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NEIL B. HUTCHINSON
INTERVIEWED BY KEVIN M. RUSNAK
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RUSNAK: Today is July 28, 2000. This interview with Neil Hutchinson is being conducted in 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 again today.

HUTCHINSON: You're welcome. Nice to be here again. Except it's hot.

RUSNAK: Yes, it is. Well, last time we left with Skylab, so I thought maybe we could pick up with Apollo-Soyuz Test Project [ASTP] today and since we have just, as you mentioned, celebrated the twenty-fifth anniversary of it, it's a timely subject, certainly. So why don't you start with what your first recollections of the idea of having something like this was.

HUTCHINSON: Well, we were coming off of Skylab, of course, and, frankly, the flight director folks and most of the flight teams were really worn out. Skylab, of course, was a seven-by-twenty-four operation that went on for a year roughly by the time all the training and the [unmanned portion]. Then, of course, once we got the vehicle in the air, when the crews left, the flight control team can't rest. We basically had to keep right on going.

Toward the end, of course, the unmanned parts of Skylab were tough, because we were continually dealing with what I would call mission-threatening issues. We were losing the attitude control system slowly but surely. These big control moment gyros [CMG], they have bearings in them that were not behaving well. We were low on—the way a CMG works—I can't remember,

were we real technical? We weren't very technical in this interview, were we? But, anyway, it doesn't matter. We had a thing called the TACS [Thruster Attitude Control System], which was basically a cold-gas attitude system, full of nitrogen. It had little jets on it, and you use energy in the gyro to control the attitude of the ship. Then sooner or later the gyro gets to a place where it can't exchange any energy, so you have [to] dump the energy out of the gyro. When you do that, it fires little jets. We were running out of the fuel that was in those tanks, just used it all up, not an anomaly. So the unmanned parts of Skylab were rigorous, maybe not quite as intense as when the crew was there, but everybody was tired. We all kind of went, "Whew," you know.

While Skylab was going on, Apollo-Soyuz was being discussed at the political level. I certainly wasn't involved in that, but Glynn [S.] Lunney, who, of course, later went on to a lot of other great things, who was a former flight director, was the PM [project manager] on Apollo-Soyuz on the U.S. side. There's kind of a club of guys that ran the Control Center and a lot of respect for the people who went there before. Glynn was getting himself involved in Apollo-Soyuz. At first, the idea seemed to me to be a little bit of a stunt. We'd done lots of rendezvous. We knew how to dock two things in space. We felt like our system of flight control on the ground in the big control center, we were kind on top of the world at the time. We'd significantly—I didn't ever get caught up much in the beating-the-Russians thing, but we had very clearly surpassed them in our technology push. We'd gone to the Moon and landed. They hadn't even been there.

There was a feeling, I think, among the—well, I had this feeling that we were sort of giving away the company store a little bit. It's not a cocky thing. In our heart of hearts, I think we all felt that we were way ahead of them, particularly in the way the Control Center and the vehicles interacted and the way we took care of anomalies and so on and so forth. As we began to dig into how to run a joint mission like that, it became pretty obvious we were correct.

Their hardware was very, very good, but very—I'm not going to call it crude, but not as advanced as the U.S.'s hardware, by a lot. The most visible part of that was their lack of computing horsepower. On the ground, in the spacecraft, as an engineering design device, tools, like

computational fluid dynamics, of course they had tools, but the thing that struck me as we were just getting started is, I was flabbergasted how far behind the U.S. they were in the computational sciences world, in every aspect, in programming, in the machinery, in how fast it was, in what you could do with it, and how they'd utilized it. Of course, control centers and spacecraft in the United States don't run without a tremendous amount of computing power.

My first involvement was when we were trying to decide who's going to suck it up and go do this again, because, like I said, we were coming off of Skylab. We all felt like it was—at least I felt; I shouldn't encompass all my friends in it—but it was a little like a lark. It was going to be easy. We were the king. Yes, we were going to let these guys come in and hook up with us, but—and, of course, some of the powers-that-be had a much broader agenda. We were right in the middle of the Cold War then, still, and Vietnam was over. Gosh, we were struggling with other political things on the other side of the world, and it just seemed like—I must admit the space program, we went through all the sixties with everything going on in Vietnam, and, as I said earlier in this interview, I never paid any attention to it and neither did anybody else. We were so busy trying to get—and this just seemed like another thing—to me, it was not we were doing something great to undo the Cold War or anything like that, it was just another space mission.

The one thing that I felt at the time really had merit was that two programs that had grown up completely separate, with separate hardware and separate people and separate techniques, and I mean grown up, the Russians were running a very mature manned space program, albeit with hardware that they had [first] put together in the early sixties. They were still flying—I mean, the Soyuz had been launched, my goodness. Do you realize here we are in the year 2000, they are still using that exact same vehicle? Manned and unmanned. It's like as if we were still flying Saturn Vs over and over and over and over again. And that's not a bad thing. It's something they're able to do from an economic standpoint. Their gear is simple but robust, and they've flown it and flown it and flown it and flown it. Boy, they know how it works and they know what they can do with it.

Well, just look, they just launched this huge piece of the Space Station with that same vehicle. Well, actually it was on a Proton, not on a Soyuz, but the Proton was flying back in the sixties, too.

In any event, I never felt any of the "We're doing something great for the country," or "We're going to help the Cold War," or anything that. To me it was an engineering process that had in its fascination the fact that you could take two very disparate programs and build interfaces between them. Of course, we had to build a docking module that would allow the two vehicles to go together, which we did, the U.S. did, and pull that off.

So I got involved in it along with several other folks. I guess the biggest really new thing, there was not a lot of—for example, we had done lots and lots and lots of dockings in Apollo, in Skylab, where we took a command module [CM] and stuck it on something, the lunar module [LM] in the case of Apollo, and, of course, we did that half a dozen times around the Moon and once around the Earth, and we'd been docking things all the way back from Gemini…

So that wasn't anything new to us, but what was really new, and it was absolutely fascinating to me, was trying to integrate the control centers. The language barrier was a substantial issue. The crew—Vance [D. Brand] and Deke [Donald K. Slayton] and Tom [Thomas P.] Stafford—worked hard at learning Russian and learned enough to be capable of technical exchanges and conversational interface and so on and so forth. But the flight teams did not, nor did the flight directors. The way we got around that was translators. We set up this scheme between ourselves and the control center in Moscow, and it's interesting, Viktor Blagov, who is now kind of like the Chris [Christopher C.] Kraft [Jr.] of the Russian program even now still today, was the flight director who was my counterpart on the Russian side. The way we did that each flight director was assigned a translator. And the translators came to us [from]—most of them were freelancers who actually worked for the State Department but on a contract. They had a personal contract with the State Department.

[M. P.] Pete Frank was the lead flight director, to my recollection, on Apollo-Soyuz, and myself and Don [Donald R. Puddy], Chuck [Charles R. "Skinny" Lewis]—trying to think if Phil

[Philip C.] Shaffer was involved. I'm sure he was. So there were three or four of us in the middle of this, all with our teams, a little bit different construct of the teams than we'd had in Skylab. We kind of took the teams apart and re-put them together. You might get a couple of positions the same, but it was kind of a new flight control team.

