NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

NEIL B. HUTCHINSON
INTERVIEWED BY KEVIN M. RUSNAK
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RUSNAK: Today is June 5, 2000. This interview with Neil Hutchinson is being conducted at the offices of the Signal Corporation [in Houston, Texas] for the Johnson Space Center Oral History Project. The interviewer is Kevin Rusnak, assisted by Carol Butler and Sandra Johnson.

I'd like to thank you for joining us today.

HUTCHINSON: You're welcome.

RUSNAK: It's a pleasure to have you here. If we could, tell us a little about your background, your education, your experiences before joining the space program.

HUTCHINSON: Well, I didn't have a lot of experiences before joining the space program. I started here awfully young. I was a mathematics and physics major in college, always liked the physics kinds of things. I guess I liked technical things. I had aspirations at one time, when I was fairly young, to be a nuclear physicist. In fact, that's what I sort of had in mind when I took a detour into space business.

I was born and raised in the Pacific Northwest, in Oregon. I lived in Portland, Oregon. I went to college in Oregon, went to Willamette University in Salem, and I got out of school kind of young. I graduated when I was twenty. I was kind of tired of school, and like everybody that finally gets out of college, I was broke. So I decided that I was going to go to work. I still wanted to do this nuclear physics thing, and I decided that I wanted to go to work and do that at the same time.

Quite by accident, I guess I'd call it a flyer from a federal job offer process was posted in the physics department at Willamette, and, of course, graduating seniors, everybody's looking around, if they're going to graduate school or going on to work, and so on and so forth. I literally applied—this was a flyer from the Navy to work on a satellite program on the East Coast. I'd spent all my growing-up life without a lot of travel in the Northwest, and I thought it sounded really neat to get to the East Coast. So I packed up my Austin-Healy and away I went.

That first job was in a place called the U.S. Naval Weapons Lab in Dahlgren, Virginia, which is still there, by the way, and still very active. The Navy's space activities are still run from there. At that time—I don't even know if you know what a slide rule is, but people were using slide rules and a thing called a Frieden calculator, which was, for its time, for a crude electromechanical device, a fairly sophisticated—not really a computer, but really was just a calculator.

When I got to Dahlgren, first activities—in fact, I worked on just one thing the whole time I was there, and that was on orbital mechanics. Back in those days, the very first satellites were going. I graduated in 1961, and I went to work that summer in Dahlgren, and they had just launched a satellite called Transit, which was kind of a forerunner of GPS [global positioning system], but I was not involved in the operational use of the satellite. We were using tracking data from the satellite to determine the shape of the Earth, basically, the Earth's gravitational terms. Of course, right about that time, it may have been a few months before I got there, some of the physicists both there and at the Naval Research Lab up in Washington, D.C., using that same data, had figured out that the Earth was not round; it was actually pear-shaped.

We began to derive gravitational terms using equations, hammered away with tracking data on those Frieden calculators and other things. We actually did have a computer there. It was called a NORC [Naval Ordnance Research Center]… One thing I never forget about that machine, the mass storage on it was a series of thousands of cathode ray tubes about this big around, and they had raster scans on them electronically moving a beam, and every place the vertical beam and the horizontal beam crossed, you could store one bit, a one or a zero.

There was a room at the Weapons Lab that was probably, I don't know, a half a dozen of these rooms that we had in there and there was nothing in there but these cathode ray tubes, bank after bank after bank of them. That was one of the hottest computers around. It's built by what eventually became Unisys. It was a Univac machine, I believe. Anyway, we got to do research using that machine and all of the manual data manipulations that it eventually went into machine-solving some fairly high-order equations. I thought I was in seventh heaven at the time.

That was about the time—at that time there was no Johnson Space Center. In fact, the decision had not been made to even come here [Texas]. There was [an] outfit called the Space Task Group, which you're probably familiar with, which was the genesis of what eventually became JSC, and they were all headquartered at Langley Research Center [Hampton, Virginia], which was one of the old NACA [National Advisory Committee for Aeronautics] NASA Centers, which was just south of Dahlgren, Virginia. It's about halfway between Washington, D.C., and Hampton Roads or Norfolk or that area down there. Not quite halfway, maybe a third.

So I was kind of on the fringes of a space program. I actually was working in a space program in it, but certainly not the NASA one. It didn't take me long to figure out there were some other things going on that were terribly interesting and, frankly, the manned part of this thing fascinated me. I was still at Dahlgren, although I'd pretty much made up my mind to come, that I was going to do something else, do something with NASA when John [H.] Glenn [Jr.] went up. That was just—you know, I just couldn't hardly believe that we were trying to figure out how to predict with the motion of a satellite in orbit around the Earth, and these guys were sending men around the Earth.

So I jumped in my car and I drove down to Hampton. The Space Task Force was still there, and I interviewed and signed up. I couldn't [immediately] leave Dahlgren because they had paid my way across the U.S. The government had paid for my relocation expenses. I had to stay there for one year. So I signed up to come to JSC in the spring of 1962, and I actually came down here a

couple of times to kind of look around. Then I finally moved, left the Weapons Lab and moved. I stayed at Dahlgren just a year to the day. I left and came here, and that's how I got started.

RUSNAK: Your path seems a little more direct than some other people, given your experience working in space.

HUTCHINSON: Yes, but I didn't grow up thinking, "Wow, I'm going to go do this," or whatever else. I happened to be close to there, I could go interview. I mean, it was literally a thirty-five-, forty-minute drive to get down 395 to get down here.

RUSNAK: Did any of the early events of the space program, the launching of Sputnik and the missile gap, these kinds of things, did they have an impact on you at the time?

HUTCHINSON: No. You know, I guess, I was fascinated with the technical side of this thing and the fact that—I mean, I had had orbital mechanics classes in school and so on. I was fascinated by the fact that something I had actually studied in terms of physical phenomenology was right on the cutting edge of things that the human race was doing. But I didn't ever relate really, at least early on, to a—you know, "Gosh, the Russians have done something dramatic and we need to catch up," or any of that.

Frankly, you know, somebody who's twenty or twenty-one years old, mostly—fascinated with their job—wants to drink beer. I mean, you know, I was not exactly into the high end of the political spectrum at that time. In fact, I never did, even as I went through Mercury and Gemini and Apollo and all that stuff. I think a lot of people that were in the program were much more concerned with what we were doing and how we were doing it than we were necessarily on beating somebody. It was certainly in the back of your mind, maybe. But even after I got very involved up

into the Apollo Program when I became a flight director and was having a significant activity in the business, I didn't ever think, "Gosh, we beat the Russians" or anything.

I think a lot of people here, certainly, you know, from the political will and the mental outlook of the people in the United States, that was a very important element of support for the program. There was an attitude that allowed a fair amount of leniency compared to what we see today with regard to making mistakes and so on and so forth. The public and the whole political structure, everything, in my opinion, was considerably more tolerant then than they are now.

RUSNAK: I think that will be a good topic of discussion when we get to later parts of the space program. When you first signed up for the Space Task Group, what were your expectations? What jobs were you looking at?

HUTCHINSON: Well, I had a degree in math and physics and had done—nobody at that time had really done much computer programming, although I had done a little bit on the NORC, on that big Univac machine, at Dahlgren. I was hired into an organization—I was hired by a guy by the name of Bill [Howard W.] Tindall [Jr.], who, by the way, I don't know if you guys got him, but he's no longer with us, and that's a real shame because he's one of those people that is an absolutely rare person. He's brilliant beyond anything you could possibly imagine. Bill Tindall was an architect of the flight dynamics part of the Mission Control Center computational horsepower right from the very beginning, right from back in Mercury.

I don't know if you know that when we were doing Mercury, the Control Center was at the Cape, and we did all the computational work at Goddard [Space Flight Center, Greenbelt, Maryland] up by Washington, D.C. One of the oddest things, after you got to thinking about it, you know, we'd have a radar at the Cape that would be tracking a launch vehicle, sending the data to Goddard, computing the answers and then sending the answer where the vehicle was right back

down to Florida to the control center. Of course, that's one of the things that we did in Houston, was put all of that together in one place.

When I was hired on, I was hired on by Bill Tindall. I remember interviewing Bill and a guy named John [P.] Mayer, who was actually Bill's boss at the time. But Bill never was very big on titles and stuff, but really, really big on what he knew and what he did and how he did it.

One of the things that—another guy. I interviewed three people down there. The third person I interviewed was a guy named Lynn [Lynnwood] Dunseith, who, by the way, also is no longer with us. Those three guys were, in my mind, the three people who most shaped the computational horsepower and what it did and didn't do in the early Mission Control Center design and construction. They all had a lot to do with the computational activities that were going on at Goddard, which subsequently were moved to Houston and then, of course, redone for the big control center here.

Of course, when I signed up, they weren't sure they were going to Houston yet. They were just in the process of that decision activity. Then when I got here, this NASA Road 1 was just kind of a—not kind of; it was a two-lane road with major ranches on both sides of it, no houses or anything else, cattle all over the place. We for several years were downtown, and NASA rented a lot of facilities up and down the Gulf Freeway.

I was in a place called the Houston Petroleum Center, which I think it's next to what is now an Oshman's warehouse, the other side of Gulfgate inboard, toward town from Gulfgate. In fact, Gulfgate was kind of the edge of Houston at that time. NASA, when they came here, of course, they got the land for Johnson from Rice University, I believe. I'm almost certain. It was a fairly large "donation of land," which is all part of the political process.

They started construction in '62, but there were no facilities at all, and they couldn't find any single place to house everybody, so we rented apartments. There was a place called the Farnsworth and Chambers Building that had a bunch of people in it. All the flight operations guys were in that

thing that I believe now is an Oshman's warehouse. But that was an office facility. It's right next to the Houston Petroleum Center.

We had a place down—I'm not going to remember the names of the streets, but called the Lane Wells Building, which was another part of that complex down there. You couldn't have called it a complex, you know. And we were all going to meetings and doing things all over the place. And, of course, my piece of that activity was directly connected with the Mission Control Center.

Back in Mercury, one of the things that was going on the space business at that time was a very dramatic increase in the complexity of the vehicles. Gemini compared to Mercury, and Apollo compared to Gemini, they're just orders of magnitude change in the complexity of the systems. What that meant to the people on the ground is a great increase in the number of measurements and the kind of measurements that you telemetered from the vehicle to the ground.

