NASA JOHNSON SPACE CENTER
FACILITIES ORAL HISTORY PROJECT

JAMES R. BRANDENBURG
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is May 7, 2009. This telephone oral history interview with James Brandenburg is being conducted in Houston for the Johnson Space Center Facilities Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Sandra Johnson. Thanks again for joining us this morning. I'd like to begin by asking you to briefly tell us about your career with NASA.

BRANDENBURG: I came to work down at Johnson in June of 1967, and I was there for just over forty years. I retired in August of 2007. Let's see. Anything else you need to know about that?

ROSS-NAZZAL: Did you work in the Mission Control Center [MCC] that entire time, or were you assigned to different directorates?

BRANDENBURG: Yes. When I came to work there, I worked for the old Landing and Recovery Division, which was a part of the Flight Operations Directorate. Part of our job then was, of course, recovering the spacecraft, but another part of the job was we had a recovery operations control room in the Mission Control Center, and that's where we managed the recovery forces, out of that room. Occasionally, I was assigned to that particular room. So yes, I've been associated with the control center since day one.

ROSS-NAZZAL: Oh, wow. Okay, so you've got a lot of good information for us about the facility itself.

BRANDENBURG: Well, I've got a lot of information, (laughter) but I don't know if I have much time to tell you, though.

ROSS-NAZZAL: All right.

BRANDENBURG: I do have a couple documents that you might want to get a hold of. I'll tell you about those when we get to that question.

ROSS-NAZZAL: That would be great. Anything that you have to share with us would be fantastic. Why don't you give us a short history about the Mission Control Center, telling us when it was constructed, what its purpose was, and how the building has changed since you came on board in 1967 until you left in 2007.

BRANDENBURG: Of course, the building, when it was initially built, they called it Building 30[M] MOW, Mission Operations Wing, and that's as opposed to the administrative side [30A] where the offices are, on the other side of the building. Like I said, it was built in the early sixties. It was built by the [United States Army] Corps of Engineers and another general contractor called Ets-Hokin & Galvan. Now, this information I'm providing to you is obviously before I was there, but I've got documents that have this information in it, and those are the two documents I mentioned to you. Obviously, the reason it was built was to provide a command

control capability for human spaceflight, and specifically, it was built with the knowledge that the Gemini Program and the Apollo Program were gearing up to start. That was the reason it was built.

Now, it was first occupied in July of 1964 by the operators in the control center, and it actually came online and monitored the first manned Gemini flight, which was in 1965, I believe. It was on monitor mode only at that time, because all the testing of all the equipment hadn't been completed. So it monitored the Gemini III flight, and then in June of 1965, the Gemini IV flight. Because it did so well in monitoring the Gemini III flight, the people felt it was ready to go in full-up control mode. It did that for Gemini IV in June of 1965. So that's kind of how it all started.

Then, of course, it has supported every manned spaceflight since then, including all of the Geminis, all the Apollos, Skylab, the Apollo-Soyuz Test Project, and then, of course, ALT [Approach and Landing Tests], which was some of the early Shuttle drop flights, where it was atop a [Boeing]-747, and then the 747 would release it, and it would land on the lake bed out at Edwards Air Force Base [California]. Then, of course, after that, it was the Shuttle Program, and then, of course, after that, the International Space Station Program, which it's supporting now. So that's kind of the history of when it was built and what it's done since then.

ROSS-NAZZAL: Can you give us a sense of how the agency changed or updated the Mission Control Center to support the Space Shuttle Program? Can you give some examples?

BRANDENBURG: Of course, all the equipment was replaced to support the Shuttle Program. Let me see. I wrote a note down here. Let me find out where it is. It was supporting the ALT

Program at the time, and the equipment used to support the ALT Program was equipment that we already had. It was just reprogrammed for that particular set of ALT flights. In parallel with that, our development contractor was doing development for the actual Shuttle flights, beginning with the OFT, Orbital Flight Test Program [STS-1 through STS-4], and then subsequently, what they called at the time the ops part of the Shuttle Program. So that's kind of how we got to there.

ROSS-NAZZAL: Can you tell us what type of equipment you were using for the ALT Program? You mentioned it was stuff that you had. Was that from the Apollo Program?