The flight directors, we all had one of these translators. Glynn Lunney had a translator, as the program manager, who followed him around. These ladies, and they were virtually all women, I believe, were capable of the most extraordinary—they could sit in a room like this, and if you and I were having a very technical two-way conversation, in real time they can listen to me talk in English, and suppose you were the Russian person, and they can translate my English into Russian as I'm saying it, so that the Russian on the other end of the line hears my conversation in Russian.

The way we did that was, they were in the Control Center. I had her plugged in right beside me [at the console] and the Russians had a similar person in their Control Center. So I would talk to Viktor in English. He had a translator on his end who could turn my English into Russian. That was the basic plan in the beginning. I would say something in English and my translator wouldn't say anything, and his translator would turn my English into Russian. Then he would say something to me in Russian, and Natasha would say it to me in English.

We worked that way for a while until it became very obvious that the U.S. translators were so much better than the Russian translators. I'm talking an order of magnitude better. Eventually the Russians got so comfortable with the U.S. translators, that our translators went both ways. The guy over there in Russia basically, they certainly didn't get rid of him, but he was in monitor mode. So he would talk to me in Russian, and she'd tell me what he said, and I'd talk back to him in English and she'd send the Russian equivalent over to him, and that's how we communicated.

We ran some really, really interesting simulations. The first few were pretty crude, really, no problems, just trying to understand how we could get the two places talking together. I never went to Russia. Pete Frank did, the lead flight director, I believe, but myself and the rest of the troops and our guys down in the trenches in the Control Center, the Trench and the other places in

the Control Center, there certainly was some exchange, particularly in the environmental control area and in the attitude control area in terms of systems and who was controlling when the vehicles were docked and so on and so forth. But by and large, they were flying a flight, and the fact they were hooked onto a Russian vehicle was kind of—and we had some ICDs, some interface control documents and so on, that helped the interface between the docking module and the Russian vehicle that established that interface and then and so on.

But by and large, I think folks would tell you, that were actually down a level from me in the scheme of things in the flight operation, that they didn't know they weren't talking to a LM. I'm exaggerating a little bit. It wasn't that big a deal. But for the flight directors and on up, it was, because we were constantly worried about nuances in the language. I'm probably not going to think of a good example, but we would measure something in pounds per square inch [psi] and they'd measure it in newton-meters—newton-meters is an acceleration term; I mixed those up. But we were worried about, you know, when somebody said something technical, like, "We've got the hatch [pressurized]," our side of the hatch at 13 psi, we really understood what they meant, and vice versa.

These ladies, I just had the greatest admiration for them. I'm going to tell you a funny story about one of them in a minute, not a funny story, but a story about something she did later. First off, they knew nothing about space flight when we started. Nothing. They were technical translators, most of them, by the way, educated in the former Soviet [Union]—not educated in the United States. These folks, their native languages, in most cases, were Russian or some variant thereof. They came with us about full-time. We first saw them about six months before flight, and about three months before flight, they were with us full-time. I mean, they were our shadow. Everywhere we went, they were at your elbow and, of course, never in the Control Center without them. Their ability to do this technical, highly technical transposition of a language in real time in a set of terminology, and you know how we are with acronyms and the Russians are, too. I mean they use acronyms just like we do. And the acronym-itis that NASA has, that we have, couple that with the

fact that all this goes on in real time, and the fact that you've got a bunch of lives at stake, with two separate crews.

You're putting these two things together, and you're cross-pressurizing them. We had trouble with the docking probe and couldn't get it out or get it in—I can't remember which. I do remember that we had a lot of trouble, because, in fact, I think that happened on one of my shifts. It may have started on somebody's, or we finished it or started it or something, because I remember having a docking probe in the Control Center on a table being field-stripped, taking it apart like you'd take a gun apart or something, trying to figure what—I don't know. We had one of those fairly complicated mechanisms on the drogue part. I don't even remember the exact anomaly, but I do remember we had a very serious problem. It almost fouled the flight up. We got around it eventually.

In any event, I would say that the translators were the most fascinating part of the entire [mission]—not that doing the flight wasn't really great, and, yes, we pulled it off and the docked time was neat. I got to do the pressurization of the two things and so on, the two vehicles.

There was another neat thing about that flight. Deke Slayton was a crewman on that flight, and Deke had had an issue, a very, very minor heart issue for many, many, many years. Of course, he was one of the original seven guys and an absolutely super troop, not with us any longer. Everybody was really keen that Deke got to fly. It's kind of like when Alan [B.] Shepard [Jr.] got his ear fixed. There were guys that really paid their dues over and over and over and finally got in the air. Alan, of course, flew on [Apollo] 14, and Deke got on Apollo-Soyuz. So that was another aspect of the flight that everybody was cheering about, and I thought it was pretty slick.

Compared to Skylab, it was just a cakewalk. I mean, there were some anomalies. It was nothing like that horrible thing we had to deal with when the micrometeorite shield came off in Skylab and we had to go in there and it was 100-plus degrees and all that kind of stuff. There was no really big trauma like that, and it was over before you could blink an eye. We got a lot of accolades for it because it was such a contrast politically to what was going on in the world at the

time. "Yes, look at these space guys. They can just ignore all this political riprap and go do something like this and pull it off."

At that time, people weren't too worried about the tech transfer. That reminds me of one other thing. The Russians visited here much more than we visited there, in terms of the flight teams. With all the hoopla today about being careful about what kind of tech transfer we can do and don't do and what computers we carry out of the country and so on and so forth, I don't even know if the rules of the U.S. Government would allow to happen what happened then. Although you look at Space Station and, my goodness, there's a lot of data flowing back and forth between the two countries and the two programs, so maybe I misspoke there.

But I always thought—I don't know this for a fact, so this is not a fact for the tape—but I always thought that they didn't have much of a Control Center when we started Apollo-Soyuz. They came over here and looked at what we had and got to sit [at] the consoles and got to get on the headsets and look at the ten-by-twenty. As an example, all of a sudden—and we didn't see much of their control facilities in the beginning of Apollo-Soyuz, and when we were getting ready in the '73, '74 kind of time frame.

In my heart of hearts, I always thought they were just scrambling to try and put something together that they knew was going to be publicly somewhat visible when we finally flew, that looked like the U.S. Control Center. But it never really did a lot of the stuff ours did. It didn't have all the really neat com [communications]. They did have a rear projection computer thing, but I always thought it might have been some kind of a hokey deal like we used to have down in the Mercury Control Center in the Cape. So that didn't bother me, because eventually we sort of became friends with them, and said, well, we're all sort of doing the same thing and we ought to learn from each other. But I've always thought that the Russians improved their flight operation capability, and particularly the ground segment, tremendously by their involvement in Apollo-Soyuz.

I think they copied our techniques. I think they looked at the way we did procedures. I think they looked at the air-ground interface where crews had instant access to lots and lots of help and lots of data. For an example, I think the Russians would have had a very, very difficult time with something like Apollo 13. If they would have had a crew that was up there and away from contact from the ground and a long ways away from home and had a very, very difficult anomaly—and I don't mean that derogatorily—I think they were using the—and, again, a lot of it has to do with the computing horsepower they had in the Control Center, how much data they were collecting on their spacecraft in terms of telemetered information and so on and so forth. And I don't know that for a fact in any way, shape, or form. It's just a gut feel I have based on their reactions and the interfaces that we had with them during that time.