In Mercury, the telemetry system—I can't remember the total number, but I'm going to guess. I'd say there's probably about a hundred measurements in the whole spacecraft, including just on/off measurements and temperatures and pressures and so on and so forth. It was all an analog system and almost, not quite, obviously it was RF [radio frequency] when the vehicle was flying, but almost hardwired through with no computers or anything. And, of course, there was no high-rate transmission of information from one point to another. So when the Mercury vehicle was over Florida, we got a lot of data, and when it wasn't, we didn't.

NASA had remote sites spread out all around the world, and we sent teams of people out there because when it was over one of those remote sites, each one of those teams was like a little control center. Cape was like the master control center, and then we had all these little slave control centers around. We actually had a CAPCOM [capsule communicator], a person who talked to the crew, just like we do in a big control center. We had systems analysts and procedures people and so on. You know, the vehicle would come over the site and you'd get AOS [acquisition of signal] when it cleared the horizon, and we'd conduct some business and look at some data, and then that information would get basically radioed verbally back to the control center in Florida because we

had no way to—some of them we had hooked up with teletype and you could do teletype messages back and forth.

My first job at NASA was to build the telemetry system for the Gemini spacecraft, the ground side of that, and that led to my first management job at the agency, which was in, I don't know, '63 or '64, somewhere in there. I'd been there a year or year and a half, and we were building a team of people. NASA was hiring like—I mean, there were just people coming in the door every day from all over the place.

As I said, we were downtown because we had no facility out here. The control center was one of the first buildings that had real stuff in it, you know…one of the first ones built there. We spent a couple years working on the design of that system, and we hired two contractors. IBM did the software. Philco Western Development Laboratories, which eventually became Philco Ford, which eventually became Ford Aerospace—I mean, they're reincarnated ninety-nine times there, you know, as the years have done on. But it was originally Philco Western Development Labs who built the hardware in the control center, the consoles, and most of the display devices that were in them. Of course, then IBM built the software that was downstairs on the first floor. My job was putting together that set of software requirements. We had a contractor do the coding, and then NASA went in under and behind them and did most of the testing. Then NASA mostly ran the software.

Of course, as the communications technology and everything moved on, we started off Gemini with a few places. We had a site down in Texas, down in Corpus Christi. The continental U.S. sites, we connected them by what then was called high-speed lines, but I think they were 9.6-kilobit circuits. I don't remember. We'd put a computer out at each one of the remote sites. Even though we still had somebody who talked to the crew out there and some systems analysts, as time went on, we got more and more of them hooked into the control center so the vehicle could be coming up over California and we would see from Goldstone, for example, we would see—well,

Goldstone is a deep space net [network site]. But let's say the Corpus site we would see telemetry from it at a very slow rate in the control center.

Of course, that concept to eventually remote all of the receiving stations into the control center matured more and more as the communications got better and better, and eventually we didn't send anybody anymore out to those remote sites. Of course, we had not only ground sites, but we had airplanes and we had—I mean, I'm moving a little on to Apollo here. But we had ships that were specially outfitted with antennas that were hooked to the control center.

So that's what I did for the first several years I was at the agency. I started out my first management job there. I was working for Lynn Dunseith. We built the Gemini system. We started off in the control center. We ran all the Mercury flights out of the Cape.

Then we got to Gemini III and we had this thing up and running, but we were a little nervous about how it was going to work. Of course, at the same time I was working on the telemetry system, we were doing this thing of moving all the trajectory computations from Goddard to Greenbelt, Maryland, down to Johnson, and putting them in the same computer that we were doing this telemetry work in. We were building a whole new set of display and control capability, because at the Cape—can I tell war stories?

RUSNAK: Sure.

HUTCHINSON: I'll tell you one really funny story. In fact, it was one of the big balloon-breakers that inspired me—that we can surely do better than this. The very first time that I was at the control center at the Cape for a flight—actually, it was not a flight. We were training. I can't remember, it was MA-7 [Mercury-Atlas 7] or something. Everyone had seen the control center on TV. I mean, you saw the big world map and the spacecraft going. So to finally get into the place—and I don't remember, this was maybe a year after I came here, it was a while. I was kind of getting my feet on the ground in Houston. I went to the Cape and I went into the control center and, gosh, I got in

there, and holy cow, there was a bunch of flight controllers in there. You know, I didn't hardly know what a flight director was versus a whatever at that time in my life.

I'll never forget, I walked into that room and I kept hearing this very odd whining noise. I thought, my gosh, you know, I wonder what that is. In the front of the room they had a world map, and on it they were projecting ground tracks. Well, it turned out they weren't projecting the ground tracks. They were in essence—they had several orbits, and I don't remember what flight this was, but let's say we were going to be up for ten orbits. You know, we were running very short flights at that time. They had all the orbits inscribed on it so hopefully the launch vehicle got you where you wanted to go at the right inclination everything inscribed on this thing. I don't remember, they may have been drawn by a computer. I don't think so.

But here's the war story. The noise I heard was they had a little Mercury spacecraft and it was strung up on wires. They had a bar across the top of that world map and they had a bar down the side. So the map was surrounded by a track, basically. They had the spacecraft suspended on wires that were connected to servos that were running up and down these tracks. Obviously, when you get to one side of the world, how does the spacecraft get back around the other side of the world? Well, it gets over to one side of the map and—by the way, another thing that was interesting, there was a little light bulb in the spacecraft, literally like a Christmas light, a little red Christmas light. When the spacecraft was over a site, somebody flicked a switch and turned on that light bulb to show that you had contact with the ground. When the little spacecraft following the ground track right around and it gets over to the right-hand side of the screen, well, the light bulb goes out and it goes zing, zing, zing, zing. It jumps up to the top, and goes "zing" back over there [left hand side] and "zing" back down to where the ground track picked up on the other side of the world, and then the light bulb comes back on.

It was all that noise of that hummer moving across there, and it made this really funny—and I never to this day forget that sound and it absolutely—you know, I thought these guys were doing

magic with computers, with the way they had this tracking system up there and the ground tracks and everything. And it turned out it was relatively crude.

Well, I came back here and we built a better mousetrap in Houston. We didn't have one of those mechanical tricks. Anyway, a little war story.

So I did that up to the fire. That was [1964] and we were going through a progression of flights. I started off operating a console. We had consoles down in the computer room just like the ones up in the MOCR, up in the Mission Operations [Control] Room upstairs where the flight controllers were, except the ones in the computer room were controlling this big computer complex.

We started off with, and we had the absolute hottest machinery known to man at the time, IBM 7090s. Then we went to 7094s. That probably doesn't mean anything to you guys, but some historian might like it. Then we went to 7094s and 360s and so on. In the systems we built, you know, nobody had ever done that before. Nobody had ever done a real-time system that processed the information as the event was happening. You saw it somewhere else at the exact instant it was happening, of course, minus the transmission time, which meant that the computers had to keep up with real life, which is what real time means.

I don't know this for a fact, but my guess is that the early Gemini control center was probably the biggest, most complex real-time application that the world had ever seen at the time it was put together. Of course, Gemini, we were able to process one spacecraft, and the Gemini Program had a lot of different things in it. We did some rendezvous. We were trying to learn how to rendezvous. We did some rendezvous with ourselves, with two vehicles, which meant we had to be able to process the telemetry streams from two spacecrafts at once. We had an Air Force ballistic missile rocket kind of thing called an Agena, which was actually an upper stage of a missile at one time, and we launched one of those on an Atlas and rendezvoused with it.

In fact, that was one of the things one time we got ourselves in a fair amount of trouble when one of those got away and we had an attitude control problem between the spacecraft and the Agena. In fact, it was Neil [A.] Armstrong, to be quite frank. You probably have all that in your

records. But it was a pretty hairy deal. Spun the spacecraft up really bad. I was not in the flight operation world at that time; I was still down in the computer complex.

Anyway, we had consoles down there, and I ran one of those. We were just building everything, so you got to name what you were called. I made a position called Computer TM [Telemetry], which I think to this day is still a position down there in the computer complex. I don't know that for a fact, but I suspect it might be.

My job was to operate and monitor and, in some cases, initialize and babysit the software that we had built to process the data from the spacecraft. I did that for a little while and then eventually I ran the entire computer complex. By the time we got to the accident, I was running—I was a thing called the Computer Sup [supervisor], which was the senior person down there in that room of all the computers that ran the whole complex down there and supported the control center. I was actually on duty when the accident happened, during the fire. I was running the computer complex when the accident happened.

There were a number of things that fascinated me about that job. One thing was that we all, everybody, had on headsets. This will sound really odd, but that was kind of a key. You could have a hundred people in a room and they all had on these headsets and they had a little microphone and whatever and you had to push the "talk" button. And later on we had these things where you could do it with your foot. Some even today, I think, are voice-activated or whatever.

But it's a way to get a lot of people in a very complex situation and communicate with one another. It would be like walking—if you've ever walked into the control center when something is going on, it's deadly quiet in there. There's no smoke and fire and big rockets and all that other stuff. It's just a bunch of people doing their job, sitting at consoles, [quietly talking].

I was absolutely fascinated by the fact that the control center is a marvelous information exchange process that takes a tremendously complex set of information, does things to it, gets it to people who can make decisions on it, and then there's a process that allows those individual decisions to be integrated and ultimately influence how a flight is going. That whole concept—I

mean, I probably didn't have that clear a picture of what I was—well, I know I didn't when I was starting. But I was fascinated by the fact that we could process tremendous amounts of data and get it [to] a form that was consumable by a human and then could be reacted to by a human, and in the end would influence something that was going on in the air.

So I really liked my job. Those days were—I mentioned earlier that I think the attitude in the country these days is absolutely—and that's probably a bad way to state it—I think the environment that NASA operates in today or even back when we were doing Shuttle, or back when I was doing Shuttle, is nowhere near as forgiving as the environment was then.

You would not believe the mistakes we made. You know, we would build a display. I don't know much it cost, but let's suppose we spent $100,000 and we built this special display because some flight controller upstairs in the MOCR wanted to see temperature plotted against three other variables. And we didn't have one of those, so we just said, "Okay, we'll just build you one." Then he looked at it and said, "You know, that's not really what I wanted. Let's go do this." Or we would put together a conceptual thing and try it out and it would crash and burn and didn't work. We'd just say, "Ah-oh, this isn't going to work." I'm exaggerating a little bit for effect, but, frankly, everything we did was the first time. Nobody had ever done it and nobody cared if you made mistakes. You just kept getting encouragement to get on with it.