BRANDENBURG: Yes, yes. I don't recall exactly what it was. Let's see. Like I said, it was equipment that we already had. I'm trying to look into this information that I have here to see if it says exactly what it was. I don't recall exactly.

ROSS-NAZZAL: How was the building changed to support the Space Shuttle Program? You mentioned that equipment was changed out. Were there any major changes done to the building?

BRANDENBURG: Are you talking about the physical building or the systems within the building?

ROSS-NAZZAL: Well, I guess, both.

BRANDENBURG: Both. I do not recall any major physical changes to the building; it's just that we brought in new equipment that was built and/or just bought specifically for the Shuttle

Program. But it was basically all new stuff, and like I said, it was brought in the building, installed, programmed, and tested in support of the STS-1 flight.

ROSS-NAZZAL: This equipment, would it primarily consist of computers, or are there other pieces of equipment?

BRANDENBURG: It's computers and computer-related equipment. Some of it was hardware—you would term it hardware, versus a computer—but the whole system, from the front end of the building until the displays on the consoles, it was basically all new.

ROSS-NAZZAL: Do you recall when JSC began transitioning the Mission Control Center from the Apollo Program into the Space Shuttle Program?

BRANDENBURG: Yes, let's see. In July of 1976, there was a contract awarded for the design, development, implementation, test, and maintenance operations, so I would say that's when it started, at the initiation of that contract. That was July of '76.

ROSS-NAZZAL: Who was that awarded to, do you recall?

BRANDENBURG: Let me see. It was a byproduct of old Philco-Ford. Philco-Ford, of course, built the original stuff in the control center, and they were actually called Aeronutronic Ford [Corporation] at that point in time. The contract number was NAS 9-15014.

ROSS-NAZZAL: As the Landing and Recovery Division sort of—I'm not sure what happened to it exactly.

BRANDENBURG: It was abolished.

ROSS-NAZZAL: Where did you move from there?

BRANDENBURG: I was in the Landing Recovery Division until it was abolished, which was right around late '71 or early '72. So at that point in time, all the people that were in that division were kind of fanned out to other jobs. I happened to go into the division that basically was responsible for the control center, for development of maintenance and operations of the control center. That's kind of where I got into the meat of actually working with MCC systems that were supporting the flights at the time. That would be Apollo. The Apollo fire was in January of '67, and I came to work there in June of '67. Then I supported the Apollo flights as a part of the Landing Recovery Division until it was abolished, which again, that's late '71 or early '72, somewhere in that timeframe.

ROSS-NAZZAL: Can you talk to us a little bit about the development of the control center for the Shuttle Program and that entire transition from Apollo into Shuttle?

BRANDENBURG: Well, like I said, I don't know that I can tell you any detail. There's a whole bunch of that detail in these documents that I have, but it's not in my head. (laughter)

ROSS-NAZZAL: Oh, sure. That was a long time ago.

BRANDENBURG: Like I said, it kicked off with that contract, and they went and did the design, a detailed design, and then acquired the systems, the computers and hardware, and then programmed them to the design specs [specifications] that they needed to support the Shuttle.

ROSS-NAZZAL: Were there any complications with that transition as you moved from one major program to another?

BRANDENBURG: I said no when I read that question. I said nothing out of the ordinary. There's always some minor complications you run into, but I don't recall anything major, any glitches at all that caused any delays in the program milestones.

ROSS-NAZZAL: I wonder if you could describe the layout of the Mission Control Center, especially as it existed during the Apollo Program and then, in contrast, for the Shuttle Program.

BRANDENBURG: There really wasn't a whole lot of difference. That's pretty good loaded question.

ROSS-NAZZAL: It is? Okay.

BRANDENBURG: The layout was basically the same. We did have to bring in new systems to support the Shuttle, and then eventually got rid of all the Apollo support equipment. About the

only thing that comes to mind major was down on the first floor in the control center, we had an area down there called the RTCC, Real-Time Computing Complex. That was where most of all the computing equipment was. That's what that was called, the computing complex. A lot of controllers that set up the equipment and managed it were down in that area. That went away, and a lot of the controllers that were down in there actually went to a room up on the third floor in the control center and supported from there. So to me, that's probably the major difference between the two.

ROSS-NAZZAL: You weren't relying on huge mainframe computers for the Shuttle Program?