The story I wanted to tell you about one of the translators. Shortly after we pulled off of Apollo-Soyuz, one of those ladies— and was it, gosh, I'm not going to remember names. Son of a gun. Well, I guess the name is not as important as the event. Translated real time open-heart surgery between Moscow and [Dr. Michael] DeBakey's place down in downtown Houston. Can you imagine that? And this is woman who is not an M.D., who doesn't know that technical lingo either, and translated a person giving directions on an operation to a person with a knife in his hand on the other end of the line. Pretty damn amazing, those women.

By the way, one of the interesting things is that they could burn out. You could, toward the end of a long day, that business of taking in something in one language and spitting it out in another, just intense, mental. I just marveled at them.

RUSNAK: They sound like quite an amazing group of women there.

HUTCHINSON: It was, and when the flight was over, they just kind of went back to their State Department anonymous lives and I have never seen an exchange from any of them or anything since. I don't know if Glynn or Pete or any of the other guys who had a translator assigned to them

ever had any contact with them after the flight, because when the flight was over, NASA was going its own way, and the Russians were going their own way, and we were working like mad trying to get the Shuttle in the air, and things weren't going real well. So we just turned our attention to something completely different, and they weren't part of our lives or our teams or our workday or anything anymore.

RUSNAK: Did you at the time see any future for this kind of interaction with the Russians?

HUTCHINSON: You know, I have to admit personally I really didn't, and I didn't think much about it. I said at the start of this discussion on Apollo-Soyuz, I thought it was kind of stunt. It obviously was more than a stunt. From a flight operations standpoint, we absolutely proved that we could do two very different vehicles and different languages and different countries and get them together. There was certainly no vision in my mind. Somebody may have had a grander plan. I frankly don't—I'm not sure. I think so.

One of the things we were doing was trying to keep our skills. Well, there were several things—trying to keep our skills honed because we were having a lot of trouble with the Shuttle. That was the time in life when we were, well, then and even subsequently, we couldn't keep the tiles on the darn thing. We were blowing up one engine a week in Mississippi [Mississippi Test Facility, now Stennis Space Center] and in [Marshall Space Flight Center] Huntsville [Alabama]. We were a long ways from having the Shuttle ready to go, and we had extra CSMs [Command and Service Modules] sitting around that we didn't use, and a couple of launch vehicles to get them up. You knew, we used the Saturn IB to do this with, not the big stack, but the intermediate stack, the two-stage.

So I think there were other reasons, and if someone said—well, let me give you an example. I would submit that no one said, "Hey, we're going to build a space station one day. We want the Russians in the middle of it, and, by golly, what a great way to try it out." Well, maybe somebody

said that. It certainly was above my pay grade if they did, because I didn't have any—and, of course, I ended up being very much involved in it when we finally started Station. The Russians had not been brought into it when I was in the middle of it, but it, of course, eventually came to pass, and now, gee, just last week one of their major contributions is up there and cooking along.

So you could look back on this and say, well, when you look back on it in retrospect of what's going on here in the year 2000, and their involvement in the International Space Station [ISS], which didn't use to be called that when I was fooling with it, it was U.S. and there were some international partners. We definitely had some international partners. We had Japan and Canada, Europe, but we did not have the Russians, because in those days things weren't thawed out. Even though the Cold War was essentially over, things weren't thawed out yet. Star Wars [Strategic Defense Initiative] was still very much a deal. But you could look on it in hindsight and say, "My goodness, boy, did we get a good data point there [in Apollo-Soyuz]."

I think, also, when Station finally got going, even the part of it that I was running when it first got started, a lot of the confidence that the U.S. had that we could integrate other folks [because of ASTP]. I mean, English has become maybe in the last twenty to thirty years much more pervasive in the world, and, we're not talking about having Japanese translators in the Control Center or English translators either. The flight crews, since the Russians and the U.S., or at least early on, are supplying the flight crews, there's a tremendous amount of language training. All the U.S. crews are very serious Russian speakers, and the Russian guys are pretty good at the English language, too, most of them, in the flight crews. But we're not going through any big hoo-ha to have translators hanging around, a Japanese translator, a Russian translator, and some of the folks that are speaking a language other than English as their native language.

I think that in hindsight, the thing was a brilliant move. It established that we could do something like that and do it very effectively. It opened the door for something that a lot of us were—when we went to the Moon, we had political will and we had money, and the combination of the two, maybe one enables the other, I don't know, probably, in fact, it does—there never was a

problem. There were, of course, battles with the amount of money we were spending and so on, but it was becoming obvious as we went through the seventies, more and more and more obvious that the investments required in the human endeavor to leave this Earth were, other than peaks like Apollo were so substantial, with the returns on that investment fuzzy and maybe a little far off, that we probably—we, the U.S.—probably weren't going to be able to do it all ourselves.

Once we demonstrated that we were king of the hill, how many times do you have to prove that and what good is it? So there was a lot of merit in beginning to change the thought process that manned spaceflight, human spaceflight—called it manned spaceflight then. That's not correct today, politically correct. Somebody'd sue me, I guess, if I said "manned." Wouldn't it be funny if the Johnson Space Center was still the Manned Spacecraft Center? Somebody would have changed it to the Human Spacecraft Center, for sure. In any event, I don't know how I got off on that. The Apollo-Soyuz turned out to be, despite the fact when we were doing it, some of us thought it was kind of a stunt, a very, very valuable step along the way.

RUSNAK: Obviously, as you pointed out, we have a lot of interaction with the Russians, and it all goes back to this one early step that we made.

HUTCHINSON: Interesting. I told you that I spent some time last night with Joe [H.] Engle. Tom [Thomas P.] Stafford, who, of course, was the…commander on Apollo-Soyuz, is still very involved with Station and that interface with the Russians. He has a group of people, including Joe Engle and a number of other people. They have a task force that's chartered by NASA Headquarters, that operates on keeping that interface smooth and keeping it politically oiled. We have a few folks who are not too happy in the Congress with our involvement with the Russians still. Thank goodness we got their piece of gear up there and going. In fact, as you know, the Station had two pieces up there before, one of theirs and one of ours. They've now got more hardware in the air than we do. Won't have for very long, but they certainly do right now.

RUSNAK: In between ASTP in 1975 and the first Shuttle launch in 1981, there was a long period where the U.S. isn't sending any humans into space. What was going on here during that period and what were you doing specifically?

HUTCHINSON: Well, during the Mercury, Gemini, and Apollo sequence, the flight teams, those programs, [each] program overlapped. We were still flying Mercury when we were building Geminis. So there was a tremendous amount, in order to fly a flight and get somebody ready to be a person in the Control Center, there's a tremendous—we did drawings of the spacecraft. We took the original equipment drawings from the manufacturers, and we built our own that were used by the flight team. They're still doing that today.

That's a very, very detailed engineering analysis process that basically tries to functionally replicate the design of a system like a propulsion system or an environmental control system, in all its piece parts and to very, very carefully identify where the measurements are on that system that the controllers are going to see in the Control Center.

So each time, if you look at Mercury, Gemini, and Apollo, that sequence of vehicles, and I know Apollo was built by North American Aviation, and Mercury and Gemini [were] built by McDonnell-Douglas, but those vehicles are a family. Apollo didn't look quite the shape of—but they all had Max [Maxime A.] Faget's shape, who was the guy who decided that's how that thing was going to be in terms of where the heat shield was and the basic conical design of the vehicle and so on.