You know, if you look at the [Apollo 1] fire and you ask yourself, you know, the magnitude of the issue associated with it and the recovery process that went on after it and the fact that—and I don't remember the exact timing, but in less than a year we were in the air again. You just wouldn't believe what went on in that year.

You know, we literally took everything. I was not involved in the redesign of the spacecraft. I was involved in the redesign of the telemetry system of the spacecraft and particularly the stuff that came out of the Apollo guidance computer on the CSM [command and service module] side, which was done at MIT [Massachusetts Institute of Technology, Cambridge, Massachusetts] at the Draper Lab. But, you know, the recovery from that and again, no financial

constraint, no mental constraint, no moral constraint, nobody second-guessing you in particular. And the recovery was—you know, we changed the entire environmental control system from a pure oxygen system to O_2N_2.

We changed out—I don't know the right number, but an enormous percentage of the materials that were inside the cabin and on and on. And we did it all in weeks, because all that stuff had to be remanufactured. Then we got a spacecraft put together and got it to the Cape and launched it. And you could never, ever, ever, ever, ever do that in this day and age.

If you look at the only other accident we've had—knock on wood—is the *Challenger*. If you look at the complexity of the *Challenger* accident versus the complexity of the Apollo fire, they're not even in the same ball game. The Apollo fire was infinitely more complex and tougher, and the recovery process touched way more things and so on and so forth.

You know, it took us four years to—or three years, or whatever, or I guess it was three and a half—to get back on track after *Challenger*. We'd have never made it to the Moon if we'd had to live with the constraints that the people who are running the program are living with today.

Why am I preaching? I thought this was an interview. If I'm talking all the time, and you're not asking questions, this isn't a very good interview.

RUSNAK: Well, that's why we call them oral histories. It gives you a chance to talk about what you want to.

HUTCHINSON: Oh, okay, just let you babble on.

RUSNAK: Well, if I can get back to Gemini for a minute, you were talking about the computer complex and it running and the importance of that. How well did it operate during missions? Were there significant moments where the hardware or the software didn't work so well?

HUTCHINSON: Well, yes and no. I think for the time and the concept, the way the control center computer complex was constructed, it was set up with an absolutely 100 percent redundant system, what would be called a hot backup today, or a live backup in that you would have two mainframes, two big computing systems, both receiving data, the same data, and both doing all the computations. One of them was on line and one of them was off line. One of the jobs of that computer supervisor, called him computer sup, that position down there, was to decide if something was wrong with the online machine to go bring the backup on.

So, yes, we had faults. Remember that we were moving through development processes extremely fast. We not only changed the software each flight because of a change in the vehicle and what was coming down from it, but we were adding big chunks. For example, the early software was not capable of doing rendezvous calculations on the trajectory side because we didn't have to rendezvous in GT-3 [Gemini-Titan 3] and GT-4 and GT-5, but we were in parallel developing that rendezvous. So every mission had a lot of new capability and new [software] builds and so on and so forth.

Then, of course, we were about maybe halfway through Gemini and we started working in earnest on Apollo in parallel. And we hadn't flown a thing yet, you know, but you needed a year or two lead time to do it.

My recollection is we did an awful lot of testing. There was an awful lot of nights, guys putting in fourteen-, sixteen-hour days, week in and week out, month in and month out. Of course, during that time in the country, Vietnam was cranking up, you know. I was, of course, not involved in Vietnam, but, frankly, that whole thing kind of went right by us. That went by me, anyway. We were just so buried in trying to get done what we wanted to get done.

Complex ran pretty well. We had a few infamous issues. One which is—I suspect you've heard about it. If you haven't, I'm amazed. I'm going to say this happened on Gemini IV, and, frankly, since this is a history, I am probably not sure of that, but I'm almost certain it was GT-4.

What we did to bring the control center on line was in Gemini III, we ran Gemini III out of the Cape and we ran the control center in Houston absolutely in parallel. The flight controllers manned the consoles, we processed all the data, but all the flight control and the decisions and everything were made at the Cape.

Then on Gemini IV, we reversed the process. The Cape went off line, although they had everybody down there. They had a team and everything else. We ran the first flight controlled out of Houston, was GT-4. To make a long story short, we missed the carrier pretty bad. The retrofire was fouled up. Of course, we did a lot of looking to try and figure it out.

We discovered after the fact that we had the rate of rotation of the Earth incorrect in the computer, in the computer complex, and therefore computed the wrong retrofire time. You know, it turned out to not be an event because everything worked out okay and so on, but it was really, really embarrassing. So, yes, there were a few things like that.

One of the things that we were learning how to do then was to do software builds off line, and then we did an awful lot of shakedown with the simulation process. We weren't anywhere near as sophisticated as we eventually got with all of the close-looped stuff that went on between the simulators. For example, the Shuttle today, the control center is absolutely—you can't—I defy you to sit at the computer [console] at the control center and not know you're not flying when you're doing a simulation. Of course, the computer programs used are the same ones used in flight. But we were beginning to learn how to use simulators that the crew trained in to help us check the software so we had a really good shakedown before we ever got in the air.

I don't recall any times—there obviously were times when the machinery was down and it should have been up, but I don't ever recall any dramatic nonsupport events that went on in the computer complex, which is a credit to the people that built it and the way it was put together.

I'm sure that we had system crisis where we swapped over the machine and then we'd bring the other one up. I can remember in those days the ability to diagnose something when it went wrong on line was very limited. So you mostly had to take a memory dump of the machine and

look at it later. You know, sometimes when we had a bad day, not a bad day in flight, but a bad day in getting a build ready, we'd pile up dozens of those things and guys would be pouring over pages of printouts trying to find out where the wrong bit got set, you know. The diagnosis of ills in software development in those days was very crude, very people-intensive. But, no, I think the complex ran—my recollection is it ran, ran very well.

RUSNAK: Was the Apollo 1 mission your last as the head of the complex?

HUTCHINSON: Yes, yes. I was there when the accident—I was running the shift when the accident happened. Of course, we, at first—I mean, just the data stopped. You know, we all started looking around figuring, you know, we're always having an issue outside of the complex. We were trying to figure out, did we crash? What happened? Because all of a sudden the telemetry all stopped. And there was a crew, a flight control team upstairs. We were running a pad test with the control center, but mostly being controlled and executed by the Cape with the control center in a monitor mode.

We often did that to get a—we did it with Gemini. We did it all the time to make sure we had all the downloads straight and we could run the real-time system all the way from the spacecraft to the control center. That was always a big deal, running live data off the real spacecraft, and this was no exception. We were participating in the pad test as an adjunct, I guess, to help check out the ground systems and to get people in the control center familiar with data and the vehicles.

It was—I don't really remember, but I do remember it was a couple of hours. It was maybe not that long, it maybe seemed like that long. It was a long time before, you know, all of a sudden the words started. The guy that runs the complex down there is on the flight director's loop so he can talk back and forth upstairs. He's one of the few people—some of the other consoles talked to the back rooms, but he's one of the few people who can talk back and forth.

You know, it was probably fifteen or twenty minutes before anyone even said, you know, "Man," or, you know, the word started getting around that there was something seriously wrong. Of course, afterward we went through a whole process to impound all the data and secure all the tapes and so on and so on. It was not one of our shining moments. But, you know, we lived to fight again another day.

RUSNAK: That's right. You talked about the changes that ended up for the spacecraft. You, yourself, went through some job changes after this.

HUTCHINSON: Yes. Yes, I did. As I had gone through those five years now of working in the real-time computer complex and working in the mission planning and analysis world, I had gotten to know many of the people who were very good friends who were actually running consoles in the control center. To be quite honest, it's a little bit of an ego trip. Those guys are the people who are kind of at the top of the pyramid on the ground. Not that the support infrastructure and the control center and the computer complex and everything isn't a very—I mean, nothing works without that. But on the other hand, the level of responsibility and the level of visibility and so on and so forth is higher if you're in the control center upstairs.

Again, I was still—and by now I was beginning to realize more and more about how clever this whole concept was of taking a spacecraft and chopping it up into little pieces and giving ten different people responsibility for a little piece. Then you've got this big integrated stream of data that comes from it, then you chop that up and give it to the right people, and that whole idea. So I decided I wanted to be one of those guys that was looking at that data. I didn't have an engineering degree, I had a degree in math and physics, but ever since I have been here I have been working on building software that analyzed the systems in the spacecraft. So, of course, I had all the basics of physics and understood [what] temperatures and pressures, and blah, blah, blah, were.

So my first step into that world was one that kept me really close to the computers. I went from a computer on the ground to a computer in the spacecraft. I had some very, very good friends—Glynn [S.] Lunney and Cliff [Clifford E. Charlesworth] and Arnie [Arnold D.] Aldrich. These guys are all folks who were—Glynn at that time was a flight dynamics officer [FIDO]. He had not become a flight director yet and was just about to. In fact, he did, right about that time, right about the time I moved.

I became a guidance officer [GUIDO]. The first job I had to tackle was one of the unmanned Saturn Vs. The computer that was in the command module, the command module had a set of dummy [stripped down inside—no crew accomodation]—we were mostly testing the Saturn V. We had two missions, [AS-]501 and 502, both unmanned, and we were testing the Saturn V and testing the reentry systems of the Apollo spacecraft. They were both suborbital. One of them was a super orbital which—well, I don't know what you'd actually call it, but we were trying to get much higher reentry velocities because the entry velocity coming back from the Moon, of course, is quite a bit higher than retrofiring coming back from being around the Earth, being orbited around the Earth.

So anyway, 501 and 502, there were two big computer programs that were very significant. One was in the command module. The other one was in the Saturn V, and it was a guidance system whose guts was a thing called the IU [instrument unit]. I basically was taught by some other people and then a lot of—I don't know if I did self-study, but got involved in the guidance and control parts of the Saturn and the command module and the monitoring of them.

What a guidance officer does in the control center is basically connect those pieces of hardware with the steering of the vehicle during powered flight, in other words, its attitude, in a crude sense. There are certain other things that are important.

There are two people in the control center in a place called "the trench," which is the front row in the control center. I became a member of the trench in those unmanned days.