BRANDENBURG: Oh, yes. Yes, we did. We had mainframes in there until—I've got a piece of paper on that. Let me see. Yes, 2002. [In] 2002, we decommissioned the last mainframe computer.

ROSS-NAZZAL: Wow. That's amazing.

BRANDENBURG: So it hasn't been that long ago, actually, that we did that. But they were there. Of course, it wasn't the same ones. Computers have a life [cycle], and you usually try to replace them every—depends on which it is—every four or five years. We replaced the mainframes as the old ones became outdated, and the new ones were what was new technology at the time.

ROSS-NAZZAL: Well, if you can, tell me a little bit about the ALT Program. You were working in the control center at that point. Were there any changes that had to be made to accommodate a flight in California versus a spaceflight?

BRANDENBURG: Yes. We used some of the existing equipment in the control center to support the ALT Program. Of course, the ALT Program was a very short program, and it didn't require anything really sophisticated because it was just being dropped off the top of a 747, and we were basically just monitoring what it was doing. So it wasn't a major program change, like it was going from Apollo to Shuttle. The ALT was fairly simple to support. Actually, I myself didn't actually support the ALT. I had people in the office that did, but I didn't. I was working on getting prepared for the Shuttle Program. I was doing what we call planning.

ROSS-NAZZAL: Can you tell me more about that, about planning for those first few flights?

BRANDENBURG: Yes. At that point in time, my job was one of what we called back then was network controller. We were the people that basically integrated the control center operations with the network operations, the network being all those tracking stations out there and, of course, the TDRS, Tracking [and] Data Relay Satellite, which were in the design and development stage at the time. So what we tried to do was we built all the plans and procedures that were necessary to get ready for STS-1. What we like to say is the job that we do for any particular Shuttle flight is we do our planning, and we do our training, and then we fly. So plan, train, and fly is what it is. That first stage where you do the planning is where you get all your

procedures and everything laid out so that you can then go do the training and use all those procedures and verify them and know that you're ready to support a flight.

ROSS-NAZZAL: Did you support any of the Space Shuttle flights as a network controller?

BRANDENBURG: I did. I supported STS-1, 2, and 3 as a network controller. Then I was actually made a manager at that time, so the guys who did what I had done worked for me after that. So I didn't really sit at the consoles anymore after that, but the people that worked for me did, doing the same thing: planning, training, and flying. From the network controller [name] for [Apollo], we changed the position name to GC, ground controller, for Shuttle. That's what they are today, ground controllers. But they do the job the same way; it's just all contractors now. This is the last NASA GC.

ROSS-NAZZAL: Can you tell us about those first three orbital test flights and how the Mission Control Center supported them in terms of planning, training, and then flying?

BRANDENBURG: Well, getting ready for each one of the flights was the same process, like [I] said, planning and then training. Of course, there's a lot of testing that goes on, too. It's not just training; you test all the systems that have been reconfigured for that particular flight, and you test all that, and then you have to go use it in training. Then you fly. I don't know if that answers your question or not.

ROSS-NAZZAL: Well, it sort of actually leads into another question, and then I'll come back to the other question. For each mission, the control center is reconfigured, is that correct?

BRANDENBURG: To some extent, yes. It's not necessarily major stuff. I don't know that there was that much reconfiguration that went on for the first four, the development flights, but sometimes the Shuttle's onboard software programs get updated, and that may require that the ground software be updated to accommodate that. So there's that kind of reconfigurations that go on, flight to flight. They still go on today, too, or at least they had been going on. I can't tell you what's happening right now. But that kind of thing is not unusual, from flight to flight, to do some kind of reconfigurations. Even the flight controllers that monitor the onboard Shuttle systems, if a Shuttle system changes, then they'll probably have to go in and change their monitoring tools, which are displays and little digital driver devices. They have to go in and modify those to support the changes that have been made to the Shuttle.

ROSS-NAZZAL: How long does that process take?

BRANDENBURG: That's hard to say. Depending on the extent of the change, it could be anywhere from a month or 2 months up to maybe 10 months, 12 months. So it would depend upon the extent of the change. It's kind of hard to answer that.

ROSS-NAZZAL: How long would it take your facility to get ready for a new mission coming up?

