

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

JAY F. HONEYCUTT
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is March 22, 2000. This oral history is being conducted with Jay Honeycutt at the offices of Lockheed Martin Space Operation in Houston, Texas. Interviewer is Rebecca Wright with the Johnson Space Center Oral History Project, assisted by Carol Butler and Sandra Johnson.

Thank you again, Mr. Honeycutt, for taking time to visit with us today. Currently you serve as president of Lockheed Martin Space Operations, but tell us, how did your interest in aviation and spaceflight first begin?

HONEYCUTT: Well, I'm old enough not to be able to say I always wanted to be involved in space since I was a little kid, because there wasn't any when I was a little kid. But it actually isn't even that exotic a story.

When I got out of school, I got drafted. I was raised in Louisiana, and when I got drafted, they sent me to Redstone Arsenal, Alabama, and I worked in one of the labs up there under a program where they would take college graduate engineers that came into the Army and put them to work for the only ballistic missile agency in the laboratories up at what was, in fact, the forerunner of the NASA Marshall [Space Flight] Center [Huntsville, Alabama].

When I got out of the service, I stayed for a while and then decided that north Alabama was too far away from Louisiana and too far north for me to be comfortable with. So at about that time they were opening up the NASA center here, which in those days was called the

Manned Spacecraft Center [Houston, Texas]. A friend of mine had found a job over here, so I started trying to find myself a job down here. It took a couple of years, and I finally transferred. So my interest really was driven more by circumstance, the fact that I got drafted and, secondly, being that I wanted to get down here.

Now when you interview these younger folks that around here, they all say, "Oh, yeah, when I was a little kid I'd sit before the TV and watch Neil [A.] Armstrong," or something. Didn't even have a TV when I was that age. So it's not as exotic.

WRIGHT: But why engineering when you went to college? What was your interest there? What did you want to do with that interest when you got out?

HONEYCUTT: My degree is actually in electrical engineering, and I had grown up associated with the electrical power industry. My dad worked in the power industry, and I worked all my summers in powerplants. It just kind of was what I was expected to do. Then I got out. My degree is in engineering, but any expertise I have is really in operations more than—I mean, I couldn't design an electrical circuit anymore, but it was an avenue to get into operations, which is what I really liked.

WRIGHT: And were you able to do that when you were there?

HONEYCUTT: Once I got out of the Huntsville area and got here. When I came here, I went to work in the flight control division for [Eugene F.] Gene Kranz and got my first set of headphones and my first console to sit at, and I've stayed there for quite a while and loved every minute of it.

WRIGHT: While you were in Alabama, Wernher von Braun was there with the scientists. Were you aware of what they were doing?

HONEYCUTT: Oh, yes. Sure. That was about the time of John [H.] Glenn's [Jr.] flight. I got there just a little bit before John Glenn's flight. So we knew what they were doing. I worked on several of the Army's rocket systems, surface-to-surface programs. So we knew about engines and reaction control systems and reentry bodies and all that kind of stuff, and we did all that. We just didn't have a crew on them.

WRIGHT: Where were you when you learned about Sputnik, and did that have any influence on—or even to think about later as you entered the space program?

HONEYCUTT: I was in Alabama then, but, no, that was above my pay grade. I mean, we were doing what we were doing, and we didn't change based on that, from my point of view.

WRIGHT: You mentioned your friend that was working in the Houston area and one of the reasons that you came this way. Was he also working in the flight training area or the flight controller area?

HONEYCUTT: He was in recovery operations, naval recovery operations division.

WRIGHT: So you had somewhat in common, not something totally different.

HONEYCUTT: Yes.

WRIGHT: Well, tell us about those first days when you came to Houston and how you got that headset and some of the first things that you did starting to work for NASA.

HONEYCUTT: When I came down here, I was assigned to flight control division. I was assigned to the mission simulation branch, which Hal Knorr [phonetic] was the branch chief. What our job was, was to train the flight controllers on the flight control team in how to execute the mission. So we took their procedures and their flight rules and their malfunction procedures and would write training exercises to put problems in the routine operation of the control center to force them to work together to solve a problem and then to allow them to work with the flight crew so the ground and the flight team could learn to work problems together.

The crew had their simulator, and they were over in Building 5 down at the Cape [Cape Canaveral, Florida], and they would train for some period of time, just with themselves, and then we built systems in the control center that simulated the crew's simulator. Then our people would act like flight crew folks so the ground team would work first with our people and our simulation of the simulator, and the crew would do their thing with the simulator. Then at some point near the mission, typically three or four months before the mission, we'd bring the two together. Then we would conduct the simulations, they were called, for the integrated sim with the control center at their consoles and the control center crew in the simulators at the Cape or over in Building 4. Then we would practice missions three or four days a week to ensure that

they could recognize problems, communicate amongst themselves and between the air and the ground, and be able to solve the problem.

I mean, that's the great thing about operations and about the human space flight program, is when you've got a problem, you've got to solve it. A lot of the robotic satellites that are flown have a sleep mode, it's called, where some problem happens and the thing shuts itself down, and it just kind of floats around up there and doesn't try to execute any commands or perform any functions, and then the people on the ground can go off and take whatever reasonable length of time it gets to solve a problem, and then they go wake it up and do whatever they do. Well, in the human space flight program, you've typically got to get it solved.

In those days, between one ground station pass and another or one trip behind the Moon, they had to get the problem solved so that you could tell them what to do the next time you had access to them. So the ability to recognize, work, resolve, and communicate in response to a problem is time-critical in human space flight program, much more so than in the robotics. And that's why, even today in the Shuttle program, even though we're coming up on the hundredth launch, they're still doing essentially the same thing with the simulation team and the crew and the Shuttle mission simulator, practicing what to do if you have all these problems. That's been a fundamental tenet of the way the crew and the ground have prepared for missions from day one.