This was going on while we were still flying, well, let's see. We'd finished Gemini IX and we were trying to recover from the fire and we were working the Saturn V. The Earth-orbit Apollos were launched on a Saturn I-B, which had no S-II stage. Most of the stack was the same except for one big segment that wasn't there. So while that was going on, I was working on 501 and 502 [which had all three stages], and we flew those two flights.

My first experience as a guidance officer, one of the things the guidance officer did was to send a navigation update, which was a ground-determined state vector, position and velocity of where the spacecraft was, because the command module did not navigate really well through powered flight. It actually did all right, but ofttimes we knew where it was better than it did. So we stuck a state vector in it before it separated [from the Saturn], went off and did its thing and came back. Of course, the first one of those was a big lob, suborbital, basically, did not go into orbit around the Earth. We were going to recover the vehicle.

By the way, I think this vehicle is over at Stennis [Space Center, Mississippi] on display. I think the 501 command module is. They've got of the two of them over there that we flew unmanned, in their Visitors Center.

We had a standard procedure to get a good state vector after powered flight was over and then stick it in the CSM. It's a command load, and the guidance officer is the guy who did that. We'd practiced it over and over, you know, training. You just trained and trained and trained and trained. Cliff Charlesworth was the flight director at the time. I don't remember who the [flight dynamics] officer was.

Anyway, I couldn't get the thing in the spacecraft. Chris [Christopher C.] Kraft [Jr.] was in the room, and it was like the only job I had in the whole flight and I couldn't. Long story short, I don't remember exactly what happened, but it turned out there some kind of error in—I believe it was in the flight software, some problem that was preventing this state vector from going in. You know, I can't recall whether we finally got it in or not. We may have. But it turned out to be a big ditty because it was fouling up the nav [navigation], and they were worried they weren't going to

get the right entry conditions. I kept sending the command load over and over again. Turned out I didn't make a procedural error; there was something going on there. So that was my introduction to flight operations, sort of a failure.

Then we flew 502 and lost an engine, first time that had ever happened. I know who the flight dynamics officer was on that flight, it was Jay [H.] Greene. He was sitting right next to me. He eventually—it's kind of funny, Jay Greene was my flight dynamics officer on STS-1 many, many, many years later. Jay and I were in the Trench, and, of course, we had simulated lots and lots and lots of stuff.

There are energy plots like velocity versus flight path angle, various things on the big ten-by-twenty [foot screen] when you are launching, and you can tell whether the vehicle is lofting or depressed or whatever. The three people in the front row—there's actually four. There's a booster, and at that time in the program the boosters were all from Marshall Space Flight Center. I'm going to be very embarrassed because I can't remember his name, but I remember his nickname. His nickname was "Bud the cigarette," because in those days there's a lot of smoking going on in the control center. This guy who was a Marshall employee, and I cannot remember his name. He preceded Frank [L.] van Rensselaer in that position, who is just a terrific guy.

But, anyway, we're flying along, we'd just lifted off and we're flying along. I looked at the console, and all of a sudden I see the engine bells steering. We called it steering. The guidance system is seeing something that was certainly not normal, because the vehicle went like this. I didn't say anything on the loop. I leaned over to Jay Greene, who was sitting right there, and the booster was on [his] left. He was here and I was here and the retrofire officer was on the other side of him and then FIDO and then myself. And I said, "Jay, this thing sure is steering an awful lot more than it did." And I about got "It sure is steering an awful lot more," and on the loop comes "Bud the cigarette," and he says, "We've got an engine out."

And Charlesworth didn't believe him. Charlesworth was also the flight director on that flight. And Cliff said, "You've got to be kidding me. Are you sure?" And he said yes. Well, you

know, ended up, we lost two. Man, when the second one went down, you know, we basically thought that thing was going out of control. All the launch vehicles, of course, have a range safety system on them. They blow them up if you get—so another interesting interface was the guidance officer and the flight dynamics officers' interface with the range safety guys at the Cape. Of course, you know, we were trying to figure out was the vehicle going to stay in control or not. Well, of course it did. The bottom line of the story is it did, and in the end, the mission turned out to be fairly successful.

But that was the second time I was in the control center and on the console. Not a casual experience, but it all worked out. I eventually got on the loop and said, "Yes, well, it looks like the guidance is reconverging on the conditions it's steering to," and so on. I was getting help from—you always get—you know those people that run consoles in the control center are only as good as the people in the back room talking to them, and I had a lot of really smart people watching what was going on and putting inputs in, and eventually made it into the flight decision process in the front room. So I did that. I did those two unmanned ones.

I made another career change which started out to be at the time—well, I won't call it controversial, but maybe not supported by all the people involved. I had made my living all those years downstairs in the RTCC [Real Time Computer Complex] working on spacecraft and spacecraft systems and the telemetry that came from them, processing the [data] that came from them. Certainly guidance officer, that was a very important thing in an absolutely critical element in the control center, but I had this thing in my mind, which really was ill-founded, but at the time it apparently had some merit to me, that I wouldn't have gotten to the right place if I wasn't involved with one of those real spacecraft that the people were in. I knew everybody by then and everybody knew who I was. I remember at the time Glynn Lunney was very unhappy, because he was the branch chief of the organization that had the guidance officers in it. But I decided to go to work in the Command and Service Module Branch and to become a GNC [guidance, navigation and control

officer], which was the CSM equivalent of a—as opposed to working a trajectory problem, it was working the systems in the command module.

So I changed organizations. I went from the Flight Dynamics Branch in flight operations to the Systems Branch that was being run by Arnie Aldrich at the time. I got involved with that. I spent Apollo 7 and 8 and 9, not much on 7, I was really just trying to learn the whole scene, but I did do Apollo 8 and 9, and Apollo 8, awesome mission, probably because—I don't know whether it was because it was my—and I was not running a prime shift, by the way. I was not the guy on the console during launch or anything, but I did pull down a shift on the GNC console on Apollo 8.

Again, at the time I didn't think that there was anything particularly extraordinary. It just seemed like the next step. Apollo 8 was not… That was not part of the plan in the beginning, and we had a real problem getting the LM [lunar module] vehicle ready to fly. The idea was, we were going to do Apollo 7, then we were going to fly a LM mission in Earth orbit, which, of course, eventually turned out to be Apollo 9. The mission that went was going to be the Apollo 8 flight, and the mission that ended up Apollo 8 was created when the LM—I say "created." We never had any intention originally of taking the CSM to the Moon by itself.

The LM got behind in its manufacturing schedule, and we had a small window, and Chris and [Center Director Robert R.] Gilruth and a lot of people, and it was certainly way above my pay grade at the time, but decided to leap into the breach and we're going to take the CSM to the Moon. And, of course, we all said, "Yeah, let's do that."

Bill [Howard W.] Tindall, my original boss there, I give him great credit. He basically orchestrated the development of the combination of the onboard and the ground navigation system that we went to the Moon with, all the conceptual stuff about using sextants like an ancient mariner and having a crewman look out and find a star and make a mark. Of course, the sextant had some—and we still do that kind of stuff. We still have that kind of a thing, a star tracker on the Shuttle and so on.

But at that time, you know, we weren't sure of a lot of stuff. We weren't sure what kind of accuracy we could get, and we had lots of simulations and so on and so forth. But when I think back on all the things that went on in Apollo and, of course, I participated in more and more higher-level things as the program went on, my own personal favorite is Apollo 8, bar none, because the mission was not part of the plan. In three months we got an idea, put it together, and took off [launched].

Then, of course, being a guy in the CSM where the whole thing was hanging on the CSM and going into lunar orbit, where we only had one way to get out with a service propulsion system, which, of course, we'd only flown once in Earth orbit and never had it in that environment, you know, the whole scene was just absolutely remarkable.

You think about Apollo 11. Apollo 11 was remarkable, too. They all were remarkable. But we had every bit as many unknowns on Apollo 8 as we did on Apollo 11. A pretty amazing piece of work. So I got to be a GNC on that.

Then I did "the Rusty Schweickart show," which was the Apollo 9 Earth orbit thing, and got much more involved because I had some experience under my belt then. I got involved in the CSM, was, of course, a very major player in that flight also, although the LM is the active rendezvous vehicle, but still in all.

And then from then I got involved in the management. By that time in the flight operations world, people had two jobs. You've got a day job and then you've got your console job. The day job is involved in getting ready for flights and many times is involved in running an organization and so on and so forth. I eventually became Arnie's deputy. We had lots of very, very smart young people coming up, really young, you know, guys running those consoles that, you know, not right out of school, but under twenty-five.

That's another thing you don't see happening today, for some reason. It's kind of silly, if you ask me, but we have a tendency to want to get people to almost be graybeards before—no pun intended—before we strap them with responsibility. I don't know, maybe there are a lot of young

people in the control center. I don't pay too much attention to it anymore, but in that day and time, age had absolutely nothing to do with anything. Because I became a flight director when I was thirty and it was no big deal. I mean, other guys were too.

In any event, so I quit riding the console flight to flight and was helping Arnie run the branch. One of the things that is important about the control center is—I mentioned this—controlled communications and the way they break things down. There's another really important element of it, and that is the fact that the control center is able to bring to bear the original equipment manufacturers in a way that brings all of their inputs into the control center in a real-time appropriate way. Of course, those manufacturers in this case—it was North American Aviation at the time—incredible repository of knowledge about every wire, every nuance, everything having to do with the vehicles.

One of the things you find out, you know, you train and train and train as a flight controller, and they throw all kinds of stuff at you. Stuff breaks and you've got to figure out what's wrong and you work with the crew and so on and so forth. Then when you get in the air, it never happens quite the way you trained. The thing is about the training is it taught you a process and a way to handle tough situations. But when they come at you in flight, you know, with a few exceptions, like Apollo 13, it didn't take us very long to figure out what kind of an issue we had going there, when they come at you in flight, they are usually shades of gray, never really clear that, well, this broke or that broke, because they don't ever quite break. You know, they're not operating exactly right, and there's a decision process about how you would react to that circumstance. Simulation is usually things—it's hard for the simulation—level of sophistication of simulations to be very subtle. You know, it's kind of, "well, it broke and we're going to implement this flight [rule]. Here's what we're going to do."