BRANDENBURG: That's a hard one, too. Let's see. Again, it depends on what you're really asking, but there's the planning stage, which really doesn't necessarily have anything to do with the facility change, other than the part of it that's reconfiguration. That's part of the planning. If there's something that's changed externally, and it drives a change internally to the MCC, then you have to figure that into your planning and go and make whatever changes are necessary. The planning stage of a flight probably begins two, three years before the flight, and then there's the training part, which is generally—well, for instance, for STS-1, we trained for I believe it was over 2,000 hours for that flight, whereas today, you'd probably be looking at maybe 300 or 400 hours, something like that. It's about three months these days as opposed to the early days, and that's all a part of a new program and how much time you spend on it in the beginning. Ten, 20 years later, you pretty much know what has to be done, and so it doesn't take near as long.

ROSS-NAZZAL: I wonder if you could select a flight—you mentioned STS-1, for instance—but if you could walk us through your recollections of this process and how you prepared the Mission Control Center, how you trained, how you did a simulation, for instance, and then flying. If you could walk us through one of your most memorable missions that you can recall.

BRANDENBURG: The planning and training for STS-1 was a whole lot different than any of the other ones, because obviously it was the first flight, and new vehicle, new controllers. I do recall that we had several attempts at the launch of STS-1 before we finally got it off because of problems we found during the countdown, et cetera. So that was another thing that drove it to be in such a long process to get ready for launch is finding the problems, working them out, and going, doing it again. But pretty much we do training for the ascent phase of the flight, we do

training for entry phase of flight, and we do training for the orbit phase of the flight—different phases where, back in the those old days, we might have had a payload on board, and you'd have to train to make sure the procedures and things were in place to do whatever the payload might need to be done. We deployed some. We went up and fixed a few of them, you know, like they're coming up on a Hubble [Space Telescope] revisit. They're going up to make some repairs on it here before too long. So you've got to train for all those different phases of the flight that are a little different than the previous flight, for instance.

ROSS-NAZZAL: Could you give us a little bit more detail about those simulations? How long would an integrated sim last?

BRANDENBURG: The simulations or training exercises, generally the ascent and entry exercises are about four hours long, and they'll consist of doing maybe four or five, maybe even six, runs. Of course, we've got the simulation team that develops the scripts for those exercises, and they'll put in problems, and the purpose is to get the flight controllers to recognize them and manage them, fix them. So ascent and entries were usually about four hours apiece, and then the on-orbit exercises are generally eight to ten hours. There were times and are times when they'd do what we call a long simulation, and those could last anything from a couple days maybe up to three days. That might consist of doing the ascent, and then going on orbit, and going to go over the operations procedures that need to happen over those entire two or three days.

ROSS-NAZZAL: How many people generally worked in the control center when you were working a simulation?

BRANDENBURG: (laughs) That's a good one, too. I did some estimates. I don't know. They're kind of guesses, but I was guessing that maybe about 300 people per shift, a shift being eight hours. Like I said, that's just a guess. I don't know how accurate it is, but it's a guess. But it's a knowledgeable guess, because I know there's 22 to 25 people in the flight control room. That's the main room. Then there's, back in the back rooms, might be anywhere from, oh, three, four, five people per back room, and that's one back room per flight control room position. Then there's people that actually work maintenance and operations in the building. There's, I was guessing, 50 or so there. Then we got the mission evaluation room. For a launch, there's usually about 150 people in that room by itself, but that's just for launch. So it's difficult to say exactly, but I think around 300 would be an educated guess.

ROSS-NAZZAL: Are there any specific Shuttle missions that stand out in your memory that Mission Control supported?

BRANDENBURG: Well, STS-1, obviously. I believe it was STS-3 that had to land at White Sands. [Northrop Strip, now] White Sands, [Space Harbor], New Mexico. That one put a scare into me, because when they landed, they had the nose coming down, and they were on the runway, and all the sudden, the nose went whoop, back up. It was kind of a scary thing, but nothing happened. Of course, [the Space Shuttle] *Challenger* [accident], [the Space Shuttle] *Columbia* [accident], and then the STS-26 flight, which was the return to flight, first flight after the *Challenger* accident. Let's see, I think STS-9 was the first Spacelab mission. Then we had a TDRS, a Tracking and Data Relay Satellite, that was the first one we put up. I think it was STS-

4. I'm not certain of that. But anyway, those are kind of the ones that come to mind. A few of the firsts, and, of course, the accidents.