I was fortunate to get in on it during the Apollo program. When I came here, we were about halfway through Gemini, and Harold [G. Miller] just assigned me to work on Apollo because it was going to be coming up in a couple of years. So when I went to my assignment, my direct boss was [Richard H.] Dick Koos, and he said go and essentially write the requirements for the lunar module simulator that we're going to build as our in-house thing.

Well, I didn't know what a lunar module was. I didn't have any clue. Actually, I knew very little about the Apollo program and how it was going to be conducted and all this sort of stuff, and Dick says, "Well, go write these requirements."

I said, "Well, you know, where would I start?"

He said there were a bunch of technical field reps from Grumman [Aircraft Engineering Corporation] down here. Grumman built the lunar module, and they were like two or three doors down the hallway. So he said, "Well, go talk to those Grumman guys."

So I went down there and said, "Give me some documentation on what is a LM, what are all the parts, and what kind of telemetries they have and all that sort of stuff, and what's likely to break, because we've got to model these malfunctions so we can put the malfunctions in and allow you guys to react to them and work at this."

"Oh, no. Nothing's going to break on the LM."

I couldn't get these Grumman guys to—I mean, they wouldn't admit that anything was ever going to break on the thing. So I said, "Well, Captain, I'll have to make up my own," which we ended up doing.

The first LM flight didn't have a crew, so you just put the thing up on an S-IB and separated it and fired it and maneuvered it around a little bit. So we did all that one in-house.

Then we started in on what became Apollo 7, Wally's flight, [Walter M.] Schirra's [Jr.] flight.

We [had] started, and then the [Apollo 1] fire happened. So they shut down the program and they got into all the fix stuff. Well, we didn't have anything to do in ops [operations] because all the engineering guys were off redesigning the command module and doing all this stuff. So twice a week, every Tuesday and Thursday, we'd all meet in the control center, and

Schirra and his crew would be down at the Cape. Glynn [S.] Lunney was the flight director, and we'd run Apollo 7 sims, and we ran them for about a year and a half. Every Tuesday and every Thursday we'd crank all this stuff up and sit in there.

So that turned out to be, I think, good for the flight control team and for the sim team because we kind of learned how to do the business on a bigger scale because Apollo was a bigger scale than Gemini. We had more sophisticated simulators. The control center was more sophisticated. The crew would be in a simulator at KSC [Kennedy Space Center, Cape Canaveral, Florida] and there'd be one for the command module and one for the lunar module, and then the data stream, you had two different data streams. You had the simulated mission data stream and then you had all the—and this was in 1966 and '67, and then you had the simulator data stream, the things that kept the things in sync so they both were operating with the same time and a visual display out the window. The simulator had the same ephemeris in it that the flight controller was looking at up here, and with middle-60s technology of trying to keep all that in sync—actually, I counted them up one time. Between the crew in the simulator and me at my console and the simulator, there were like fourteen computers.

The control center had 360s, which were the size of that door and about as long as that door. Today you put all of it in something that looks like that [pointing to the audio equipment]. But huge, for their time, they were huge computers and computing complexes and huge numbers of people required to keep them all together and in sync and as real life as you could make it. Then our job was to try to poke holes in whatever they said they were going to do. We spent a lot of time—my folks spent a lot of time reading all the mission-related planning documentation—the mission is going to do this, we're going to land here, EVA [extravehicular

activity] is going to occur with this, and the malfunction procedures where they would say, if this breaks, this is the way we're going to go fix it.

Well, our responsibility was to poke holes in all that and say, "Well, I don't really think this is the right way to do it," or, "They'd probably do it but it's going to be hard to keep the communication chain running," or, "Maybe they can do this, but I don't think they can do it in the amount of time they think they can." All those kinds of things it was our job to poke holes in, not necessarily to say, "Well, you say you're going to do it this way. You ought to do it this way." I mean, our job was, "Well, you say you're going to do it that way. That's not really going to work. You ought to go figure out another way to do it."

WRIGHT: Did you have any constraints when you were coming up with these?

HONEYCUTT: None whatsoever. Well, I mean we had in the sense that you didn't want to kill anybody. I mean, you didn't want to put the crew in a set of circumstances for which there was no recovery. Occasionally that happened because the simulator would not do what it was supposed to. You tried not to generate adversarial cases in which you pitted the ground against the flight crew. You built ones that tried to bond the ground and the flight crew. It was never our intent to make anybody fail. So you try not to overload some individual console position, or, more importantly, sometimes in your quest to give every console something to do, because otherwise they're sitting there and get pretty bored all day long listening to somebody else work their problems, well, if you weren't careful, you'd give everybody something to do, and all of a sudden the flight director is overloaded because every console is trying to tell him about their problems.

So you kind of just had to listen to the flight director loop and just make sure the traffic on it was kind of—I mean, it's one thing you learned in the sim area, is you can listen to a dozen loops, and we'd just sit over there and see how many different yellow buttons you could get lit up on the consoles. I mean, even today I can go over there and plug in and listen to eight or ten loops and catch anything significant that comes out. I mean, I couldn't repeat all the traffic that's on it, but when somebody starts talking about a problem, then you go concentrate on that.

So we would try to keep the exercises balanced and not get anybody in trouble. There were some great people that were flight directors in those days, Kranz and Lunney and Cliff [Clifford E.] Charlesworth and people you've interviewed, I'm sure, or will. You guys plan to interview [Gerald D.] Gerry Griffin. All of those guys were incredibly smart and incredibly motivated and incredibly capable of managing the flight team. Unfortunately, [Christopher C.] Kraft [Jr.] had stopped being a flight director by the time that I got here, but he was the role model for all of them. They would not tell you what to do. They might say, "I think such and such a position needs a little—we need to work on them a little bit," or, "I'm kind of worried about such and such a procedure, and maybe you could run a case." But they never would say, "Well, I want you to do this and I don't want you to do that." It was our call as to what to do, and we had a reasonable amount of independence in that respect.