In any event, the Mission Evaluation Room, as it's known today, it's called the MER. In those days it was known as SPAN. Spacecraft Analysis is what SPAN stood for. It was the funnel through which we got North American and all of the engineering horsepower in JSC that was not

riding a console in the control center, their inputs, into the system. I ran a shift in that room. The room has consoles. It's a back room. When one of these gray areas comes up and the flight controllers can write up a chit [anomaly form] and send it back there, we send it off to Rockwell and they analyze it and send answers back. Or sometimes if it's a real-time thing, you're being an intermediary in real time. Arnie, myself, a guy named Mel [Melvin F.] Brooks. They had a CSM SPAN and they had a lunar module SPAN. The lunar module, of course, connected up to Grumman people in New York and a lot of people in Houston that were lunar module folks.

The purpose of those rooms was to orchestrate the inputs from outside the immediate flight team to help the flight team solve problems. That's where I was on Apollo 13. I did it 10, 11, 12. I was there for the lunar landing, [the] CSM on Apollo 11, performed really well.

I was in the SPAN room. I was running the launch shift when we got the lightning hit on 12, which [unclear] because the CSM just went crazy. Every light we owned went on. The fuel cells disconnected off the bus, the platforms dumped, the computers quit. But luckily the IU, that old thing I worked on way back in those unmanned days, flew right on. Interesting. I never—another guy who is not around anymore, I hope you—did you get [Charles C.] Pete Conrad?

RUSNAK: No, unfortunately, we did not.

HUTCHINSON: Damn. That's too bad. A very good friend of mine and a great guy. But I'll never forget, there were some comments [from the crew] first about, you know, "I've got a fuel cell light, I've got a main bus light, I've got an IMU [inertial measurement unit] down, I've got an IMU locked, the eight ball froze." You know, there were a series of those sort of calls coming out. If you ever knew Pete Conrad, he has a laugh that you will never ever forget. He cackles. Here's this—I mean, we're dying here. The spacecraft just got hit by lightning and the entire CSM is dead. The lights are out. The only thing that's on is the caution and warning panel. We're on to batteries. And all the buses are disconnected from the fuel cells, the computers are down. I mean the thing is

in deep yogurt. And Pete starts laughing. I'll never forget him cackling, going uphill, because they were just—I mean, you sit there with your arms [folded] and hope the S-IVB got you where you needed to go so you could get on with life.

That was pretty sporty, because, of course, we were trying to figure out if any permanent damage had been done. We had to literally reinitialize the entire spacecraft. Everything. Reloaded the state vectors in the computers, had to realign the platforms. We actually got away one orbit late, but we never could have done that without the control center. The SPAN room was pretty busy after launch on Apollo 12.

Anyway, I did that for three, four flights, five flights. Then they were looking for some new flight directors, and I got involved in that and did that for a long time.

RUSNAK: Did you want to say anything more about Apollo 13 and your involvement with that flight?

HUTCHINSON: Apollo 13 was—I was actually off shift at home asleep [when] the accident happened. I was again running a shift in the SPAN room and got woken up. I don't even remember who called me. Nobody called me. Somebody heard it on the radio and called my house and said, "There's been some kind of major ditty going on. You'd better get over there."

One thing, you know, it's interesting. I digress here for a minute. I'm going to back up. Do you know we used to sleep in the control center? If you've ever seen those two buildings, you know there's a Building 30 office wing and then there's a Building 30 control center. And there's this really odd facade with the kind of spiky cement things that cover it up going between there. That was a deliberate design, and we had a bunkhouse and a cafeteria in that passageway between the two things. When we first put the control center together, the thought was that we would always keep a reentry team, somebody who could reenter the spacecraft if we got in trouble, over in the control center, sleeping. And ofttimes we had other pieces of teams who stayed. I've actually slept

over there, and we had a bunkhouse with over [twenty] bunks and showers and everything in there. Eventually, you know, many years later it got converted to office space. But I digress, because I got rutted out of bed at home when the 13 thing happened.

I was, of course, very involved with the organization in the Flight Control Division that babysat the command service module. It was our system and our stuff. Of course, I'd ridden the console out in MOCR and then was back in the SPAN room. People were on to—it didn't take us very long. In fact, before I ever even got in there, there was a lot of analysis aiming at the fact that we'd had a problem in the O_2 tank, one of the cryo [cryogenic] tanks. I mean, we hadn't gotten it down to a heater malfunction at the time, but you know, it wasn't long till we pretty well understood we were in deep trouble. The recovery process—and I say "recovery"—the flight team on the ground and the guys in the air—by the way, I haven't read [Eugene F.] Kranz's book. Kranz is having a big party this week, by the way, here. Next week, couple few days. I'm not going to be able to make it back, unfortunately.

But the lunar module people and the things they did were the heroes in that scene, because getting the thing set up as a lifeboat—you know, I remember our big deal all the way back, we only had two problems: batteries and temperature. And we were really, really worried about the temperature in the command module because it got very, very cold, and worried about condensation, a serious issue, because we weren't doing a real good job with the humidity, because, you know, the whole CO_2 scrubbing thing was being done. That's the box that we put together—well, we didn't put together, the LM, some other people did.

The LM guys were the big heroes there, and we basically were trying to figure out. We had a completely non-nominal sequence getting set up for entry, when to jettison and all that. We couldn't jettison the LM until the last minute, because we had to stay over there until we could go in and run on batteries all the way in. We had to get rid of the LM, and there was a big debate about dumping the CSM first and flying a configuration we had never flown before, which was a command module only and LM. All that stuff.

So we were very, very busy on the way back. But my retrospective thought is that the LM guys were a lot busier than we were. You know, when it was all over—you know, when you're doing it, there is no sense of—I mean nobody's scared or anything; you're just doing your job. When it was over, you had a fair amount of satisfaction that you beat the machine, because we did. Us and the LM guys and all the rest of it, you know, we took a set of circumstances and used the machinery in a way it was never ever, ever, ever remotely contemplated to use. Nobody had ever thought of bringing a LM back on purpose.

And you just wonder what you'd have done if something like that had gone down on Apollo 8, or gone down on one of the landing flights when you were already on the surface. But space flight is risky business, and we just try to minimize it.

But anyway, my recollection of 13 was a tremendous amount of work by the LM people and a lot of work by the command module people for doing non-normal things and trying to understand all of the odd procedural things we were going to have to do to get ready for entry and the issue about the batteries. We were worried about the surge loads on the batteries and having to depend completely on them instead of having the fuel cells right there. Of course, you know, when you get rid of the service module, you don't have fuel cells anymore. I mean, you always enter on batteries, but the sequence was very non-nominal.

Interesting, though, we had that major hiccup and didn't take too long to figure out the culprit and hardly a blip in the flight schedule, we were back in the air and away we went. We certainly didn't kill anybody, but we were very fortunate that we didn't. Once again, you know, the attitude of, "Hey, let's get it fixed and get on with this," got it done.

You know, I don't remember, but my recollection is that we really didn't have much of a schedule delay in Apollo 14. We pretty much went when we said we were going to go, and we went feeling like we understood what went wrong and had it fixed.

RUSNAK: You mentioned, before, the SPAN room, one of the purposes of it was to bring the engineering horsepower of JSC to bear. I was curious to hear your opinion of the relationship between flight operations and then those people in Engineering and Development [Directorate of JSC] [E&D].

HUTCHINSON: Well, you know, early on I think there was a certain amount of—I don't want to call it professional jealousy. I guess I would call it "We know the vehicle better than you and you couldn't possibly diagnose things as well as we could." I'm talking about the Engineering Directorate's thought processes with regard to the control center.

But I think the leadership of E&D, and at that time it was Max [Maxime A.] Faget—I have a funny Max story. Remind me when we get to STS-1, if we ever get there. How long have we got? We're not doing too bad. I feel like I'm just babbling on here. I guess that's okay.

RUSNAK: We're all right.

HUTCHINSON: The E&D folks, I think as time went on and circumstances happened, got more and more respect for the flight operations people and the fact that they were pretty good at what they did and most of the time didn't do anything stupid. Most of the time, if we had time, we'd make sure we had engineering guys in tow in a decision to do something or turn off a fuel cell or react in some way. I know I certainly, when I got to the flight director role, I certainly had a great deal of respect going back the other way, because I'd been on a couple of consoles in the MOCR. I'd been in the SPAN room and seen the kind of data and information that you could get from them.

FOD [Flight Operations Directorate] or MOD [Mission Operations Directorate], as it's called today, I think, didn't always agree and sometimes didn't do exactly what the engineering folks wanted. But pretty much I'd say most actions and reactions by the control center, given enough time, were pretty much a consensus. We'd have Rockwell in tow—or North American or

Rockwell in the case of the Shuttle, in tow. We would have E&D in tow. And the reason is that most many times it's back to this thing about failures never being crisp. Many times the reaction to a failure in the air is very much a judgment call, and if you're the operator on the console who's going to be making the call, you'd like as many people voting on your side as you can get. And if you had the time—and of course there are lots of times when during ascent, for example, which I've done, there's no time for anybody outside that room, let alone outside the building—you'd better have figured out what you're going to do under a set of circumstances and do it now or you won't get there.

So ascent, entry, landing on the Moon, in essence what I would describe as powered flight, where bad things can happen to you if certain things go wrong, there really isn't any time for that kind of input. But, you know, 99 percent of your flying time you're in zero-G floating around in orbit somewhere or on your way to the Moon or whatever, and there's time to think things out before you do something.

I think that there may have been some—there were some personalities in the early days in the engineering organizations, a couple of them I would remember very clearly. A guy named Don [Donald D.] Arabian, who if you haven't talked to him, you ought to. Don's a piece of work. He's a great guy, one of the smartest practical engineers I've ever seen, but also a guy that operated at a very high level of intensity. And when Don decided something ought to be one way, he'd almost march out [into] the MOCR and order it done, so to speak.

Scott [H.] Simpkinson is another guy. Walt [Walter C.] Williams. A lot of those people in the early part of the program that might have come out. Walt kind of went the other way. He was kind of one of the original flight operations guys in the Mercury you'd see down at the Cape. But there were some very strong personalities that I don't think ever got to the point where they had a comfort level with the flight operations people. The flight operations people, of course, the whole science of it—and it is a science—was built around Christopher Columbus Kraft. He didn't ever take any crap off of anybody for any reason, including Max or any of Max's troops. So having

Chris kind of be the godfather of the whole process was extremely important to the integrity of the flight operations teams. I'm not suggesting that he didn't respect what was going on in E&D. He'd be the first guy to go ask them for help. But in terms of establishing his own troops as capable and competent and able to discharge the job they had, the man wouldn't take a back seat to anybody.