They were a family of vehicles, so even though the programs overlapped, getting all of those people on the ground tuned up to how they were going to monitor and aid and assist the operation of those vehicles, once you did Mercury—actually, it was a pretty big step from Mercury to Gemini because the amount of instrumentation changed a lot. We got a lot better at what we could measure

and how much we could measure, and Apollo was even more than that. But they sort of were a family. We had separate systems handbooks that were built for each one of those and so on.

Then we flew Sklylab. The workshop had its own—it was a whole brand-new vehicle. But remember what was on the other end of the workshop was a command module, and, good heavens, we had had that data on the floor for years and years that we needed. We had people who understood how the vehicle ran and so on and so forth. So we did Skylab, and we used that command module, and then we did Apollo [Soyuz]. So we used it again, and, yes, we had the docking module, and it didn't have very much instrumentation on it.

Then we went to Shuttle. The Shuttle, in terms of sophistication of its measurement systems, in terms of the complication of aerodynamic flight, which we'd never dealt with before—you know, the Shuttle is an asymmetric vehicle. It doesn't look like it ought to launch right, because it's not a pencil. Some of us in the early days wondered how that was going to work, not being an aerodynamicist. In fact, the Shuttle, to this day, it's a very tricky vehicle to launch. It has to be pointed carefully in the right direction at certain times or you'll tear the wings off or tear it off the external [tank]—it is not a casual launch process.

In any event, the Shuttle was an order of magnitude more sophisticated in its instrumentation, an entire decade worth of computing—because, remember the command module. Think about this. The Apollo guidance computer, which was the guts of the command module in terms of all of its guidance and navigation and so on and so forth, was basically an early sixties' piece of gear. You think about where computing technology was in, say, 1965. There was no such thing as a laptop. Hell, there were people still pounding Friedan calculators in 1965.

Then we went from that to this five-computer, four primary ones and one back-up one, and all of this sophisticated data-gathering stuff and a downlink that just had more measurements on it than Carter had pills. We had systems that—we'd never flown something like—well, we had, but we had things like an APU [auxiliary power unit]. It's like in an airplane, the APU does the

hydraulics, which moves the aerosurfaces and the engine bells on the Shuttle and so on and so on and so on. So we had new systems.

At that time period, I think that was one of the really neat times. What I did personally is I went back—you know, everybody had two jobs in the flight world. You had your day job, which was in the office, which was you were a member of an organizational unit or leading one. In my case, I was leading one, who had a set of jobs to do to get ready to go fly. If you were in the systems world, you spent time trying to understand the systems that you were going to fly. That understanding was gained by building drawings of them and studying them and then having simulations and practicing in the Control Center. If you were a trajectory person, you were learning how the vehicle went up and how to monitor it. You were devising displays to put up in the Control Center and so on and so forth.

Now, when we went from the Apollo era, which included, in my mind, Apollo, Skylab, and Apollo-Soyuz, they were all derivative, all very tightly connected, even though the flights themselves were dramatically different. It was a major step function in everything we were doing. For example, during that time I ran a—I've mentioned Bill [Howard W.] Tindall [Jr.] before, one of the smartest people I've ever met. Bill Tindall's the guy who figured out how to navigate to get to the Moon, as an example, and how to get it into computer programs on the ground and get it into computer programs in the air and when we had to exchange information between those computer programs and how we could track them on the ground and build a state vector, i.e., an understanding where they were, and then get it into the on-board system and re-anchor it, how to make inertial systems work.

Well, we had that same problem on Shuttle, and I was privileged to get the chance to do for the Shuttle what Bill Tindall did for Apollo. I ran an outfit called the Ascent and Entry Flight Techniques Panel for years, started it right after Apollo-Soyuz was over. What our job was, was to figure out how the interaction between the crew, the vehicle, and the Control Center was going to work during launch and during entry. The reason that we did them both in one—we eventually split

those panels apart. In fact, Don Puddy, I can't remember when, but Don took over the entry part. The reason we had them together in the beginning, and we had them together for a long time, probably, I don't even know whether we split them up before STS-1, maybe we did. The reason was, the team that launched them, because of the abort modes in Shuttle, might have to re-enter them. We couldn't switch people. We couldn't switch teams, so one group of people had to know both up and down. Then we had a group of people, and that was Don's folks and Don, who specialized in the down only. If the flight was nominal, in real life Don re-entered them.

Anyway, it's interesting, the flight techniques panels have gone on for years and years and years. I saw somebody over at Johnson yesterday that was still involved. They're still doing it. They're still refining abort sites and trying to figure out how to [optimize] trajectories. But it was [a] very, very, very complicated process. You had to integrate the launch trajectories, the engines where they were pointed. Of course, there was a whole design process, ascent trajectory design, going on outside this flight techniques thing. We were constantly bantering back and forth. We, for example, defined what was going to be said between the ground and the air during launch.

In other words, there are certain points in the launch where the Control Center has some data the crew doesn't have, or there's certain major events, like getting rid of the SRBs [Solid Rocket Boosters], when you'd all like to know they're gone. You can look, but the Control Center never looks at anything unless it's on the TV [monitors], unless it's data. We don't look at pictures there.

We went through a process during those years of figuring out how to fly this machine and how to get it back and, of course, the aerodynamic, the entry part of it was not casual. We'd never landed anything like an airplane. There were things like gear-down and wheel-stop and stuff like that, that guys running around, fighter pilots and that kind of crowd knew very well, but, of course, it was totally foreign to the flight control teams. The Shuttle, of course, is a dead-stick landing.

One of the things, for example, that still goes on today, that the whole energy management scheme on Shuttle which carries the energy—in a dead-stick landing, energy is a direct function of your altitude. How high up in the air are you determines how far you can go if you don't have any

engines. So the idea is, here's the landing site and you want to carry the energy as close to landing as you possibly can. The Shuttle has a very, very steep glide slope. It's about eight or nine degrees. That doesn't sound very steep, but if you were in an airliner doing that, you'd think you were headed for sure death.

One of the fun things we got to do, that's another story. I'm getting way ahead of myself. But, anyway, all that design had to take place, and how we set up this heading alignment circle, and how to carry the energy very close to the runway and then dump it all right at the last minute, to make sure you had enough, enough to get to the runway because if you don't get to the runway, you only get one short crack at it, and you're out of luck. The whole concept of landing in a desert, because it was forgiving and, of course, all of that was going on at the time. So we were learning how to fly the vehicle and defining all of the flight rules. The Shuttle has a lot of redundancy. So if you lift it off and something broke, do you come home, or do you go on up to orbit and then you come home? Or etc., etc.

So, the new vehicle, learning about it, trying to understand how to fly it, and then on top of all of that, we had one entire group of people, and Don Puddy headed this up. There was only one flight team, and it was Don. I don't know if you remember this, we had a separate flight test program testing the very end of the Shuttle [flight profile].

There was a Shuttle built—in fact, I believe it's up at Dulles Airport [Washington, DC] in a hangar these days, called the *Enterprise*. I'm not going to remember the name. Was the *Enterprise* the name of it? There was a program called approach and landing tests, ALT, in which we put it on a 747 and dumped it off over the desert and then flew it for a very short period of time. In fact, the guy that I was out with last night, Joe Engle, was right in the middle of that, he and [Richard H.] Truly and some others. We ran this whole series of flight tests. The big Control Center here was really not involved in it a lot. There was a small control center out at Edwards, but there was a flight team and a bunch of flight controllers. Don was in the middle of that in charge of the flight team business.