Cliff Charlesworth, the day after the sim, he would always make me go up to his office and say, "Now, why did you do this, and why did you do this, and why did you do this?" But that was the way he was. He wasn't trying to get me to go or not do. He just wanted to harass a little bit over why we did things.

WRIGHT: When you sat down to plan these sessions, was it a team effort where you all came up, or did each person on the simulation team take one area and devise that? Tell us how all that came about.

HONEYCUTT: The sim team was broken up by—but the leader was, and is today, called the simulations advisor, a.k.a. sim sup. And then we had booster people, we had trajectory people, we had spacecraft people, command service module and the lunar module, and then we had network or voice people, because there was no TDRS [Tracking and Data Relay Satellites], so we had these sites strung all around and they each had different—some of them were S-band, some of them were VHF, and some of them had radar, and some of them didn't. So we had to simulate that entire network.

The trajectory had to be right so the look angle was right, so that our system picked up, enabled telemetry at the same time the flight dynamics officer had predicted that acquisition was going to occur and the mission computers. So it took one person just to keep up with all that configuration stuff and to chase some of the computers. Either the mission computer or the simulation computers in those days obviously weren't as sophisticated as they are today or as fast. The programming was a lot more complex. So occasionally things didn't happen right or you got the wrong—I mean, I remember several times we would initialize in lunar orbit and we'd be going north to south, and the big plot board in the front would get tilted. [Laughter] So we were always chasing those.

It took somebody to do that, and then it took somebody to—each one of these sites had a person there that the people downstairs, the telemetry people and the track people and all the guys that were down on the first floor that actually ran the mechanics of all the dataflow stuff,

well, they had to talk to people at all the sites. So we had to have somebody, actually one guy, that was everybody at every site for three or four different people to talk to. So there was this constant keeping up with where you are and what's happening.

Every once in a while, you know, you'd throw in some malfunction that screwed everything up, and some of them, when you were coming, sometimes the computer would put one in, and we're off chasing the flight control team before you figured out what it was.

So the sim team was about forty people or so, and they were broken up. There were some of them that were track people, and there were some of them that were LM people, and there were some command service module, and there were some trajectory. We would divide ourselves up into those positions, but we really were only one team. It didn't take forty people to run a sim, but it took about ten, but there were five flight control teams. So they had us outnumbered. The bad part was, on the flights that went to the Moon, they were on three-month centers. We called them integrated sims when the people in the control center and the crew were in the same thing. Well, we were running those for three months prior to the flight. We were running integrated.

Then we were having to run non-integrated for some of the downstream flights. There were two floors in the control center. The second and third floors were identical ops rooms, so they'd run, like they ran [Apollo] 7 off the second—I can't remember—second floor, then number 8 was off the third, then [Apollo] 9 was going to be back on the second. So in any given week we'd have to run up and down the stairs to—

WRIGHT: Great exercise.

HONEYCUTT: Because on Mondays we were doing this mission, and on Tuesdays we might be doing this one. It was only for about a year and a half or so, but we ran sometimes six days a week, a twelve-hour sim. You had to get in there before to make sure everybody was set, and you had to stay afterwards to remind yourself what you were going to do tomorrow, and fixing things that were broken during the day, sometimes six days a week. So what we would do is on Sundays we'd come in and literally figure out what we were going to do next week.

You'd start out, we'd have all these nice typed and formatted sim scripts, we called them, for this exercise, these are the things we're going to put in when we do it, and all this other stuff. After about six months of this, we'd go in and take some piece of paper and turn it over, and if you got this one, you'd go figure out what to do. It was reasonably unstructured. Fortunately, nobody really knew whether we were right or wrong. No one—I don't want to say no one knew what they were doing, but you had no experience to compare what you were doing with. So my idea of what could or couldn't happen was just as good as anybody else's. So that allowed us to have some amount of freedom. Somebody would start griping about, "Well, you put that in, and that can't possibly happen." I said, "Says who?"

So that helped us control, but it wasn't what you would call an academically prepared set of things. What we really would do is say, okay, what is the major objective we want to accomplish? Some runs were all day. If you were practicing going to the Moon or being in lunar orbit or something, you'd run from seven in the morning to eight at night. If you were doing like launches or landings, you might run six, eight, ten, twelve cases in a day. You'd try to figure out what's the main objective you'd want to accomplish with each one of these runs and then what other two or three things you'd want to throw in to make it exciting for a couple of other console positions, and, oh, yes, remember they still can't find the leak in the suit that you

put in. When it's behind the Moon, they can't catch it coming around. So the ones they didn't get good, sometimes we'd repeat them to help them get comfortable with it. Then, as much as anything, the rest of it was just blind luck. [Laughter] Just go do it.

But everybody wanted to be trained. Everybody recognized it was value added to what we were doing. Dr. Kraft at that time was the director of flight operations. He hadn't moved upstairs yet. And was even then legendary. I had never laid eyes on him. The bad news about running sim six days a week is you were in the control center six days a week. The good news about it was you never had to go to Building 1. So I'd never even seen Kraft up close. I had seen him in the control room. If you picture the old mission control room with the [screens] up front and all the consoles, there were some little glassed-in rooms over on the right, well, that's where we were, over there. So we looked out into the control room, and we could watch the results of whatever was going on.

I'd see Kraft out there, but I never had been close to him, but I knew I was afraid of him just because of his reputation and the respect that he had from everybody. While we were doing the year and a half of every Tuesday and Thursday on Apollo 7, I'm sitting in there one day and Lunney was out on the flight director console, I'm sitting in my console, which was a long one but I was there by myself, and just room for two people, and there was a chair there, and I'm busily doing something, listening on the loops, and the door to the sim room opens and there comes Kraft into my room, and I went, "Oh, my God. Now what?"