RUSNAK: If we could take a break here just to change out the tape and come back.

All right. We're back with Neil Hutchinson.

If we could start off now, let's talk about how you became a flight director and started that portion of your career at NASA.

HUTCHINSON: Well, you know, it's kind of like the whole deal. I think I just happened to be in the right place at the right time. I certainly didn't have any aspirations at least originally to be one, even when I was—well, I'll tell you a funny story about the flight director thing, because I didn't accept that job exactly casually. You know, there was the original three: [John D.] Hodge and Kranz and Kraft. Red, White and Blue teams. Then there were a group of guys that—you know…John Hodge was talking about leaving NASA, which, of course, [he] did, and Gene was going to be a flight director forever. Chris needed to get out of it because he had much broader responsibilities.

So long about, I don't remember exactly, but '66, in that kind of time frame, Glynn and Cliff and Milt [Milton L.] Windler, [M.] Pete Frank, who's another good friend of mine—if you haven't talked to him, is a guy you really ought to talk to because he's right here and he had a lot to do with a lot of stuff. Gerry [Gerald D.] Griffin, who I'll talk about quite a bit here in this sequence, because the way the flight directors—well, I'm getting ahead of myself.

Let me go back and talk about the selection process. So they had picked those four other guys, five other guys, and they were flying Apollos and doing quite well and so on. We at this time had—NASA wanted to build a space station, and they needed a Shuttle to get there, because they couldn't afford the Saturn V kind of cost for the lift vehicle and so on and so forth. Again, I was not

operating at the programmatic level, but [Richard M.] Nixon was President, NASA wanted very much to build both and build them together as an entity and they just could not get the administration's support to do that. They did get support for a Shuttle, and so they said, "Okay, we're going to clam together something out of the piece parts we have left over." Of course, we hadn't quit flying Apollo yet, and at that time we still had up through Apollo 20 on the books. We were flying up through 20, and this was probably around Apollo 14 or 15 at the time.

So there were some plans in the works that even though we couldn't get the administration to support a brand-new space station, we might be able to put together this thing called—at that time we called it the wet workshop.

We had another problem that was going on in the agency at the time. That was, with the lunar landings coming to an end, the Marshall Space Flight Center was in trouble with regard to its charter, because its charter was building big engines. Of course, you know the entire Saturn V stack was built, owned, and operated by them, so to speak. So the idea of having this wet workshop where we would take a piece of an old Saturn and use it as a house, a living place, because it's a pressure vessel. Initially the idea was to get it in the air and outfit it in the air, which, of course, didn't turn out to be the way we did it, thank God. But that was going on at the time.

So people were already beginning to look beyond Apollo. You know, you have to look at the time span and the intensity of what was going on between Mercury, Gemini and Apollo. You know, Kraft and, although Gene stayed on through the end, people—it's a pretty intense job. And, you know, you fly a flight, and, boy, when you're through with one, man, you know you've been somewhere. So there was a feeling that we didn't have enough flight directors and that the programs that were coming up were going to demand some more of that kind of person.

The way the Lunneys and the Charlesworths and the Franks got to where they got was some on-the-job training, so to speak. Cliff had been a flight dynamics officer. He came on the same path as Glynn. Milt Windler came out of the recovery operation, when we used to pick them up in the water, and came up. So the guys got there from different paths, but once they got there, there

was a bit of maybe riding console beside a guy like a Kranz or a Kraft, who had done it, and then a fairly steep learning curve. They wanted to do that again.

There was an issue going around the issue about the risk involved in each Apollo flight. Again, I was not involved in any of this decision process, but we certainly knew about it. Each flight was, you know—these were not stunts, but they were very close to them. This was not a "do the same thing again." Each Apollo had its own characteristics, particularly because where we were landing and we kept trying to stretch the stay time and we kept trying to stretch the science. There was a great deal of risk riding on each flight for fear if we had an accident, you know, and we'd had Apollo 12 with the lightning strike, we had Apollo 13, you know, and we'd had the accident, of course, to start the whole sequence, the pad fire. People felt that the political capital that the agency had was waning.

So at the same time they were talking about increasing the number of flight directors, this whole decision process about cutting Apollo short was floating around. And of course, it eventually became a reality. I don't remember, to be quite honest, the exact date or the timing with regard to Apollo, but it was right around the 15 time that we were named. There were four of us. It was myself, Chuck [Charles R.] Lewis, Phil [Philip C.] Shaffer and Don [Donald R.] Puddy. We were all coming out of—Phil came out of the same background as Glynn. I had been in both camps, both the hardware and the trajectory side. Don came out of lunar module. Don was a big player in the Apollo 13 lunar module thing, for example. Chuck Lewis came out of the same place [organization] Kranz came out of.

Gene Kranz, when I first went to the Cape in Mercury, Gene Kranz was an O and P. He was just getting ready. He occupied a position down there called AFD, assistant flight director. They did away with it long ago. So he didn't come out of either the systems world or the trajectory world. He came out of the procedures part, the mission rules, ops procedures, that part of flight control. That's where Chuck Lewis came from.

So the four of us got named, and they wanted to get us console time, so we each got assigned [to] a flight director of the five that were still flying. By that time Gene had sort of backed out of the scene, and Lunney and Charlesworth and so on and so forth. I drew—don't think I drew, I think it was on purpose—Gerry Griffin. So I hung around Gerry Griffin for two Apollo flights. I say "hung around," because on 16 I did virtually nothing, and it was OJT [on the job training] big time. I can't remember how we split it up. I think Chuck and Don did 16 and Phil and I did 17. I don't remember exactly. But two of us went on one of the flights and two of us went on another, in an on-the-job training capacity with one of the old whiz kids in the left seat, if you talk about airplane talk, or actually in the right seat, and us sitting off to the side of them, and then eventually getting to run their team ourselves with them being quiet and sitting beside [us].

That worked out extremely well because, number one, Gerry Griffin is—and Gerry, by the way, did the landing on Apollo 17, and I did the CSM. So we kind of split the flight team up while this LM was on the ground. We had been doing that for quite some time, and it was a real easy way to get on-the-job training. Of course, on the way out, he ran the whole thing, and I sort of was there. We went through all the training that way and so on.

That turned out to be a very effective process because you got to see the intimate part of the person that was your mentor, so to speak, in action because there's a lot of voice traffic in the control center that's not on the loop, always, between that console and the one behind it, which has Kranz and Kraft and those guys at it most of the time. At that time that's who was there. And the CapComs and the flight surgeons, that little triad of the console behind you, the CapCom to your right and flight surgeon, which at that time was just to the left and down one. Lots of off-the-airwave traffic in that environment, just the way things are done and some of the things you don't want on the voice recorder.

So you got kind of an intimate look at how the position ran and so on. Of course, all of us, all four of us had been in the MOCR many times. We were all sort of battle-tested, so to speak. So it was not like you were taking this giant leap of faith. I did very little on Apollo 16. I did a lot on

Apollo 17. I did the EVA [extravehicular activity] coming home. We had a camera system in the back of the service module that we used for getting some data off the lunar surface while the LM was down. We were constantly going around and operating this system. We had a thing called the SIM [scientific instrument module] bay, which carried a number of different instruments. There was not only a camera but I believe we had a LIDAR back there. I can't remember all the instruments that were back there.

But in any event, one of the things we had to do on the way back from the Moon was to depressurize the command module, crawl back there…and get a set of film. I keep saying "film." It was data out of a recorder, and I think it was both film and data. So I got to do that.

I did the reentry, the last one back from the Moon. Of course, at the time, you know, we didn't really get a sense of how final that was. We were still in the thought mode of "We're going to come up with something new and something different and there's going to be new flights and new things going on. Yeah, 18, 19 and 20 are kind of mothballed for now, but, you know, we may." I wasn't sure that we wouldn't fly one of them. We still just couldn't imagine powering down this incredible machine that had been put together.

But then Skylab was beginning to take shape, and, of course, that's where we all of us headed, Don and I and Chuck and Phil. Phil did the launches on Skylab. Then the four of us plus Milt, one of the guys from Apollo, stayed on and we did that killer deal, which was a killer for the control center.

Anyway, Apollo 17 was a great deal of fun. I'm still good friends with Gene Cernan, of course, Jack [Harrison H.] Schmitt. Ron's [Ronald E. Evans] gone now. But a great bunch of guys, had a good time. Had a great flight. Just hard to believe it was the last time we were going to do that and we still haven't been back.

RUSNAK: During your flight is when Nixon said "Great job, but we probably won't be back to the Moon before the end of the century," or whatever it was.

HUTCHINSON: Yes, among other things. Richard Nixon, not one of my favorite people, based on his lack of—he was a person who got to reap all the benefits of the manned space program and never really supported it in his heart of hearts. I mean, leave all the Watergate stuff out and all that other stuff, he was, in my personal opinion, not a friend of us, of the space program. You know, we sort of survived in spite of him, and he did get a lot of accolades, of course, because of the events that happened on his watch that he really didn't have anything to do with and was not a supporter of in particular.

RUSNAK: You mentioned that NASA at this time was looking forward to Apollo or Apollo Applications [Program, AAP], which was Skylab.

HUTCHINSON: AAP, right. I haven't heard it called that in a while.

RUSNAK: You mentioned it being difficult for mission control because now you've got a vehicle that is going to be up for long durations of time. How did you prepare for these types of missions?

HUTCHINSON: You know, a number of things went on that carried over from Apollo that, in my mind, in retrospect, and even as we got on through the Skylab flights, presented a lot of difficulty. One, for example, was the fact that in Apollo we developed the ability to plan flights to the absolute microsecond, knew where every crewman was every instant in time, everything he did. And we did that on purpose because the flights were very finite and very short and there was a great deal of pressure to get an awful lot done. We packed them so full that it was humanly impossible to recover without the assistance of somebody who could integrate the whole process, if you fouled something up or got late or whatever.

So we got in the habit of, at the control center we had a position called the flight activities officer, who spent his whole time crew timelining and so on and so on and so on. Of course all the rest of the people in the control center, the things that went on revolved around the flight plan. So we came out of Apollo with that kind of mind-set and we went into Skylab that way. Skylab, of course, was a situation where we had more time because they were on orbit a lot, you know, long lengths of time. We continued to do that planning process both before the flights and then when the flights were going on.

