.

WRIGHT: One significant change that occurred was that when you began your career, the United States was in a space race with Russia, and now in the recent years of your career, you have helped the United States work in a partnership as well with Russia. How was that for you to make that change in your life of one philosophy to the other?

OSGOOD: Well, let's see. Of course, we had the feeling that running an open program like this had proved itself, and that Russia wasn't able to do that, and that now where they're working with us, they still have a lot of trouble being open enough so that we can really have a good working relationship. But it's fascinating. You don't have any hatreds or anything of that sort there, it's just that you have to learn to actually work with them to get the information you want at the time you want it. So now if we would like the Russians to maneuver the Space Station to a certain place at a certain time, you have just months of negotiation that has to go on. This is right now before it's manned...

I'm working on a flight right now where they really want to place the Space Station in a particular relationship so when we launch, we'll be able to launch in a shorter period of time. The longest period of time that it takes to launch, we call a flight day four. We'd like

to have all of them be a flight day three. Well, if you can have your target maneuver for you and be at the right place at the right time when you lift off, well, it would work. I'm not sure that we're going to get that coordination done yet. I don't work directly with the people that do it, but I work with the results of it.

And I certainly hope that the service module gets up there all right. I don't know exactly what's going to happen [to] the whole program, because there's only one [service module]. We're going to have to do some scrambling if something happens to that service module for the station.

WRIGHT: It certainly would be a nice closure to all your contributions, to be able to be there when Space Station is there and manned.

OSGOOD: Right.

WRIGHT: Would you have changed anything during these whole forty years, if you would have done something different?

OSGOOD: Congress could have kept pouring more money in. [Laughter] And we really would have liked to have gotten started on the Space Station much sooner... In general, I've been amazed that we've been able [to accomplish so much.] Every so often with the management you'd kind of think, "Well, I really can't tell what's going on. I hope they can," you know, but in general it's all worked out. I don't think we could have done it better.

I must admit that after Apollo was over, there was a slack-off. You didn't have the same goal... So now it's more like work. Before, it was, "I'm surprised they're paying me to do a job that's so interesting." Now it's a little more like work.



WRIGHT: What was the greatest challenge of this career?

OSGOOD: I don't know. It always seems like I just moved into things that were convenient and let someone above me do the most work. But I would say getting up and facing a room full of people when I had a presentation to give, screwing up my courage enough to get up there. But in general, all the rest of it has pretty well just been an integral part of the puzzle.

WRIGHT: And you enjoyed your work so much that you chose not to move into management?

OSGOOD: Oh, yes. I sort of looked at it as if I'd raised my three children and I didn't really want to guide the careers of anybody else's children. I really enjoyed this type of work a lot more than I would management work. I did have a few opportunities when I could have, particularly when we transferred out of NASA. They really expected me to take a management position there, but management isn't the type of work that I'd like to do, and I knew it. I'd always believed in the Peter Principle, that you rise to your level of incompetence, and then you stay there... I wanted to stay just one level below my level of incompetence. [Laughter] So I do still feel like I contribute.

WRIGHT: Well, we thank you. If you allow it, I'd like to ask Sandra or Carol and see if they have any questions that they might have thought about.

OSGOOD: Great.

WRIGHT: Do you have anything, Carol, that you have? Sandra, did you think of anything?

HARVEY: I did, actually. First I'd like to say what a fascinating career.

OSGOOD: It has been.

HARVEY: A couple of things. When you came to MSC as an aerospace engineer, how about when you moved into that department, in terms of ratio of men to women? We got a feel when you were the math aide that there were more women. What about when you became an aerospace engineer?

OSGOOD: Probably was even less, because before I was in a group with basically women for the math aids. I was the only woman in the Rendezvous Analysis Branch. There were just very few women all the way through JSC, in fact, all the way through my NASA experience.

HARVEY: Did that pose any obstacles for you, being the only woman in Rendezvous?

OSGOOD: No, I never really thought about it, but my husband always told me, "This is the way they work." I'd come home saying this and this and this happened, and he'd explain it. Then my brother was one that was always competing, and once I learned to live with my brother, I could learn to live with anybody else, see. [Laughter]

I did have one office mate that was just about like my brother, but he was a little bit smarter. We just sort of jostled off of one another. But I didn't ever feel really threatened by it. He did make too much noise. I'd go home at night and my head would just be ringing... I'd still be hearing him talk... But he was always into something. But I'd always come back with something. We had a good relationship.

At lunch we'd work on the crossword puzzle and we'd get into competitions. So there'd be one group working on theirs and another group working on the other one. The

rules were that you could use any dictionary or anything you wanted, because it takes time to look it up. It's just whoever got through first, you know. So he and I were a team, and we'd just ace them most of the time, keep score on the blackboard, that sort of thing.

HARVEY: Will you indulge me in a couple more?

OSGOOD: Yes.