He sits down. He's got a headset on, and he sits down and plugs in, and he says, "Any of these flight directors giving you any trouble?" He didn't use exactly that word but one similar to it.

I said, "No, sir."

He said—and I'll never forget this—he said, "When you're sitting on this console, you're working for me. Any of those guys give you any trouble, you call me." He said, "You got that?"

I said, "Yes, sir."

Unplugged, walked out, and never came back in that room again for the whole rest of the program. [Laughter]

But that's the kind of guy Kraft was and is. I think I was twenty-seven. He took a bunch of people that were my age or younger, Steve [Steven G.] Bales, Jay [H.] Greene, Tommy [W.] Holloway, people that are still around and involved in the programs, gave them an incredible amount of responsibility, trusted them, trusted the success of the program, the lives of the crew on these people, and built really the leadership of the Johnson Space Center [JSC, Houston, Texas] is still benefiting from—and a lot of the contractor team is still benefiting from having had the opportunity to work for Kraft in the early age of the beginning of the Apollo program and be taught how to accept and execute responsibility.

I mean, Chris was hard. If you did your job, you did your job. If you didn't, he didn't have a place for you on his team if you couldn't do what he asked you to do, but if you could, it was great. And that was his message to me really was, "You, young man," as he always called everybody, "you've got this thing, and you'd better not listen to the flight directors, because if they tell you wrong and you do it wrong, then I'm going to blame you, I'm not going to blame them. Because this is your little spot of responsibility, and I expect you to execute it, and if you have any trouble, you let me know." And out he went and never came back.

WRIGHT: You had quite a tough job, that you had to think like a controller and you had to be able to know their job well enough to be able to set those simulations up. How long were the longest days that you had trying to prepare for some of those sessions?

HONEYCUTT: We spent time trying to figure out what the script was going to be, and we spent some time early on learning the systems, but the rest of it was just get in there, "Well, you guys didn't do this. We expected that you would have done it this way, and we would expect that such and such a console position would have the ability to have found this data quicker than they did. So maybe their display is not formatted right, or maybe they're looking at the wrong display at the wrong time. You know, things like that. But mostly our job was not to critique them. Our job was just to point out the weakness and then let them go figure out with the rest of the flight control team and with the flight director on how best to handle it.

I remember one time there was a failure, a lunar orbit insertion case, where you're getting to the Moon and you're going to turn the command module around and fire the engine and slow down and get in the lunar orbit, and there was this big helium tank in the service module that—I don't remember all the number bit counts, but every bit count was a huge amount of helium that would leak out before the telemetry would ever indicate any change. If it was like 200 psi in there, and to go to 199, there was this huge amount of helium that would leak out. So we would initialize the sim, and the flight controller would sit there with a band on all the telemetry parameters, they would put some tolerance on them so that they didn't have to check every number every time, they would just wait until they triggered some bottom or top on the band and then they would ring a little buzzer or light a light or flash something, then they'd go chase down what it was.

So we'd fudge all the numbers and get right down on the edge of the band with it already having leaked out and then we'd initialize a sim and we'd leak it one more time, because we'd figured out that by the time you did that, they didn't have enough—they had enough helium to get into orbit, but they didn't have enough to get out again. So essentially we stranded them in orbit.

But Kranz was the flight director, and they went off—I mean, Gene essentially turned the entire propulsion team's planning—here's what you look at and when you look at it and how you look at it, and what you do with it. I mean, he completely redid the entire way that they did that. It was one of the cases where he came and said, "Run that thing again for me, because I want to see if we've got a—" but he went off for like a week, with all the propulsion guys trying to figure out what they needed to do because it was a legitimate failure, and what do we have to do in order to defend against this kind of thing in real life. So we would see a lot of that. Nobody ever got mad at us.

WRIGHT: I was going to ask you what the relationship was between the simulation team and the actual flight controllers.

HONEYCUTT: They always told us we didn't have to take the final. I don't know if you guys got to him or if you have him on your list, but the retroflight officer was a fellow named John [S.] Llewellyn, who's still around here. John was an ex-Marine, and he's a big, muscular guy with somewhat of the reputation of an ex-Marine. The very first simulation I ever ran was a set of launch aborts. For the Apollo program, if the booster shutdown caused you to abort, you parachuted into Africa or you parachuted into the ocean or you parachuted into a lake in the

middle of Africa, depending on which way you rolled the spacecraft when you came off of it. And you had to tell the crew pretty quick which one of the abort modes you were going to use.

So John had this bunch of answers essentially on the back of an envelope, and his technique was that as soon as abort was called, he would tell them what abort mode to go to, and then he would go to the mission computer and get the trajectory-driven solution that came out of the mock. Then if it was different than what he had called, he'd call up a change.

Well, he called up the wrong one initially and then we failed the mock. So he couldn't get the right solution in so the crew went down and splattered all over the desert or something. He got up from his console and he stared and glared in there at me, and I thought, "Well, this is going to be a short career." So I don't know, we broke for lunch or something, and he came storming in there, and I thought, "Well, this is the end of my career." And he came up to me and said, "That's the smartest thing you ever did." He said, "I really appreciate it. I've been doing this. It was wrong. I knew it was wrong. I never got caught at it, though, so I continued to do it, but I'm glad you ran that case." And that's was the usual reaction that we got from some of them. Everybody griped every now and then, but in general.