Of course, in the Skylab case ofttimes things didn't go the way you needed them to go, so there was a fair amount of replanning, but the replanning was all restricted to the control center. I'll talk some more about that as we go through the Skylab sequence, because it eventually presented some pretty serious problems to the ground and the crew and the interface between us and so on and so forth.

You mentioned the training. Skylab also brought to bear the start of a change of philosophy in the way people who had serious scientific intentions and plans interacted with the manned program. In Apollo, we tried to plan the science in advance. When we were out on the surface, yes, there were geologists who were saying, "Go get that rock," and, "Go get this rock," and whatever. But on balance, the amount of experimentation and the framing, the scientific—and leave biomed out of it, because that was always an issue back then. I mean, there were circumstances where that particular field of endeavor had a lot of experimentation and so on going on with it. Like we didn't figure out the bone-loss thing for a long time and so on and so on and so on during the Apollo manned space flights.

But leaving that aside, there had not been in my thought process a tremendous real-time interaction involvement of the outside science community with the crew being essentially an extension of the scientists. Jack would probably shoot me if he heard me say this, because he's a geologist and we sent him to the Moon because he's a geologist and we wanted to get a geologist on the Moon. In other words, we were trying to put the scientist in the circumstance where he could

use his judgment appropriately, and he did. In Skylab, of course, that was a very overt decision. Each one of the three crews had a scientist on board. It happened to be Joe [Joseph P. Kerwin], who had an M.D. on SL-2[a], but Owen [K. Garriott] and Ed [Edward G.] Gibson were bona fide card-carrying scientists in their own right. So that was one thing that was changing as we were going from Apollo to Skylab, was trying to introduce the concept that you don't have to have everybody be a fighter pilot to go do it [be an astronaut].

Another concept that was changing was trying to involve the outside science community in the planning process while the flights were going on. Skylab had a lot of different things. You know, it had a big package of instruments that looked at the Earth. It had a package of instruments that looked at the sun. It had a package of stuff that was inside that involved human factors. We flew the MMU [manned maneuvering unit] around inside there. It had an enormous complement of medical experiments like the LBNP [lower body negative pressure], which was one of our favorites, where you got in and took the body down to vacuum until you passed out—not really. But trying to understand the blood pooling, or lack thereof, issue between zero-G and 1-G and so on.

So the complexion of what went on in the control center, there were, in essence, a whole new set of players who got a lot of votes. It used to be, you sit in the control center, you're flight director in Apollo, and the guys that did surface ops had some of this, I admit, in Apollo, but in general, you know, you're a flight director in Apollo, you're on your way to the Moon, you're going around the Earth, you're doing a rendezvous or something, it's pretty much a spacecraft contained thing. You've got the fighter pilots up there. You've got all the guys in the control center and it's kind of a little club. It's all engineering and spacecraft systems and trajectories and that kind of stuff.

Skylab changed that whole scene and, of course, that was carried over into Shuttle. Hopefully, it will be carried over in a different way but big time in the Station as it finally gets going

[a] Editor's note: on Skylab, Arabic numerals (SL-1, 2, 3, and 4) designate mission by launch order, starting with the launch of the unmanned workshop as SL-1. Roman numerals (Skylab I, II, and III) indicate the manned flights to Skylab in launch order. Therefore, SL-2 is also Skylab I. The transcript follows this nomenclature.

here. But Skylab introduced the scientists and all of their friends as card-carrying members of the fighter pilots society.

That process and the fact that we didn't simulate—well, let me back up. You know, by the time we'd gotten to this point, we had simulators that we trained the fighter pilots in that were really good. They had telemetry streams that looked just like the real vehicle. As I said one time earlier, you sit in the control center in simulation, you couldn't tell you weren't flying.

Now, when you introduced all the scientific stuff, there's a whole new set of instrumentation that you probably can't afford to build a real sophisticated—I mean you build a simulator that simulates the sun and what one of those solar corona instrument is going to see when it looks at the sun and send that telemetry to control center so somebody can look at it. So the whole training process took on a different—you introduced all these new people.

The fidelity of the simulations for the systems that they were interested in for science were not as good. Most scientists have a hard time with real time. I don't know how to say that. That's probably not well said. They want to think about things. You think that spacecraft problems are shades of gray? Man, talk to somebody who's looking at the sun and what's he seeing and does he really want to move and point the thing somewhere else and so on and so forth.

So the nice, crisp, "yes sir, no sir, turn it on, turn it off," rigid, disciplined flight operations mentality had to take a real side step when we got to Skylab, to accommodate this new cadre of people who were going to have an input that you'd better listen to, because if you're a flight director, they're your customer.

I don't think we were as well trained for Skylab as we were—and there's one other thing. The workshop changed its complexion a number of times during the training cycle. It went from a wet workshop to a dry workshop. Various systems inside got changed. For the very first time in the history of manned space flight, Johnson was not in charge. Big deal. When I can go over to Max or to Chris or to somebody and say, "I'm not getting trained right because we haven't put enough money into the simulator,"—and I'm making all that up—and since Chris owns the simulator, he

owns the crews, he owns the control center, he owns the spacecraft, he owns the simulator, he can—and I'm using "him" metaphorically here—he can make things happen. Try that when the owner is not in town.

So I don't think, although we developed a wonderful relationship with Marshall over time, it was not as thoroughly connected. We were operating, I suppose—I don't know what the budgets were for the ground systems at that time, with a little less money. We had a hard time keeping the simulations integrity up with the changes that were going on in Huntsville with the actual vehicle.

So I don't think my own sense of the training cycle [really got us] trained. The biggest thing we did was learn how to do—we had these long-duration sims, where we'd stretch them out over days. So guys had to run the control center and go home and sleep and come back and so on. We had a few of those getting ready because, of course, we knew we were going to have a big deal when we got to flight in terms of lengths of the flights. The first flight, of course, was two weeks. Supposed to be. Well, it was but we had a lot of trouble before we got to the manned part.

So the nature of Skylab and the training that went with it was a lot different than Apollo and the flights that had gone before. The players were different. New constituencies. And all this time, MOD, or FOD, as it was it was called then, was trying to adapt to maybe moving a little bit away from the fighter-pilot mentality and little bit closer to the science and the research and the real stuff that was supposed to go on there and did go on there.

Anyway, we got to Skylab 1 and then we had a disaster, another one of our beating-the-machine days. The unmanned launch did not go well. Don Puddy was the flight director on the unmanned launch. You know, all hell broke loose, literally. We fouled the vehicle up going uphill and we got a pressure problem across the micrometeorite shield that was around the workshop and it came loose and then it jammed one of the solar panels, and we got up there and things were not good. That was another Apollo 13 kind of time in the control center. Although there were no lives at stake, there was a program at stake and three subsequent flights, and we were in a condition where basically the mission was a failure.

Once again, all those resourceful people in engineering and people from Marshall and so on and so forth figured out a number of things. You know, that was a couple of weeks we were—we delayed the—we, of course, had to replan the whole manned mission, because we had to fix the workshop or we weren't going to do anything. In fact, P.J. [Paul J. Weitz] and Joe Kerwin spent—well, I don't recall, at least half the flight to fix the stuff, trying to get us back into a state of where we could live and work in the place. I had the fortune of doing the activation the first time. I did them all, in fact, all three of them.

You know, there were a lot of things. It was very, very hot in there, even though, you know, we tried like hell from an attitude-control standpoint and so on to get—we, of course, had some EVAs to do because we had one of the wings trapped that was trapped by the debris from the meteorite shield. Eventually all that worked out. Skylab 2, the first manned flight, we had the square wave in the unmanned thing and then, of course, we had to do a lot of replanning. A lot of the replanning had to do with manifesting equipment that wasn't even invented when we lifted the first one off, like the parasol and the big cutters to cut wires and EVAs and all kinds of things like that.

Of course, we had to develop and train some of the parachute guys at JSC from Apollo, guys like Jack [A.] Kinzler and Kirby [James K.] Hinson. I can't remember all those guys' names. A guy named Caldwell [C.] Johnson, who was one of Max Faget's whiz kids, marvelous guy, came up with this parasol trick. Then, of course, the flight operations guys [and crew] had to understand what we were going to do and how we were going to deploy and when and so on and so on and so on.

So that two weeks was really kind of a scramble, and then we got into flight. We basically didn't fly anything we trained for until we were almost ready to come home, because every day was improvise this and improvise that and are we going to get that done. That crew, Pete [Conrad], all three of those guys, they just had an attitude about them that they were going to get this done no matter what.

When they went in the workshop, I don't remember what the temperature was, but it was 100 degrees or something like that, I mean, to where you couldn't touch the side of the vehicle, you'd burn your hand, almost. We eventually got in there and got the systems turned on appropriately and we got that parasol out, and we eventually got the solar panel, the one that didn't get ripped off, mostly deployed. So we flew with a one-wing deal, and it went on from there. But Apollo 13 and that flight were the two beat-the-machine deals in my career.

Back to the flight planning part of Skylab. We have to watch my time here. I've got about twenty minutes. I probably won't get to Shuttle, which was kind of the pinnacle of my career. That doesn't seem right here.

RUSNAK: We'll get as far as we can today.

HUTCHINSON: Well, there's some important things about Skylab. Skylab, the flight planning process that I mentioned earlier that went on, we came with an attitude derived from Apollo, that the best idea was to optimize what we could get done at a given time. With all of these new customers of the flight operations team, and I include both the control center and the crew in that category, we all felt a certain amount of pressure to deliver a lot of results. There was kind of a thought process in the community that, you know, these guys are fighter pilots and manned spacecraft guys and they want to fly the big rockets and go around and they're probably not going to do a very good job on the science. And that doesn't mean that they weren't anxious to fly, "they," the science community, and they didn't have good experiments and so on and so on. But I really think in their heart of hearts they felt like we probably couldn't turn it out.

Then the crap happened going uphill on Skylab 1 and it was, "See." It was sort of "I told you so." We were doing fighter-pilot stuff the first two weeks we were up there, you know, fixing things, going EVA, trying to get the darn thing habitable, and not accomplishing anything. They

had here this multi-hundred-million-dollar Apollo Telescope Mount [ATM] for looking up and all this Earth research, and we weren't touching any of it.