So there were a whole group of people doing an intermediate test process or helping with an intermediate test process. Then there was a whole other group of people who stayed, who didn't get involved in that on purpose, so we could go work the orbital test flights. They were called OFT [Orbital Flight Tests] for a while, the first four Shuttles. One of the big things in Shuttle is, when is it operational? Well, it's 2000, and, in my personal opinion, it's still isn't. It's an R&D [research and development] flight every time you push the button.

So we were absolutely up to our ears in work. I was running an organization that had all of the Shuttle systems in it. Somewhere along that time, mid-seventies, I don't know, can't remember exactly, '76, I think, we started trying to figure out how we were going to divide up the flight work. I drew the ascent straw. We started simulating—I'm probably not going to remember this exactly right either, but '78, I would say.

The programmatics on Shuttle always seemed to have a launch date about three months in front of us, for a long, long time. We'd just about get to the point where we thought we really were ready to go do it, and something else would happen. We'd have another problem. Of course, the two problems that were most prevalent on Shuttle were the tiles and the engines. We were having big trouble with both of them, as a program. We weren't, the flight controllers weren't. It went on and on.

One of the big problems in the Shuttle engines, we had cracks in the blades in the turbines of the high-pressure pumps. It was a metallurgy, combination metallurgy design-heat issue, and it was all Marshall Space Flight Center. Marshall's cross to bear were the engines, and Johnson's were the tiles. The engineering sides of those two organizations just killed themselves trying to get those two problems sorted out. Of course, the contractors, too. Rockwell was in the middle with the Orbiter, and Lockheed had a lot to do with the Orbiter, more than you'd think. They were the tile whiz kids under subcontract to Rockwell. I wasn't in the programmatic side of it at the time, in fact, never was in the Shuttle.

While all that was going on, it was, what engine did we lose this week? The flight teams, we kept thinking, "All of a sudden those guys are going to get their act together. It's not a matter of getting their act together. They're going to find all the faults and get them sorted out to where they're comfortable to launch, and we'd damn well better be ready."

We probably picked the flight directors, I don't know, in '76 or '77, somewhere around there. Don was off running ALT, so it was just natural he should just back it up and do the entry part, and I did the launch. Chuck Lewis was the on-orbit flight director. The three of us, we all put teams together. Don didn't. Don's team came together real late because he was all buried in Approach and Landing [Tests], but he did, too. We started practicing in 1978 for the launch we kept thinking was only a little bit in front of us, just a little. "We've got to keep going, we've got to keep going."

Along with the flight control teams getting ready, there was a tremendous amount of work being done in the software development world on the ground because we had to build simulators so the crews could train. Then the simulators get hooked into the Control Center to simulate a flight. Had to build all the software and the control complex downstairs in the basement of the Control Center to get all that going.

In retrospect, it's kind of like what just happened on Station. You know, everybody fusses about the Russian delay and all that other stuff. To be quite honest, I believe that we will look back on the Russian delay and say thank God, because we got to put a whole bunch of hardware together at the Cape and test it in a sequence that we never would have gotten done if we hadn't have been under that umbrella of that delay. Well, the flight teams and the crew and all of the people who were involved in the operation of the Shuttle were thanking their lucky stars that we had the time to be as thorough and complete as humanly possible, because we were under the umbrella of this constant set of issues that kept the program on the ground for three years, in essence, or two and a half years.

I think I must have run, I don't know, 500 launch-abort sims [simulations]. I don't know the exact number. I'm sure it was over 500. We got into a pattern, it's funny, and Puddy, too. We all did. Chuck maybe not as much as Don and I, but, of course, a lot of mine include entries, because every time we'd abort, we'd abort once around or get up there three-quarters of the way and then try and turn around and get back. Well, you can't get back to the Cape three-quarters up, but anyway, a lot of entries for me and a lot more ascents.

Of course, as time went on, the simulations, in order to test us, they'd get more and more sophisticated. It's an interesting game if you're running the simulation complex, just how much trouble you can throw at a flight team before you bring them to—you can bring them to their knees anytime you want if you put enough stuff in there. So we had a constant thing going like that.

We got to be very, very close to the crews. We trained off and on before STS-1 with both Joe Henry [Engle] and Richard—Dick Truly—and "Crip" [Robert L. Crippen] and John [W.] Young. Like we've done in a lot of other things, one little sidelight war story—we had debriefings. You'd run a simulation. It goes well or badly. You take notes and everything, and everybody pretends like it was a real flight, and then you'd say, "Okay, stop. King's X. It's over. Let's all sit down and talk about it."

I had a reputation for spending too much time in the debriefings, because I figure we spent the time running, we'd better spend the time figuring out what we did right and what we did wrong so we didn't do it again. So, anyway, that's kind of a joke around the system, that Hutchinson's debriefings were just awful because they just went on and on and on. You'd spend four minutes in ascent and abort the thing, come back, we'd talk about it for an hour before we went again.

We had another kind of debriefing. I don't even know if I talked about this much in Skylab. The camaraderie that gets built up between the crews and the ground, inside the ground team, is very, very important and very strong, a big deal. One way to do that is when you get through beating each other up, and, of course, we make mistakes and the crew makes mistakes, and you've got to fess up because there's no hiding when you fouled something up, you know, somebody sends

the wrong command and the crew throws the wrong switch, it's all recorded there. Everybody says, "Oh, God, look what I did here."

From a flight director's standpoint, if you're an ascent flight director, there's a little switch on the console. It's called the abort switch. It doesn't physically do anything, but what it does, is it puts a light on in front of the CDR [commander], the guy in the left seat, that says, quit, abort, get out of there, come back home. So, throwing the abort switch is a big deal. I never threw it in real life, but I did a bazillion times [in training]. So there's a certain amount of tension. That's probably not the right word, but getting comfortable with each other's judgments, between myself and John, and getting a communications path that is very open. I'll tell you, those two guys—and I probably spent more time with them than I did Joe Henry and Dick Truly, maybe even the four of them together, but particularly John and Crip, I just can't imagine, there's never been two people that I had more faith in. I'm sure that we had the same—I mean, I had a lot of faith in the Skylab crews and the [Apollo] 17 guys which I got to know really well, but maybe it was the long training period.

One thing that is, of course, absolutely unique about the Shuttle, it's the only vehicle the U.S., or anybody in the world, has ever built that was not flown unmanned. So we sort of had a lot hanging out.

When you look at how the flight actually went, it's just an engineering marvel. I mean, the people who thought that thing up and designed and built it, I give credit to every one of them, because the flight team in real life, we had a few little ditties here and here, we didn't do a thing. Oh, we did, but we sort of sat there and watched this marvelous thing go down. It just did it. It was a little more than that, but it really, in all honesty—and then you have to look at its track record over the years. Even despite the *Challenger* accident, the vehicle's a marvelous, marvelous piece of gear.

But, anyway, back to the flight crew. We had these debriefings, long debriefings, and then we had the real debriefing, which took place at a place called B&Ms. You probably never heard of

B&Ms. B&Ms is a beer joint over in LaPorte [Texas]. Actually, it's not in LaPorte. It's behind JSC. It's a garage. Maybe they don't do it around here anymore, I don't know it is. Does anybody know about the Outpost around here?

RUSNAK: Yes, sure.

HUTCHINSON: Okay, take the Outpost down about four notches.

RUSNAK: That bad, huh?