WRIGHT: There were some occasions, I guess, that you had simulations that you planned for and then they changed the missions on you. For example, the one that comes to my mind is Apollo 8. Were you already planning for simulations for 8, and then when they moved—

HONEYCUTT: No. Actually, we were in the middle of 7, I guess, and getting ready for what turned out to be 9, [James A.] McDivitt's flight. Harold went off to Building 1 to a Kraft staff meeting and came back and said, "Oh, by the way, we're going to the Moon in three months, so

we've got to go and invent this mission." Fortunately, they all had a launch phase. Some of them use I-B and some of them used the Saturn V, but they all used a booster and they all used a command module. Some of them used the LM, and some of them didn't. So we kind of could put all the stuff together. Then all you had to really go try to figure out how to do was the kind of mission-specific things and the new things. I mean, when you added a LM to something with a command module on it, when you added an S-IVB to the launch vehicle, when you had to figure out how to do a translunar injection sim or a lunar orbit injection sim or a landing sim, but they all entered and you had to run launch aborts from all of them. So we could kind of patch together as they changed. The difficult part was in making sure that the simulation system itself could accommodate the new part.

We didn't build any of the simulation systems. I mean, we were pure operators, but we wrote all the requirements, and then we would send the requirements either over to the simulator people or to [Lynwood] Lyn Dunseith's organization, and they would then change the simulator computers to make them compatible with the new requirements. So we had to always know what was coming because there was a time delay between the time you told the computer people you needed something and they could get it in and tested and verified and all that. So we had to keep up always with what was coming down the road from a requirements point of view.

Then as new phases got entered, you had to make sure that you had a malfunction capability to allow you to test and exercise those phases. You had to make sure you got all that in the systems.

WRIGHT: Those three months, once you found out that we were going to the Moon, did it change the attitude of the people there, or did people seem to be—

HONEYCUTT: No. None. I mean, everybody worked as hard as they could work, it's on this or on that. It was an incredibly dedicated group of people. I remember when I first got here, which was in, really, the middle of Gemini, you'd see a guy—I mean, Jack [R.] Garman must have been twenty-two years old or something, Steve [Stephen G.] Bales was about the same age, and you'd walk by their office and you'd say, "Who are those guys? What do they do?" Because they were always there. I don't care if it was during the day, if it was night, if it was on the weekend, they were always there, and all the response you'd get was, "Well, they're working on the lunar stuff."

We were in Building 30, right in the admin [administration] wing, right next to the control center, and it was hard to tell on any given weekend or any given evening at six or seven o'clock, it was hard to tell whether there was a mission going on or not because there were so many people working so many hours just making sure everything was covered. My memory is that one mission didn't have any more importance factor associated with it than any other one did. I mean, it just happened to be whatever's next is the most important one to do.

For example, I think Apollo 11, we ran the least number of integrated simulations on 11 that we did any of the lunar programs, and that was partly because Neil [A. Armstrong] spent a lot of time training in the LLTV [Lunar Landing Training Vehicle] and some other things, and part because there was so much compression of time for them that we didn't have to run that much. [Apollo] 8 and 10 had been to the Moon, so the ground team was pretty confident. All the flight directors had quite a bit of experience and their teams were pretty experienced, so the integrated sims kind of went like that, with 11 being the one—I mean, most people would think it would have been the opposite, but—

WRIGHT: I guess the major difference on that one was that you did simulations for the landing.

HONEYCUTT: Yes, and they probably were okay, but again, it was procedural-driven. I'm not sure that I know how much fidelity was in the actual visual display. Somebody would probably answer that when you guys get around to talking to them, but from a procedural point of view, it was pretty good. I mean, it was well done.

WRIGHT: About eleven days before the launch, there was a simulation that was done with the white team that featured one of the alarms, and from our research, we understand that the conversation you had with Jack Garman led to that simulation being put in there, that you detected or you found out that that alarm could be something that went off. Do you remember that?

HONEYCUTT: I know we did that, but—I mean, I've been asked that several times. I don't really remember the circumstances. Jack was one of our sources of "Why don't you think about this, why don't you try that, I wonder if Bales can pick up," because Jack and Bales, one of them was real technical, had the most knowledge of the onboard computers, Jack did, and then Steve, as the guidance officer, he was out on the pony end of the stick in the mission control center. But we did do that, and we did run that thing, and it did help, I think. It helped them.

My favorite one, though, the guidance officer console was on the end next to where we were, and that's all computer floor, in those days, anyway, the square computer floor. So we had somebody go in the night before and tied a string to the circuit breaker on Bales' console that drove his displays on the console, and then we run the strings on the floor of the sim room, and I

think we run launch aborts. It could have been lunar landings. I don't remember now. But anyway, right in the middle of the sim, right when Bales was coming up to make this really critical call, we yanked the circuit breaker and took all the power off his console. Of course, there's a whole string of—I mean, it went from guidance to FIDO to retro to booster, and Bales just moved them all down, and the poor guy doesn't know they're in the booster thing. All of a sudden he's sitting down in the middle of the floor without anything to look at because Bales has taken over the console next to him, and they just dominoed everybody down [the consoles].

We would do failures of the equipment in the building. One time we simulated that a circuit breaker, all those panels in the hallways in the old control center that were out there, all the breakers that ran essentially all the lights and consoles and everything and on the floor all go through these breakers.

So we failed one one day, and they took out, I don't know, a third—we did it on an all-day sim kind of a thing, and they took out like a third of the consoles and half the lights. I mean, it was a bad deal. It took them forever to figure out—I mean, they figured that a breaker had gone, but they couldn't find the breaker because they didn't have a good set of drawings. The boxes weren't numbered, and the breakers inside the boxes had no numbers, and there were no schematics that you could start with a console and trace back. So they must have screwed around for twenty or thirty minutes, and they finally came in, and they said, "Aha! We found the breaker, and now we want to put it back on."

I said, "Well, where's the replacement breaker? Show me the one you're going to put in there."