So when it finally got to where we thought we could begin to accomplish some science, we didn't get a heck of a lot done on Skylab [2] because of Skylab [1]. But when SL-3 came along, the second flight came along, depends on how you count them, the second manned flight, there was a feeling among us that, "By golly, those guys are going to change their tune," and we were going to get all we could squeeze out of this thing.

We had a crew is Skylab II, [Alan L.] Bean and Garriott, Alan Bean and Owen Garriott, in particular, who—let's see. Jack [R.] Lousma was the third guy in that crew. They shared, I think, everybody's frustration that the program had gotten off to not a very good start. The intentions of all of the science that wanted to be accomplished was not—there wasn't a lot done on the first flight because we had to work on other things. They [the crew] were as determined as we were that, by God, we were going to catch up. Part of that catching-up process involved the control center using the kind of planning capability that it inherited from Apollo and literally planning every time you laid a spoon down or turned around or went to the bathroom or moved from one point to another point or had to get something out of stowage or whatever.

We got into a pattern in Skylab II, and the crew with this attitude that, "I'm going to make up for all the lost time," and whatever, those guys got in the habit of responsiveness that I don't think has ever been seen before or since. They allowed us to optimize to the spoon pickup. And we did. And we got to where we could do conflict—because certain experiments, you know, like you don't want a guy running around the rim of the workshop when somebody's on the ATM trying to take pictures of the sun because you want the vehicle quiet. I mean, I'm making that up. Well, that actually was a constraint. There were all constraints there, all kinds of scheduling, and we got so good at that we had a position called the FAO, flight activities officer, still had one even in the Shuttle days. They probably have one on Station, too, although they are doing Station completely different, thank heaven.

But we got to the point where we could just absolutely control those people. It was like they were robots. And you know, once in a while they wouldn't get something done and they'd just say, "Okay, let's put this down. What's the next thing we've got to do? And scheduling time down to the nearest minute or two minutes or five minutes from the time they got up in the morning until the time they went to bed at night, every day, day in and day out, week in and week out, month in and month out. We were up there sixty days, plus. Sixty days, I think, with the SL[-3] crew. And we indeed turned out—we, they—the system turned out enormous amounts of science data.

Of course, we had a card-carrying scientist on board in the form of Owen, which helped the relationships with the scientists on the ground. Flight team was getting used to this new set of customers and trying to make sure they got their just due and so on and so forth. And I believe they did.

Then we got to Skylab III and we expected—and another element in this phenomenon, it is that it takes people—first off we had, except for Jack, except for the first crew, we had no experience with big volumes. There is, and it's a widely recognized circumstance these days, that there is a certain amount of zero-G adoption time where people's learning curve even if they've been there before, particularly when they're in larger volumes, is very, very high. The repetitive tasks, they can improve them 100, 200, 300 percent after they've done them a few times in zero-G. Again, this sensitivity to the amount of volume in having to move from Point A to Point B and do you have to crawl along or can you just push off one bulkhead and you'll end up at the other place. So there's a lot of that kind of learning.

The II crew, the second crew, we didn't really have a chance to turn the gain up from a scheduling and flight activities standpoint on the first crew. The second crew, we were just really learning how to do it so they had a chance to kind of get their zero-G feet on the ground, so to speak, and get going. They kind of came up to speed with us as we learned to tune the flight planning activities and get them tighter and tighter and schedule them harder and harder and more and more stuff. They were coming up to curve with us.

We got the third flight, "we," the ground. If you've read any material on this, you know that I was right in the middle of this, on the wrong side of it, clearly a mistake on my part and on the control center's part. We expected those three guys to pick right up where the [Skylab] II guys left off. We did not give them one ounce of zero-G to get used to it, do the task a few times, and then we'll schedule it tighter and so on and so forth. They got up there and Bill [William R. Pogue] wasn't feeling very good, which is another thing we've now come to accept as well, yes, so it happens, so what. But, you know, it was still kind of spooky then, guys getting sick and you know, not the fighter-pilot image. Oh, what are we going to do?

So the control center starts off, you know, and the guys get up there. I went through the activation. They did a terrific job. We got in there. And the third day here comes the flight plan up, and it's the day after the last flight plan we didn't get done when the other flight crew came down, you know. Of course, at first, and we practiced with them some and so on and so forth. Well, we simulated—well, between the unmanned missions I trained with the upcoming crew, because we were unmanned for a while between each one of these numbers. You know, that was a serious mistake on the part of the control center, because we just expected Bill and Frank—or, Gerry [Gerald P. Carr] and that whole crowd to just jump right on the bandwagon and take off.

On their side of this equation, there was not enough communication early on that we were getting them in trouble. They were pretty quiet about it. Again, it's the fighter-pilot mentality, you know. "I'll be damned if I'm going to cry 'uncle.' I'm going to just keep trying to get this. If they keep sending me flight plans I can't get done, I'm going to try again."

Of course, what happened then was as we continued to press them, was mistakes begin to be made, more than we had seen with the other crews. And then you began to say, "Hmm. What's going on here?" I think it might even have been a year or two later when I sat back and looked at that whole thing and said, you know, jeez, we really did something stupid. Because between the two of us, you know, they didn't cry "uncle" soon enough. They had an absolutely valid reason for crying "uncle," because the control center had screwed up, and we just kept screwing up until we

got them all fouled up. You know, we ended up with Deke [Donald K. Slayton] on the radio talking to them and—ah, jeez, it was the worst.

In the end, of course, they turned out to be every bit as good as the other guys. You know, they turned out the stuff. Man, you wouldn't have believed the—they were up there three months, ended ninety days.

It's funny, one of those guys, even before he was, but since, Ed Gibson is a very good friend of mine. He and I have chatted about this off and on. He's another guy you ought to interview if you haven't done it. Very smart man, knows a lot about what went on there. But it was clearly a case of the control center not recognizing that people needed some zero-G adjustment time before they could really be productive, and there's just no point in pushing them early on, because they weren't going to get the job done. We don't do that these days on the Shuttle. We let them get organized really before they—and really, Spacelab and Space Hab, they do have some extra volume, but nothing as big as the workshop.

We'll be back in that in Station. And, of course, the thing we're doing in Station is that they are going to do their own flight plan in the air, let them optimize their stuff. I mean, I don't know exactly how they're doing it, but I know that there's not going to be this work every single minute of their time with a plan from the ground and send it up. They're going to be doing their own optimization. I'm sure it will work out much, much better, because they all have the right intentions in mind and they can be much, much, much better judges about how fast they can go. As long as the big conflict resolution can get orchestrated within that framework, crews are much better at knowing what to do and what not to do and when to do it and when not to do it and so on and so forth.

RUSNAK: At least they can learn from your experience on Skylab.

HUTCHINSON: Well, I think everybody did. You know, we all came back and when we got through the debriefing process, it became pretty obvious that the control center had gotten—and you know the press and everybody played it up. There's been a couple of books written that there was a strike in space or some—as a matter of fact, I'll tell you a funny story. There is a Harvard Business School case. Do you know about Harvard Business School? They do these cases. And if you get an MBA at Stanford or somewhere, you're likely to get the Harvard Business School case about Skylab III. They talk about people's expectations and miscommunication and all that part of a management [scheme]. I don't know if it's a good example or not, but, you know, I just look on it as something that we just weren't thinking straight. We should have seen it, and it was very insidious, because the mistakes were little at first. Then every once in a while you kind of caught in somebody's tone of voice that he was irritated, you know. It's not a good scene, but, yes, good lesson learned.

RUSNAK: It seems like what you were saying before about how you're monitoring spacecraft systems and there's a lot of gray areas, it's not complete failures, it's little things here and there that slow down rather than utterly breaking.

HUTCHINSON: Absolutely. Yes, that's another characteristic of being in that business. And then you put a human in that sequence up there and you introduce another variable that is not exactly clear when something doesn't go right. Was it the machine? Was it the man? Did we do it at the wrong time? You know, makes it even harder.

RUSNAK: Well, we're kind of running low on time today, so I want to give you the chance if there's any concluding remarks.

HUTCHINSON: Okay, well, I don't know. I hope I get a chance to do the rest of this sometime. We haven't said anything about Apollo-Soyuz, didn't say anything about Shuttle, didn't say anything about Space Station, which is a big deal these days since we're about to finally get it in the air seventeen years after we started, which is a sad comment in itself.

In my current reincarnation in life, I'm involved in both the manned and the unmanned side of NASA, among other things, as a contractor, as a leader of a group of people that support the Johnson Space Center and Goddard and other places. So I still have my hand in the business, so to speak, just from a very, very different vantage point.

RUSNAK: Hopefully, next time we can sit down and talk about this.

HUTCHINSON: Yes, we got a nice clean break here. Although there's lots and lots and lots of war stories about having to do with the way the teams worked, the control center activity, how many days on and how many days off you had. Apollo, any flight that had been flown up to that time, you could suck it up. You know, it was like training for a prize fight. You train for the fight. It was like the early Shuttle flights. You know, you train and train and train, then the fight happens, i.e., the mission goes, you work your tail off, you are in there every day, and then the mission's over. And Skylab never got over.

And you know Chuck Lewis got very ill. I myself flew the last flight with a kidney problem that I ended up with a very serious surgery. It's not serious anymore, but in those days it was. It really, really took it out of people, because you never got loose from it.

And we did all kinds of crazy stuff. We had our families in the control center for affairs, to try and change the pace of things. I had a big dinner. Maybe all the flight directors did. We had a big sit-down catered dinner in the control center [with the spacecraft] in the air. It was during one of the unmanned—when the crews weren't up there. But, you know, they were just trying to keep people's focus and attention. We had guys drop out of teams. We had to change players.

I'm trying to think. I think—and I'm not sure—if you guys haven't talked to him, you ought to. Have you talked to Chuck Lewis? He's a local guy, the flight director who was very much in the middle of that. You know, Chuck got very ill toward the end and was unable to finish with the flight. I believe Milt or somebody got called in to take Chuck's last—but it was very, very—it was very hard on the ground people and presented a whole different set of problems to the way we'd done manned space flight before, and so will this one [space station] coming up. Hopefully they got some lessons learned there on that, too, because, you know, they're into a ten-year, twelve-year, fifteen-year deal and they're going to need to learn how to do that on the road.

RUSNAK: Thank you.

[End of interview]