HUTCHINSON: That's what B&Ms was. As soon as we were done, we'd all head for B&Ms—the cap coms, the flight crews, the flight team. I'd usually get two-thirds of my MOCR [Mission Operations Control Room] bunch and whoever else wanted to, and we'd go over there. That's where the real debriefings took place, B&Ms. The sims schedule would allow you, two or three times a week you would be running sims. Maybe not that much in the beginning, but certainly toward the end, and we'd always manage to make it over to B&Ms for a beer. It was a little bit like the Singing Wheel was, which was a big hangout, and at one time the Flintlock was a big place around here. It's gone now. There's, I don't know, a pitch-and-putt thing or some other crazy thing over there.

Anyway, that was a very important part of getting ready for STS-1 because the flight teams and the flight crews were very dependent on one other, got very comfortable with each other's capabilities and how to communicate, just a really, really, really, really fine team. The other thing, I guess, about STS-1 and that time period from '75 till we launched, since, ever since, no one has had the privilege of working that long with one flight crew on one problem, because we turn them around so fast. I know we know how to fly them more or less and so on and so forth, and so it's not like the first time, but that extended period when we kept having trouble, we originally had the

launch date set in ’78 and then it moved to ’79 and it moved to ’80 and then, of course, we finally got off in ’81. I’m not sure it was ever even in ’78, but there were two or two and a half years of constant movement where we had actually set a launch date and everybody said, “Okay, let’s start getting tuned up,” and then “Oops! Nope, we’re going to move it [the launch date].”

That time provided an extraordinary ability to get a group of people integrated into a really tuned machine. Interesting that on my flight team for STS-1, there were five future flight directors in the MOCR. Of course, some of the people who are running the agency, Jay [H.] Greene was my Flight Dynamics Officer [FDO] and he later became a flight director. Gary [E.] Coen was my GNC [Guidance, Navigation, and Control Officer], later became a flight director. Al [Granvil A.] Pennington was my INCO [Instrumentation and Communications Officer], later became—etc. All names who came on after we left and did great things with the Shuttle Program and then went on to do a lot of other things. Jay’s deputy manager of the Space Station Program these days, for example.

Anyway, what were we talking about? The time before the launch? Yes.

RUSNAK: One of the things I wanted to ask about was the decision to launch the Shuttle the first time with the crew on it. What did you think of that?

HUTCHINSON: That was a product of—I thought it was pretty sporty, and I think if you ask Max Faget or Chris Kraft or Bob [Robert R.] Gilruth or any—well, Bob was retired by then—but any of the people who had been there and done that, they would all tell you that it was a very risky proposition. They engineered the hell out of it. We did everything known to man to make it safe, but "F=ma" is very hard. And that vehicle, from a launch standpoint, is very tricky.

When you get the vehicle going uphill and you’re still in the sensible atmosphere, there are tremendous aerodynamic pressures on it, and you have to get the angle at which it is going through the airstream exactly correct or you’ll tear the wings off or tear the Orbiter off the tank. So it has a

very narrow performance corridor. In order to get the proper inclination—when you're in powered flight, when the Shuttle takes off, it rolls. You've probably noticed that. What it's doing is getting itself oriented so the Shuttle goes into orbit on its back. It goes in like this upside down, with the crew upside down, like this. You roll it to get it in the launch plane because of the aerodynamics. You've got to get that roll out of the way and get that whole thing set up long before you get to the max dynamic pressure [Max Q], which is—I'm probably not going to remember all these things—which is on up the road, way before you let loose of the SRBs, by the way.

That's when the amount of atmosphere when combined with the direction the vehicle's going and the velocity—the velocity at which it's going is the worst. In other words, the greatest aerodynamic force is on the vehicle. There were just so many pieces of this thing. As you probably know, we had ejection seats in the first four flights, when we had two crewmen. My personal opinion, I don't know, we tried—you know, we looked at all kinds of things, like pad aborts and you blow out of the thing with the vehicle sitting straight up, and they get enough altitude for a parachute to even open, let alone—there were lots of things like that. We basically installed rocket motors. We had no way to really get out of the vehicle, to be quite honest. Once the solids are lit, you're going to go somewhere. Of course, we did design—I keep saying "we"—the engineering community and so on, with Marshall having a big role in it, JSC, too, because the level-two program office under Bob [Robert F.] Thompson was here, another guy that I've had great admiration for, really. I don't know if you guys have talked to him, but he's another guy. I believe he's living here in Houston. Have you talked to him, Bob Thompson?

RUSNAK: We haven't, but we're in the process of arranging one with him.

HUTCHINSON: Yes, brilliant guy. There, when things were tough, of course, ran the Shuttle Program and during the design development phase. In any event, we did everything that was humanly possible, but the Shuttle was a very difficult vehicle to fly. Apollo had the launch escape

tower, and it hauled the command module away from an issue, hopefully, and got it to an altitude high enough where you could put parachutes on it and drop it in the water, but if everything was cool. Really, despite the ejection seats and the fact we had them and, jeez, we had to arm them and guys had to wear a different kind of uniform—not uniform, but whatever—that was not an abort mode that in any way, shape, or form, the flight team or the flight crew, I think, ever really embraced.

Once you lit the solid rockets as opposed to a liquid engine, which you can shut down, there's no turning them off. So we got a launch sequence set up that started the mains considerably before the SRBs. As you know, the main engines go off at about T minus six [seconds], relative to liftoff, so you get several seconds. In fact, you get them up basically up to, I don't know, 90 percent thrust before you decide to blow the bolts and let the SRBs go. So you're pretty sure you've got three good mains. As you probably know, in the life of the program we've had several pad aborts where we actually started the main engines and then shut them down and didn't go. So it's turned out to be a pretty effective launch system. We all knew that eventually there wouldn't be any ejection seats because why would you have five people on board and only be able to blow two out? Kind of silly.

So the unmanned versus manned thing, probably early on, I was a little bit incredulous, thinking, gosh, this is back in the mid-seventies. And, of course, that decision was made long before that. I suspect that decision was made in the early seventies, probably '71 or '72. I was not involved in that decision, I was off flying Skylab when that was done, but my suspicion is, it was absolutely driven not by the fact that we thought we were so damn smart we could do it, but by money.

Unmanned flight test, which, as you know, the Russians did with a vehicle very similar to Shuttle eventually, Buran—I'm not sure how to pronounce it—but the Russians did it. They lifted one off, flew it around the Earth, landed it. Did it all, no people on board, whatever. So it absolutely is something that could have been done, but the cost was awesome. That's a whole flight

control system and everything. It's different. So I would like to believe that as opposed to some kind of clairvoyant engineering judgment, that was very much a programmatic cost-driven decision. Once it was made, then we all put our shoulder to the wheel, including the engineering folks who said, "We're going to figure out how to make this absolutely as bullet-proof as we can."