ROSS-NAZZAL: Can you tell us how the *Challenger* accident impacted operations or the facility at JSC?

BRANDENBURG: Of course, it impacted the people. I don't know that it impacted anything else because there was nothing we could do about it. We did some testing following it to try to help figure out what went wrong, but other than that, really the impact on operations was that there wasn't any for a couple of years, because the Shuttle was grounded, and we had to get it fixed before we could fly again.

ROSS-NAZZAL: Were there any modifications made to the building at that point, or equipment, while we were down?

BRANDENBURG: Result of that? No, I don't recall anything that was done directly as a result of that.

ROSS-NAZZAL: After the *Columbia* accident, were there any modifications or changes made to the control center?

BRANDENBURG: Yes, I'm sure there were. After that, they went in and made all these modifications to the Shuttle to be able to do the on-orbit inspection of the tiles. So I'm sure that

we made changes on the ground that coincided with the on-board changes they made. But there weren't any changes made that were really directly as a result of the accident. Like I said, there were on-board changes to the Shuttle made that drove changes to the ground.

ROSS-NAZZAL: When the different Shuttles came—when *Challenger* came on board, *Discovery*, *Atlantis*, and *Endeavour*—were there any changes that had to be made to the control center, or are they pretty much the same animal?

BRANDENBURG: Pretty much the same.

ROSS-NAZZAL: What impact did working with DoD [Department of Defense] have upon the Mission Control Center and the facility?

BRANDENBURG: Which question is that on this paper? Oh, I see. How did DoD-classified flights impact the facility? What measures were taken to protect classified information?

Well, of course, it did impact the facility, because we had to make modifications to protect data security. The third floor of the control center was used for the support of the DoD flights, and we had to keep all the information that was classified separate from the regular unclassified STS [Space Transportation System] information. So, for instance, we had cable runs under the floor; the ones that supported the classified flights were separate from the ones that supported the non-classified flights. That was pretty much across the board, everything, even the voice loops on the key sets, the ones that could have classified information on them

were separate from the ones that didn't. So yes, there was a lot of impact to prepare the facility for the DoD flights.

ROSS-NAZZAL: Do you know when that process began, as you began to revitalize the Mission Control Center in support of DoD missions?

BRANDENBURG: Let's see. I don't recall that, no. I'm sure it's in one of these documents that I have.

ROSS-NAZZAL: Are those wires and all of the other changes that you made to the facility, are they still located in the facility, or have they been taken out since?

BRANDENBURG: Of course, what we did do also is the third-floor control room was deemed a National Historical Monument. Basically, all that equipment that was stored in it was declassified. Actually, it was about the same time as we were putting in new equipment, so it was all decommissioned basically in place.

ROSS-NAZZAL: Do you recall any of the DoD missions that stand out in your mind, or were they just one of many?

BRANDENBURG: (laughs) No, there's none that stand out in my mind.

ROSS-NAZZAL: I'm curious. As the program matured, we started out with the four flight tests, and then we became operational, and over the years, the flights became much more complex, especially now that we have Space Station. Did that change the operations at all within the facility?

BRANDENBURG: Not really. The basic operation of how you manage a flight is the same. Matter of fact, it's basically the same as it's been since day one, you know. The flight director and the team and all the support personnel—it's basically all the same now. The only really difference is the interaction between the Station team and the Shuttle team. That's a little different. But again, the way they do it, and the way they manage it is basically the same since it's been since day one.

ROSS-NAZZAL: How many people would typically work in the control center when a mission was up? Is that about the same number as the sim?

BRANDENBURG: That's the number I gave you, 300.

ROSS-NAZZAL: Okay, it's 300.

BRANDENBURG: Back to that question. I told you about how many per shift, and that was basically for a flight. Now, there could be some tests were being run or stuff like that, there might be only a handful of people in there running the test. Then, of course, we have the team

that's in there 24/7 that operates the control center: the system, the computers, and all that. They're in there all the time. That depends. It probably averages 30, 40 people.

ROSS-NAZZAL: Can you describe some of the unique equipment in your building that you used to support the Shuttle Program? Was there anything in particular that stands out?