The guys said, "Oh, well, we don't have any here in the building. We keep them in the storehouse up at Ellington [Air Force Base, Houston, Texas], and you don't want us to go up there and get it, do you?"

I said, "Yes." [Laughter]

So off they go. Finally, about thirty minutes later, they came back, and they said, "Now, here, can we turn the lights back on?"

I said, "Well, yeah. Okay."

Well, the next day we went in and got there at 6:30 or 7:00 o'clock the next morning, and there were these huge rolls of drawings spread out on the floor and guys on their hands and knees color-coding wires, and in about a week there was a number on every one of the boxes and there was a number on the breaker inside the box, and you could go and in five minutes get the right thing and trace yourself back. And they redesigned the logistics mends in the control center so they made sure they had the right spare parts for real-time kind of support that you would need.

So, I mean, there were positive things that resulted from doing these things that they benefit from today, and it was all a learning thing. I mean, we had some incredible sims that we just stumbled into. You went to break this, and the guy would press the wrong button and did this, or the simulator broke something, and all of a sudden they're off trying to react from there. We weren't brilliant script designers as much as often just fortunate that something broke at the right time to make us look good. Of course, we'd never admit that this wasn't a part of our plan all along, so we took all the credit for it, but a lot of it was just blind pig finds an acorn or something.

WRIGHT: We've read descriptions of simulation people or teams that have ranged from creative and imaginative to devious and sneaky. So I guess you kind of followed the both of those.

HONEYCUTT: We were all of the above. The fun part was, I mean, we listened to the Flights [Flight Director's] looping and we would listen to the loops that the front room guys would talk to their back room with, and then we would listen to the internal to the back room loop, and every now and then the decorum on the voice loop declined as it got further and further away from the flight director's loop, and when you'd get in those back rooms, you'd hear us called some awful names and all kinds of cursing going on and yelling at each other back and forth. I mean, they were pretty good.

WRIGHT: Were you around for the debriefing as well?

HONEYCUTT: Yes, we conducted the debriefings. Well, the flight director would do their debriefing. He would debrief with each one of the console positions as to how they performed for whatever thing and how they worked together and talk with the crew, get the crew's comments and all that. We would come in at the end and say, "Okay, we broke this at this time, we broke that at that time, the thing went in, it took you guys thirty minutes to recognize that it was in."

It was Flight's job to build his team and manage his team the way he wanted it to be managed. What we tried to do was point out things that were either not caught as they could have been caught earlier or could have been handled differently or did you ever think about doing this or that. So the debriefings, from our point of view, were primarily in that vein,

"Here's what you missed, Flight, in your thing," or, "Here's the value of the leak," or, "Here's the time of the something or other." That was pretty much the way we did that.

You had the different teams, and each team was somewhat a function of the personality of the flight director, and they were all different. Lunney was kind of laid back, and Kranz was more dynamic. A lot more traffic on the flight director loop on Gene's shift than on Glynn's. Charlesworth was kind of like Glynn. When Kranz was the flight director, you didn't need too many things to do, because Gene would initiate his own, "Well, why don't we go look at such and such," which would make the team work together to figure out what they were going to do about something, which was all we were doing. So when it was a sim for Gene, typically you'd put in fewer things, from our point of view, than you would for the other guys, because he generated a lot of work himself. So they were different and had different debriefing techniques and approaches and interests that they might have for some particular thing, whether it would be a console position or a mission event or whatever it might be.

WRIGHT: This past year marked the thirtieth anniversary of the Apollo 11 mission. Would you share with us where you were during that time period? Were you preparing for yet another mission, or were you able to enjoy the moment?

HONEYCUTT: Since I didn't have to take the final, as they said, what my job was during the Apollo programs, the [NASA] Headquarters [Washington, DC] people—Chet [Chester M.] Lee, just passed away, was the sort of Apollo person at Headquarters and was sort of the headquarters program office for Apollo. Chet and a number of his people would come down for each one of the missions, and they would actually sit in the sim room, and they didn't really have any job,

anything to do, but they were providing Headquarters oversight. Although they may have been familiar with mission objectives and the bigger things of the flight, they really didn't know much about the details or the specifics, so what we did was we served as sort of their technical support. That's why I was in the sim room with Chet during essentially every one of the missions. [Apollo] 13, I was home asleep. Other than that, I was in the SCA [Simulation Control Area] with the Headquarters people. You know, everybody had to be pretty proud on that day because we worked pretty hard to get there. I mean everybody, the team.

WRIGHT: I believe the value of the simulations and the training has proven itself many times over, and it's been said that the simulations and the training helped so much when it came to rescuing the crew of the Apollo 13. If you were asleep, I'm sure it didn't last for long.

HONEYCUTT: No. Somebody called, and I came out here and we helped. The various things that they wanted to try and all that sort of stuff, we essentially ran sims practicing some of that stuff. Some of our guys went on some of the teams that were trying to figure out how to—we asked a lot of our people. I mean, we had forty people that had to know as much as—I mean, I think Kranz was a division chief and flight control, and there were probably, I don't know, three or four hundred people in the flight control division, and my forty had to know what every one of them did, plus we had to know what went on on the first floor, which really was not in Kranz's division but it was in the mission, so we had to know all the ticks and tracks and recorder people and computer supes [supervisors] and all of what they did, too. So our people were pretty knowledgeable about the mission. So some of them went off on some of these teams that were

put together to try all these different things on what might work and what might not work. So everybody was pretty busy.

WRIGHT: And it seemed to work.

HONEYCUTT: Yes. Never had any doubts it was going to work.

WRIGHT: Some of these situations that you put these folks in, you didn't have any idea if that situation would ever occur, but then you'd have things like on Apollo [12] when the lightning struck. Did you plan on anomalies like that as well, natural problems that might occur?