HARVEY: You talked about rendezvous, but we didn't talk as much about Gemini. I'm wondering what problems or—as Gemini is the project, of course that was the first docking missions. What did that pose for you as rendezvous analysis?

OSGOOD: Let's see. On Gemini V, there was just one vehicle. We wouldn't be rendezvousing with a target. But it had a device on it that we called the pod, that was to be deployed and then rendezvous with it. Well, they got into the timeline to deploy it, and they deployed it... Then they had trouble with the [Gemini] fuel cell, which was very new at that time. So it was just a very short period of time before just forget the pod.

When they finally figured out what was wrong with the fuel cells, that we weren't going to have to come home, then Bill Tindall was in there saying, "Okay, we don't have to have that pod. We can rendezvous with a spot in space," you see.

In one book or other, they wrote that up and said that the engineers were quite disappointed when they lost the pod and they went to the Flintlock to bring it down. [Laughter] And they tended to drink a lot too much beer...but I had three kids at home...[and couldn't join the drinkers.] I wasn't the engineer responsible on this one [Gemini V]. Bobby Culpepper—I don't know if you've interviewed him or not; he was part owner of Barrios [Technology] there for a while, he was in charge. He was really

disappointed, but he wasn't the drinking type, so he was still around when they needed somebody to come back and do some work. [Laughter] But these other guys, they stumbled back, and they were able to do pretty well with it.

But the atmosphere there would be to work real hard on something, and when it was done, then they'd go and drink or go do something right away...to relieve all the pressure. I tended to—my husband wasn't part of that, and neither—so I couldn't participate in it, but that seemed to be their way of releasing pressure. They controlled it fairly well, but I felt they drank too much. [Laughter]

Then what my supervisor did, he tended to be the one [for] crisis planning... I don't know if you're going to interview Ken Young or not, but things would just wait until they you just—everything was just about due, and then he'd start working on it... [Laughter] Then you'd work as hard as you could and when it was done, "Great! Let's go play!" [Laughter] But we did have a lot of fun. It was great.

HARVEY: One other question I had about the Shuttle Program. You talked about the Shuttle as being—it kind of got customers now, different things. How did your job change with the addition of the payloads and different weights that the shuttles might be carrying? Because with Gemini and Apollo, you could kind of judge what the weights would be. This was changing. How did it change your job?

OSGOOD: Well, it didn't change mine much. We have another group that works with where the center of gravity is and where everything is positioned and the like. It's more like can one experiment function with another experiment? Does one need to be in an orbit that goes over a large amount of land and the other doesn't? ...For inclination of orbits, the highest inclination we could fly is 57. Then you can run a mapping experiment that will map just about all the mass on the earth...and there will be others that have some other requirement

that interferes with that one... So that's mainly how I'd get—not the actual placement of the cargo, but how it functions.

HARVEY: One more question for you. How did you figure out this whole rendezvous and everything and you'd never done it before?

OSGOOD: Well, we had Bill Tindall. [Laughter] If I had brought in some of the notes—I've got them in my car. 1961 is some of the dates on it and so on. You start out with your equations of motion and how one vehicle moves and how the other one moves in relation to it. Then you just keep working on it until you've figured out how to lift off at the right time to rendezvous with a vehicle that's already up there. But an awful lot of it was getting that AEG [Analytic Ephemeris Generator] so you could run data to know exactly where each vehicle is. If you can run it and things don't work right, you could start over and change, find what you did wrong, and you can try again, you see. Then once you get all these methods worked out, well, then they become a program, and you just fill in the blanks and it comes easy.

But with Bill and his rendezvous notes, the group that would meet every week, and Bill Reini doing his programming, us running the program to see what results we got. "No, that doesn't look quite right." You just keep at it. It's amazing. I'll bring that notebook in and see if there's anything in it that interests you.

WRIGHT: It's been very obvious that when you started, you had a simple tool of a pencil, and, of course, now you're working with the aids of computers. So that was a whole new learning curve for you, the continuing change of technology for tools.

OSGOOD: Right.

WRIGHT: Did that ever slow you down, or was it a way of helping you?

OSGOOD: No, every so often I'd say, "I don't want to have to learn two systems at once."  
[Laughter] Because sometimes you'd have different keyboards and two different systems...and then you'd be spending all your time correcting your errors from one keyboard to the other keyboard. They might have thought I was cranky sometimes... but in general they knew I'd come around. But you'd really work—you'd get from one system on to the next system, and then once you're on that individual system, well, then things would smooth out and you'd be able to work with it.

WRIGHT: It must have been a continual challenge, but it must have been very enjoyable for you to have dedicated forty years of your life to the space program.

OSGOOD: Yes. It's amazing.

WRIGHT: I know that your contributions will serve it for many years to come, and we certainly appreciate you taking the time today to share those with us.

OSGOOD: Good. Thank you. It was a pleasure.

WRIGHT: Thank you.

[End of interview]