BRANDENBURG: Where's that question?

ROSS-NAZZAL: Right above the DoD question.

BRANDENBURG: Oh, okay. I found it. Not really. Most of the equipment in the building now is COTS, Commercial Off-The-Shelf. Now, back in the Apollo days, there were some pieces of equipment that were designed and built specifically because there wasn't anything out there off the shelf that would really support the requirements or the needs. Two pieces of equipment to come to mind regarding that are DVIS—Digital Voice Intercom System. It was a system that was designed and built by Ford—oh, golly—back in the early nineties. It's still there; it's still operating. Or else was when I left. I don't know if it still is or not.

The other piece of equipment that was designed and built specifically for the control center was the projection plotter. That's the big screen, the 10 by 20-foot screen that's in the flight control room that plots the trajectory of the vehicle. It was actually designed and built specifically for that purpose. Now, it has been since decommissioned and replaced with other projectors—they're as good a quality a projector as what we had back then. Back then, you couldn't get anything that was the quality we needed. So those are two pieces of equipment that

we had, or, like I said, we still do have the Digital Voice System, DVIS, but the plotters are now—I remember the last plotter that we actually had designed and built for the control room cost us about a million and a half bucks.

ROSS-NAZZAL: Wow.

BRANDENBURG: Projectors that we buy that are replacements today cost us about $10,000 or $15,000. So that's what technology advancement has done for us.

ROSS-NAZZAL: The Shuttle Program was pretty cost-conscious, so there wasn't any unique equipment that you can think of?

BRANDENBURG: Other than what I've just told you, no.

ROSS-NAZZAL: Oh, I'm sorry, I misunderstood. I'm sorry, I thought that these two items were built for the Apollo Program, but continued to be used in Shuttle.

BRANDENBURG: No, no, no, like I said, the DVIS system was actually built in the early nineties.

ROSS-NAZZAL: Oh, okay, I misunderstood.

BRANDENBURG: So that was well into the Shuttle Program. It was built to support the Shuttle Program. It was built to support the building, okay?

ROSS-NAZZAL: Okay, yes. (laughs)

BRANDENBURG: Then the other thing is the plotters. They did support Apollo, but they also supported Shuttle up until the time that technology built something that was an adequate replacement part. I don't recall exactly when that was, but I think it was sometime in the mid-nineties.

ROSS-NAZZAL: During your time that you worked at the control center, the original control center was closed out, and there was a new flight control room established for the Shuttle Program. Can you tell us a little about that and why that decision was made?

BRANDENBURG: The new building that was built, and it's kind of attached to the old building, the new building was built to support the ISS, International Space Station. Matter of fact, initially, they called it SSCC, Space Station Control Center. That's what it was built for. Due to budget crunches and stuff like that, we shut down the third floor control stuff because of budget problems, and then we flew the Shuttle flights out of the second-floor control room from then until when the new building got built.

What they ended up doing in the new building was they put the International Space Station control room in a room that wasn't really designed and built for that purpose—but again, this was all due to budget concerns and problems—and they took the Shuttle control room from the old building over to the new building, into the flight control room that was actually supposed to support Space Station. So that's kind of how the sequence of events occurred there between

how they got from the old building to the new building. Recently, they moved the International Space Station control room back over to the old building, into that second-floor flight control room. So that was the sequence of events, what happened there.

ROSS-NAZZAL: There was a new Shuttle Mission Evaluation Room added in 2004.

BRANDENBURG: There was.

ROSS-NAZZAL: Can you tell us about that?

BRANDENBURG: I sure can. Matter of fact, I was the project manager for that.

ROSS-NAZZAL: Fantastic.

BRANDENBURG: Let's see, where did I write that down? Well, I can't find it. Where is that on your list?

ROSS-NAZZAL: It's not one of the questions. I just had some notes.

BRANDENBURG: I wrote something down about that here.

ROSS-NAZZAL: You might have written it with the sections of questions about how the building had changed over time or any modifications of the building.