But in the end there were some—I'll tell you a funny war story about during the launch. The Control Center is a very quiet place. I don't if you've ever been in there when something's going on, but it's like all of us sitting around this room, probably not as much as noise as me talking to you, because everybody's wearing a headset, and everybody's busy, and your work is right in front of you. People will come up and get up from your console and go talk to the guys staying at this console once in a while or whatever, but particularly during a critical phase in the mission, like a launch, there's a pall that descends over the place. You could hear a pin drop in there. Nobody's moving. Nobody's getting up. People are talking. We're having conversations. Capcom's [capsule communicator] talking to the crew. I'm talking to the capcom. It's business. There's no smoke and fire. Nobody's watching the big rocket go. I don't know if you've ever seen a launch at the Cape. It's physiologically quite an experience, even if you're on the ground. There's none of that that goes on in the Control Center. It's watching numbers and plots and stuff like that. Of course, part of simulations is to get you into a mode where it's unemotional. You're just doing your job. It's a set of numbers. As I've said, we'd run hundreds and hundreds of practices, so we felt like we knew what we were doing and it felt like we'd done every "what if" we could possible do.

So we get to the real day. Of course, we had a couple of false starts. We had that big problem with the computers; backup and prime getting out of sync. In any event, we finally got to real launch, and "three, two, one, zero," and away we go. We're going uphill and we're doing our thing. We had certain places in the sequence where we made deliberate calls to the crew and the crew made deliberate calls to us about things that happened.

When you're going through this period—I can give you an example. When you're going through this period of max aerodynamic pressure, the engines are throttled back to lower the

velocity just a tad during that time period, so you don't get quite so much pressure. Then they're throttled back up to 100 percent. The Shuttle engines are variable thrust, within reason, not a lot.

So we had a call, an air-ground call, where the Control Center looked at the engines after they came out of the throttled bucket and said, "Go [at] throttle-up." That's a typical—if it was no-go with throttle-up, you knew we had trouble. That was a call between the air-ground [control center to crew]. In fact, I think it's being done to this day.

So the Control Center is a very precise, very quiet, very businesslike, absolutely dead-silent place. So this is going on. The launch is going, right? We're going uphill, and we get through max Q and it looks good. We're go with throttle-up, and it looks good. We're coming up to SRB sep [separation]. In significant events, like the first launch of the first Shuttle, there are some people around that wouldn't normally be in the Control Center. There are very few of them, but Max [Faget] was in the Control Center, sitting at the PAO [Public Affairs Office] console, one console over and one console behind me. Chris was there sitting behind me, Kraft. Of course, I'm by myself at the flight director console. There's no extra people anywhere except a couple of folks like that, which it's certainly fine that they be there.

We got to staging. Max jumped up and screamed, "They're off!" And he scared the living bejeesus out of everybody in the Control Center. Chris turned around and said, "Max, for chrissake, sit down," or something like that. I don't remember exactly what he said, but I'm telling you, he scared me to death. It's because that place, it's this quiet, businesslike whatever. Of course, Max was so ecstatic. The SRBs were a real big deal, and the aerodynamics we'd just been through. It was ten years of his engineering design life being turned into an absolute success there, and he lost it, sort of. Never forgot that. There's lots of good war stories like that.

In any event, yes, we did launch. Dan [Daniel C.] Brandenstein was my capcom, another really great troop. He still lives here in Houston, who ended up flying the Shuttle many times, I think three or four, before he finally retired. Great guy. Dan ended up, it's interesting, the original astronaut class of '78 formed the nucleus of the whole Shuttle astronaut corps, thirty-five folks, both

mission specialists and front-seaters. Rick [Frederick H.] Hauck was the first guy in that class to fly. He flew STS-7 or -8, something like that, and then Dan was the second. Maybe there wasn't an exact pecking order, but I can tell you, at that time in the program those two guys represented the absolute cream of the crop in that bunch. Rick Hauck was Don Puddy's cap com, and Dan was mine, which is another indication of the strength that those teams that launched and operated on and brought back STS-1, we had absolutely the very best group of people that we could put together in the whole world, on the ground and in the air. And it all worked.

Let's see. Where are we time-wise? Oh, my goodness.

RUSNAK: After STS-1 got into orbit, they had some problems with tiles missing.

HUTCHINSON: Yes, we did. The tile issue on orbit was worked offline. There was some work done in the Control Center, but worked offline in a very sensitive way because—I need to be careful what I say here. I'm not even sure what I should say. There were techniques available outside of NASA to understand exactly where the tiles were missing and how many. They were used, and it became a non-issue. So the flight team, we did some— several of them fell off during launch, and so some of them we knew where they were. The flight team did some work on that, but, frankly, that was an offline exercise that the answers were then brought back into the flight team, not to worry. We did not have a great deal to—we worried about it until we got answers back, but there wasn't a heck of a lot that the flight team really could have done about that.

There was some scrambling around to look at what equipment was inside the vehicle near the places where the tile were gone. I don't even, frankly, remember exactly where they were. I remember a couple of them were in the back. One of the them was up on one of the OMS [orbital maneuvering system] pods. My recollection of the tile issue on STS-1 was just that the flight teams were not particularly overwhelm[ed]. If anybody was involved much, it was Don Puddy, because it

was his bunch that had to deal with it. Again, the problem was worked offline and it didn't take them very long to figure out that we were okay.

Yes, I thought after we got in orbit—I had the neatest job, of everybody. I mean, I couldn't relax, but when my part of that thing went down, the part I was involved in went down, and it went so well and after all of the training on the really bad things that could have happened to us on the way uphill, and it all came off, I felt, probably not relief, but I felt a little bit like we did after 13 or maybe after 11, like we kind of beat the machine. We overcame it. We really didn't, because we didn't do a darn thing, except pretty much watch it. But it did go very well.

One of the things the Shuttle does is when it comes back, there's a fairly large ionization sheath around the Shuttle, heat shield around the bottom of the Shuttle, and it's so significant you can't communicate with them. So that was another piece—of coming out of what we call blackout. It was another piece of drama that was always there, kind of [like] launch, that until it really happened, you weren't really very comfortable.

Of course, I had ensuing shifts on the flight, but in terms of issues and the like, the ones we were working on were pretty benign. The flight team didn't get involved in the tile real big. In the end, I had a good time. It was kind of like I'd given my speech and I could then sit back and watch the other people give theirs, so to speak.

Of course, we got to do it again on STS-2 and -3. STS-2 was the first time for the second time. Never in the history of space flight had a vehicle ever been used twice. There was a fair amount of concern there. Of course, we had a problem on 2, which the flight team handled really nicely, I think. We got done what we needed to do. We got the second time done safely and proved that, hey, we really do have a reusable vehicle here. Then the program went on.

I have to tell you one more war story. In fact, I told it to a group of about 500 people yesterday. We had some of my troops down here together in a room. We were talking about the upcoming sequence on Station, which is a very, very—I think what's going on now in Station is just as tough as launching the first Shuttle or landing on the Moon or whatever, this next five or six

flights. We were having a little talk about that. This story I'm about to tell you, which is absolutely true, we got [to] the end of STS-1, and the Control Center has a tendency, when the flight is over, it's a little like a prize fight, you just knock somebody out when you're successful. It's one of those that you've been training and training and training, and then you go do it, and you fight the good fight and you win; i.e., the mission was a success. There's a certain amount of euphoria goes on until you figure out, hey, I've got to get ready for the next one two weeks or a month down the road or whatever. Of course, STS-1, there was a lot of hoopla after the flight, a great deal of stuff. I got to go to the White House and meet the President. We had a luncheon at the White House. It was really, really quite something, the aftermath. I'd never seen anything like that in any event in my roles and things. But that's neither here nor there.