HONEYCUTT: We did some of that. I mean, we'd have a hurricane take out the Canary Islands or an earthquake take out Guam. We'd make up some of those. Or a crewman has a heart attack and some of those kinds of things. But usually we got those by the simulator. That means some simulator funny that would just spit out some weird thing. I had a back door loop to the flight director, and we'd kind of decide whether to take the thing out, reset, or, "Well, this looks pretty good. Why don't we play with this one for a while," depending on whatever their preferences were.

WRIGHT: Well, simulations changed as the mission changed and technology changed, but the other thing that changed was your role. As you walked in, you were starting in the flight training division, but yet you were the chief at this time, or at the end of the Apollo era. Could you tell us

how that role came about, how you received more and more responsibilities and what led to that latest position?

HONEYCUTT: Well, as much as anything, it was being in the right place at the right time. When I came here, for whatever reasons I ended up on the console and stayed out of my own way. So I did okay. So Harold Miller decided that he had a section head opening, and so he asked me if I wanted it, and I took it, which didn't change anything other than I got a grade raise. But I was still on the console and stayed there until after Skylab.

Then after Skylab, they reorganized the center, and they took the branch that I was in and moved it to—let's see. During Skylab, they had a reorg [reorganization] within flight control, in which they combined the requirements branch and the sim branch. So they put me in as the deputy of that. Then after Skylab, they took half of that branch and moved it to flight ops, [Donald K.] Deke Slayton's old organization that Warren [J.] North was running at the time.

So they sent me over to work for [James W.] Jim Bilodeau, who had the procedures, the flight crew procedures bunch, Tommy Holloway and John [W.] O'Neill and Dave [David C.] Schultz, then me as the sim branch. We were the four branch chiefs that reported to Bilodeau. So I got taken from the comfort of flight control with all these people that I'd known and worked with and thrown over to flight crew.

In the old days, flight crew people and the flight control people didn't really get along near as well as they do today, not the flight crew themselves, but the people that worked in procedures and training and the things over there. They worked with the crew, and we just worked with the flight control team. So then they threw me in there with all those guys. So all

of a sudden I was over there with a bunch of strangers that suspected our heritage anyway, and working for Jim Bilodeau. That got us through Apollo-Soyuz [Test Project], I guess.

Then after Apollo-Soyuz, I actually went up to work for—George [W.S.] Abbey was in the job that Sue Garman's in now, and Kraft was the [JSC] Center Director by then. So I went over to be essentially an aide to George, working for Kraft, and I stayed up there for six months or so.

Then George moved down to the eighth floor to run flight ops, and I went down there with him and got out of the simulator training business pretty much. That was in '77 or so time frame, and then for the next two years we selected the astronaut class of '78.

Then I went to headquarters after that. In 1980 I went to headquarters and spent a year with one of those same kind of horse-halter jobs, people call them, for John [F.] Yardley when he was in the job that [Joseph H.] Rothenburg's in now.

Then I came back and went in the program office and stayed in the program office till '89, when I went to Kennedy, and stayed there in Shuttle ops until '95 and when went upstairs for two years and I got out and came here, and still trying to figure out what I'm doing.

WRIGHT: Well, apparently someone thinks you're in the right place at the right time. So that works out.

During those days that you were working so closely with the Apollo program, as you mentioned, you were working so many hours and so many days of the week, what were your thoughts when you heard that the Apollo program was going to be canceled?

HONEYCUTT: Skylab was coming up. The other thing is, everybody now wants to know, well, gee, there are a lot of allegations that everybody worked hard on the Apollo programs to beat the Russians, and I never saw any indication of that whatsoever. I mean, we worked hard on the Apollo program to be successful. The President [John F. Kennedy] said we ought to go there and land and come back in this decade, and everybody was busting their buns to make that happen. I mean, I never had or knew of anyone or heard of anyone that said, "Well, I've got to do this because it's going to help us beat the Russians." I mean, "I'm going to do this because I'm working on the Apollo Program." I mean, I'm sure somewhere, maybe in the State Department or somewhere, everybody was wanting to know how we were doing against the Russians, but I never had that sense.

I've been very fortunate, with the exception of a couple of very, very brief periods, I've been blessed with having a good job. I've been blessed with having some wonderful bosses, and I've been fortunate enough to have some really good opportunities. In those days Apollo was going to end but Skylab was coming. Skylab is going to end, but ASTP is going to be right behind. It got a little that way between '75 and '80 when Shuttle kept kind of moving to the right, but we had the Approach and Landing [Tests, ALT] thing that went on. For me, we had astronaut selection stuff, which was pretty cool. We had 7,000 applications. I read every cotton-picking one of them. We had 220 people that we interviewed. I talked to the references on every single cotton-picking one of those. I mean, it was an incredible task. Duane [L. Ross] and George [Abbey] and I spent more time than anybody else on going through all that stuff. So, I mean, although we weren't inclined, we weren't bored.

Then I got to go, had to go, went to go to Washington, and I got to see a little bit of the Washington scene and then came back and stuck my oar in program office work, which turned

out to be a lot different than ops, but just as much fun. I had a wonderful series of opportunities in NASA to do some really fun stuff. It never really was like a job. They paid you for it, you know. [Laughter]

WRIGHT: That was the good part of it.

HONEYCUTT: Working with some great people and for some great people. When you can list John Yardley and Chris Kraft and George Abbey and people like that as your supervisors, you did all right. I mean, you had a lot of opportunities to learn from some pretty cool people.

WRIGHT: Hard to select a time period that was your favorite?

HONEYCUTT: Right now is. You know, I mean, they all were. Apollo was when it was going on. It's hell to grow old, but having had the opportunity to work on the Apollo programs, it's obviously the highlight of anybody's professional career.