BRANDENBURG: Yes. Let me just tell you what I wrote down. I know your question was specifically about the MER [Mission Evaluation Room], but basically what I said is the facility is really in constant change, because as the systems get old, they have to be replaced. So the systems and the facility is in constant change. For instance, back in I think it was ’98 or ’99, we built a new Customer Support Room [CSR] that was designed to support both programs, the Shuttle Program and the International Space Station Program. So that was built I think it was in ’98 or ’99, somewhere in there. Then the new MER was built, and that was a result of the *Columbia* accident. The MER folks decided they needed more room, and they came up with the money, and we built it.

Then, most recently, the old FCR 1 [Flight Control Room] that was used for Apollo and Shuttle, it was converted and built into a Flight Control Room for the International Space Station ops, and the reason that was done is because the International Space Station control room over in the new building was pretty small, and people were not happy with being in confined spaces. So the Flight Control Room 1, was there, wasn’t being used for anything. Well, it was being used for something, but what it was being used for was payload and that kind of support, and that got moved into some other building, so it was available to convert and do the flight control room for the International Space Station controllers.

ROSS-NAZZAL: It sounds like the building changes quite a bit, as you pointed out.

BRANDENBURG: Yes.

ROSS-NAZZAL: Do you know who the contractors were who made changes to the building in terms of these facility changes?

BRANDENBURG: Well, it's different ones, but the initial contractors in the building getting ready for Gemini and Apollo were Philco-Ford and IBM [International Business Machines]. The contracts to do the ops and development work in the building are redone about every—it could be as little as three years or as much as ten years, but they're recompeted. For instance, in '86, the ops contract was competed, and Rockwell Space Operations got that. That would be USA [United Space Alliance], primarily. Then Lockheed Martin did development work for the ISS [International Space Station] and Shuttle. Then, of course, I mentioned the Aeroneutronic Ford. So the contractors support that business change from time to time. Matter of fact, one of these documents that I have here says, "Contractual History of Major Implementation and Operations Milestones."

ROSS-NAZZAL: Oh, fantastic.

BRANDENBURG: It's a document that picks up in April of 1962, and it is dated 1985, so it covers at least through '85. The other one is a document called, "MCC Development History," and it was compiled in 1990.

ROSS-NAZZAL: These two documents that you mentioned, you'd be willing to share those with our office so we can get them scanned and share them?

BRANDENBURG: Sure.

ROSS-NAZZAL: That'd be great.

BRANDENBURG: Matter of fact, what I wrote down here is—I don't know if you guys did an oral with Dennis [R.] Hehir.

ROSS-NAZZAL: No, his name doesn't sound familiar at all.

BRANDENBURG: He took over as facility manager for the control center when I retired. He has copies of these.

ROSS-NAZZAL: So you think I should just contact him directly?

BRANDENBURG: Yes, I would. He has the copies. Let me give you the names of them again. "MCC Development History," August 1990. The information in that document—well, you'll see; his name's on it—Ray Loree is the guy that compiled it. The information came from different places. The other one was "The Contractual History of Major Implementation and Ops Milestones." The document has a date of 1986 on it.

ROSS-NAZZAL: Okay.

BRANDENBURG: One other thing. There's a letter. It's a bunch of information, and it was compiled by Bob Legler, Robert [D.] Legler, in '97. There were some questions that one of the reporters, John Getter—I don't know if you remember him or not. I think he was a CBS reporter. A bunch of questions, historically MCC questions. This Getter got a bunch of good information. Dennis has that also.

ROSS-NAZZAL: Okay, great. I'll send him an e-mail.

ROSS-NAZZAL: Just a couple more questions. Do you think that there's anyone else that we should talk to to get as much history as we can about the facility?

BRANDENBURG: Yes. I don't know if you remember Jack Knight.

ROSS-NAZZAL: Yes, actually, I think we've talked with Jack.

BRANDENBURG: Oh, you have?

ROSS-NAZZAL: Well, for our oral history project, not for this project.

BRANDENBURG: He was actually a flight controller. He was a division chief. He knows a whole lot about the history of the flight control part of the operation. Now, he was never—well, I won't say never—he came over and became our division chief for a while, but he was mostly in the flight control operation, and he's got a whole lot of history in his head about that.

ROSS-NAZZAL: Okay, anybody else that you suggest?

BRANDENBURG: Nobody that I can think of right now. The guy that wrote two of the documents, his name is Ray Loree, but he's got all his information out there in black and white, so I don't think you'd need to talk to him.

[End of interview]