So we got on the ground, and, of course there's great jubilation in the Control Center. Used to be, everybody lit up cigars. We used to smoke cigars in the Control Center. In fact, back in Gemini and Apollo, when we built the Control Center, we had ashtrays built into the consoles and the like. It's kind of like when the Control Center was first built—I told this story to a number of people, and I'm virtually certain it's true—it didn't have a woman's bathroom in it. Try that on, considering what they've accomplished in that room since and who's done it.

So there were some cigars around unlit, and everybody was just absolutely ecstatic. One thing Don did that I didn't, that was, if I'd been him, I don't know if I'd done it, he let a lot of other people come into the Control Center and sit down and plug in during the entry, including me. I was sitting right beside him, or over to the side of him. You have to be plugged into something. If you don't have your headset plugged in, there's only a finite number of plugs. So we were all in the MOCR when the entry was over, when landing was over.

There was a lot of pressure in the ascent thing to have extra folks in there, people who wanted to be there in the MOCR. I shut it off. Of course, I couldn't control Max and Chris. They could go anywhere they want. They could plug into my console they wanted to. And there were a

couple of other guys like that, that were there. On balance, I tried to keep the ascent team, only the people who had a job to do plugged in. Anyway, Don accommodated some of the other of us.

So we got on the ground and everybody's screaming and hollering and put up this big patch up on the front of the MOCR. It's a very emotional time. All of a sudden you hear this banging. You know the VIP room? This was in the old Control Center, and there's a VIP area behind. Of course, it was absolutely wall-to-wall people; you couldn't move in there. Chris, for the entry, was sitting in the VIP room right in the front. So we're all down around the console, jumping up and down, whatever, patting everybody on their back. And there's this [knocking sounds] Edgar Allen Poe's tapping on the window kind of thing, and we all turned around. It's Chris, and he had taken a piece of paper, an eight and a half by eleven piece of paper, blank sheet of paper, and a Pentel pen, and had written on it, "We just got infinitely smarter," and he was holding it up against the glass. Never a more prophetic statement made.

You think about what that flight test did in terms of proving a set of engineering concepts that were nothing more than drawings and people's ideas and whatever. In one fell swoop, we validated the whole thing. Go back and think back only ten years or fifteen years before, when we were running unmanned Saturn Is, unmanned Saturn Vs. We flew the command module three times before we ever even put anybody in it. We damn near lost one of those. It is just absolutely incredible. The gain in knowledge and the validation of all the Max Fagets of the world in that one short flight test.

RUSNAK: Well, if we could stop there to swap out our tape real quick. [Tape change.]

HUTCHINSON: You were going to ask a question, Kevin.

RUSNAK: No, no, go ahead and finish.

HUTCHINSON: Well, I was going to say, we launched STS-1 in April. Then November—it's quite a time between 1 and 2, but we had to go back to practicing. We did some refinements on the ascent. There was some discussion about what kind of changes we ought to make on the flight teams, and we essentially made none. We flew 2 with the same crews on the ground. It was me and Puddy and Lewis. We had the same players. We didn't make any moves because we were worried about the first time for the second time.

Then as we moved on through the flight test sequence, there was a four-vehicle sequence where we were using the ejection seats and before we put any extra people on board and so on and so forth, and one of the thing we wanted to do was introduce the arm, the Canadian arm, the remote manipulator. There was not a lot of tuning necessarily going on in ascent, but the rest of the parts of the flight envelope, we were expanding how we did maneuvers, how much we used the onboard systems in terms of how we updated the state vector. There was continual learning process going on about how to operate this vehicle in a more efficient fashion.

I skipped over a lot of very, very important events. Opening and closing the payload doors on the Shuttle at that time was a really, really big deal. Had never done anything like that before. An electomechanical mechanism that big, in zero G they don't weigh anything. On the ground, in order to open the door, you've got to have all these counterweights and pulleys and stuff like that. Of course, the door had to be open to get the payload in. In the first flights we had virtually nothing in the bay. Instrumentation, a lot of instrumentation. Getting all kinds of stuff for the engineering community.

But there are lots and lots of things like that, how the water spray boilers worked to control the heat rejection during ascent and entry, another very important—water spray boiler's a thing that just crudely blows water out in a vacuum, it only works in a vacuum, and as the water expands, it cools, it's a coolant device. Batteries, how the batteries and fuel cells worked. Of course, we had a fuel cell problem, too. So there were lots and lots and lots of good flight test stuff being done

during these flights. We call them DTOs, detailed test objectives. There was a constant push from outside the program to declare the Shuttle operational. "Quit testing it, NASA. It's an airliner."

You know, at this time in our lives, although it took us four or five months to get from STS-1 to STS-2, there was talk around that we were going to be able to fly this vehicle twenty, thirty times a year. Not talk; plans. And there was a constant programmatic pressure that those of us in the operations world felt to "Get over this testing thing, guys. Once you've expanded this envelope, this vehicle has to be an airliner." The concept is up and down, up and down, up and down. Put gas in it and let it go and get it back. Of course, as we all know, the difficulty of doing that and the sophistication of the vehicle and where the state of the art is and everything else—because I think the Shuttle is not the edge of the state of the art in its avionics, but in terms of design and the process of reusing it and so on and so forth, it is. It's interesting that here we are twenty-five years later and nobody's come up with a better mouse trap, and I suspect it'll be another twenty-five year before somebody does. I think we'll be flying that thing till 2030.

So we decided in the flight operation that we'd kind of get with this thing, and so we cooked [up] this lead flight director concept where one guy kind of oversaw the mission development, all of it, all the phases. As was the case with the flight crews, we were very worried that flying this thing so much, we're going to wear people out. So we had a plan to begin to introduce new people in, all over the place. We had a whole group of 50 or 100 up-and-coming young people who were moving into the back rooms and eventually getting a job in the MOCR and then migrating into the flight director position, the lead position in the Control Center.

STS-3 was sort of the start of that process where the teams that had basically done those first two flight tests begin to morph into different people and different leadership and different roles, and we begin to try and bring some of the newer—we didn't name any new flight directors then. We were still just the three of us. Actually, maybe we did. [Tommy W.] Holloway and some others started to come into the picture then.

So I did STS-3 as the first lead flight director in the Shuttle Program, and it was a kind of a different role, and conceptually we tried to do things a little differently in terms of the way the teams were organized and so on. That was my last real involvement with the Shuttle in a flight operations capacity.

It was time to pass the baton. Myself and Don and Chuck had been flight directors longer, active flight directors longer than anybody ever did the job, over ten years. We were all flight directors for twelve years. I know there were periods in there where we didn't fly, but the level of intensity, not as high as when you're getting ready to fly, but very high, doing all the flight techniques when we were in that lull between Soyuz and Shuttle. I think we were all sort of worn out. I felt like I had done every job there was to do and it would be very, very hard to ever top launching STS-1 in that environment and kind of career. I could never had done what a Gene [Eugene F.] Kranz did. Gene is still a flight director today, I think. He's a wonderful person. He has stayed mentally and every other way connected in that environment and in that framework his whole life. I couldn't do that.

So I was ready to go do something else. I told Chris that. Chris was getting ready to do something else. The people who had sweat that program through ten years of development and gotten it into this position were all either getting ready to leave the government or were looking at other things, so there was a lot of change going on in the agency. I don't know if I got caught up in that or not, but I was ready to go do something else. I certainly didn't want to go fly Shuttles the rest of my life, although I wouldn't have traded it for anything. So I moved on. Cut.

RUSNAK: Okay, thanks.

[End of interview]