The great part about it was that it was a bunch of twenty-five and twenty-seven-year-olds that were doing it and had all this responsibility, and the crime of today is that in virtually every case you've got to be forty-five or fifty before they will let you have that same amount of responsibility. It's a real downer for development of people. You develop people by giving them responsibility and giving it early, and some of them flunk out, but that's okay. The ones that are left will do okay for you.

We do it within my company as well as within the government. Kranz and Lunney and Griffin and Charlesworth and [M. P.] Pete Frank [III] and all those guys, Chris, that were the

truly great flight directors of the program quit being a flight director at a younger age than today most people get selected to be one. That and the creeping bureaucracy that tends to roll into the programs are the real disappointments that you see as it gets older. I mean, you could do things. If you wanted to do something, you just did it. And now you've got to go get forty people's permission, and nobody in the field is authorized to make all these decisions, they have to go to headquarters. That's all a result of bureaucracy taking over the system.

By golly, in the Apollo program, we thought we were damned invincible. I mean, "We've got to do this, and ain't nobody gonna stop us, and there's no chance that we're going to fail. We are invincible." And everybody had that attitude. Well, today not everybody, but there are a lot of people who now have the fear of failure attitude, and, "Well, I don't know. Maybe we ought to review that some more. Maybe we ought to bring in some outside people to look at it. Maybe that's a little too risky, we shouldn't even try that." You see that beginning to creep into the management where, in the Apollo days, "Hell, let's go do it. We couldn't possibly fail. We don't fail." Those are the kinds of things you see today that are different than they were then.

Now, having said that, I've got a lot more insight into the system today than I did then, and it may be that a lot of that was there, we just weren't exposed to it because we were off doing real work and somebody somewhere had that same fear of failure and all that kind of stuff, but it wasn't filtering down to the guys on the floor like today I think maybe it does. So it may have been there, I just may not have seen it. But from a personal experience, that's the kind of differences.

WRIGHT: When you were so busy accomplishing so much every day, did you know what was going on in the world outside of spacecraft?

HONEYCUTT: No. I pretty well missed the sixties. I mean, I would see it on the news or something, but the hippie generation, I mean, I know a lot of music from the fifties, but you play tunes from the sixties and I don't recognize most of them. I don't recognize most of the movies or the bands or the popular events. I mean, what went on in Vietnam I knew about and some of the stuff that went on on college campuses. I know H. Rap Brown and some of those major events, but kind of the general cultural thing that went on in the sixties, I pretty well missed it, certainly the last half of the sixties.

WRIGHT: And I guess your family life was a little contained to the few hours that you had off as well?

HONEYCUTT: Yes. For a number of people, that was a pretty major strain on the families. Have you talked to Kranz? He used to do these family pep talks. He'd get the auditorium over there, and you had to bring your wife in and you had to bring the kids, and then Gene would get up there and talk about the program and the sacrifices that were being made and how they were all part of the team and the patriotic thing. I mean, you know how Gene is. All these wives were sitting there with this glassy look on their face, and 90 percent of them walked out and said, "What the hell is he talking about?" [Laughter] But he felt he had to do them, you know.

WRIGHT: Well, I'm glad you shared that with us. No, he didn't mention that. [Laughter]

HONEYCUTT: But they were classic Kranz, [General] Patton's speech up there. I mean, you'd see the flag back there, and you could see Gene in his little shiny helmet. [Laughter]

WRIGHT: Sometimes, as a sim sup, did you have to talk with your folks to kind of work them through a little bit as some of the days got long and kind of give them pep talks?

HONEYCUTT: Never. Malcontents you got rid of. We used to be the burial ground for people that didn't fit in some other area, and all of the branch chiefs were always looking to dump some folks on us. They sent me this guy one time, I can't remember now where he came from, but they sent him to me, and I think he worked for Arnie [Arnold D. Aldrich]. I can't remember. They said, "You've got to try to make something out of this guy because we owe it to him."

Okay. I said, "Well, what's your problem?"

He said, "Well, nobody will give me any responsibility. They won't let me do anything. I just want some responsibility."

I said, "Okay. I can fix that." So I started loading him up. "Write a script about this, go do this, go find out about this." This goes on for about a month.

That's when personnel used to be up at Ellington before they moved down here. So one morning at ten minutes after eight, the phone rings—now, this was in 1968 probably. The phone rings. The personnel guy says—I can't remember the person's name now—said, "They're up here and they're resigning."

I said, "They are? Why? He didn't say anything. He was up here yesterday and he seemed to be in a pretty good mood."

He said, "Well, he's resigning effective immediately, and the cause is too much pressure."

So I said, "Well, okay."

So time passed, time passed, time passed. I was in the program office in probably 1983 or '84, one day. Shirley [G.] Huss was my secretary. The phone rings. She says, "There's some lady wants to talk to you."

"Hello?"

"Well, I'm So-and-so from the something Rehabilitation Center in downtown Houston, and do you know—" whatever this guy's name was.

I said, "Yes."

She said, "Well, we're trying to make him a productive member of society and get him back in the work force, and you're his last supervisor." [Laughter] I mean, when I sent that guy out, he dropped completely out of this society for twenty years.

WRIGHT: Goodness. Haven't heard any more from him, huh?

HONEYCUTT: No. I was his last supervisor. But those kind of people would pass through. Normally, everybody was motivated. People just didn't complain about hours or anything. The divorce rate went up, but you couldn't keep people away. My problem was more burnout than it was them grouching about having to do it.

WRIGHT: We'd like to close out the session today.

HONEYCUTT: Is this what you're looking for?

WRIGHT: Absolutely. You're doing really well, and we'd like to set up another time, pick up from Apollo and move into Skylab and go from there.

HONEYCUTT: Okay.

[End of Interview]