NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

CLAIBORNE R. HICKS
INTERVIEWED BY KEVIN M. RUSNAK
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RUSNAK: Today is April 11, 2000. This interview with Clay Hicks is being conducted in his home in Alexandria, Virginia, for the Johnson Space Center Oral History Project. The interviewer is Kevin Rusnak, assisted by Carol Butler.

I'd like to thank you for having us in your home. If you could just start by telling us some about your background and how you came to work at NASA.

HICKS: Well, Kevin, in 1953, in June, I graduated from Newport News High School. I was a candidate for the apprentice school at Langley [Research Center, Hampton, Virginia], but because of most of the points in the veterans that were coming back from Korea and some of the other wars, they had point preference, so I didn't make the first round cut for the apprentice school at NASA. That's what I had applied for. I had no intention of going to college; I had no way to pay a way to college. I was raised by grandparents who were working class, and in those days we didn't have lots of scholarships, just weren't dropping in for students and things.

But one of my friends mentioned to me, "Well, what are you going to be doing?" I said I was waiting for NASA, or NACA [National Advisory Committee for Aeronautics] then, it was N.A.C.A., not NASA [National Aeronautics and Space Administration]—I'm sorry. He said, "Well, VPI [Virginia Polytechnic Institute and State University, Blacksburg, Virginia] is starting a co-op [cooperative education] program where you can work, alternate going to work and going to school, and it'll help pay your way." And he said, "They're having exams over at the College of William and Mary [Williamsburg, Virginia] and VPI branch over in Norfolk at the end of June, and a bunch of us are going over there. Would you like to go?"

And I said, "Sure, why not." So John Allen and a few of us others that had graduated from high school went over there, took the scores, and about a month later they called and said that I had made the grade and I had been accepted into the freshman class at Virginia Polytechnic as the first Virginia Tech quadrant of co-op students. They had already started a group in the summer, at the end of June, but this was the group they were screening to start in September of '58. So another group of about twenty students had already started in the previous quarter, by going to work at Langley, and we were going to be their replacements. Well, they started in September, excuse me. And we went in December at the winter quarter. So the group that was picked in June started out in September and then they were going to pick the second group and let us know by July or August, and then we could set it up, and we would start into school in the September period and go to work in December.

So I was selected, and NACA agreed to it. It was another just a side point when I put on my application to VPI to enter into the engineering co-op, one of the things we had to specify is what engineering school and where would you might want to work. So I had already signed up for—wanted to be an apprentice at Langley because of the high-quality work and the advanced technologies and that kind of a thing, because I was interested in math and interested in chemistry and drafting in high school, but nobody had ever talked to us about engineering degrees or engineering activities or stuff until we got reviewed by Virginia Tech and the guy got me all pumped up for, you know, engineering. When they looked at the application, he said, "What are you interested in?"

I said, "Langley, aeronautical engineering," so that's how I became an aeronautical engineer, because Langley was there, and I wanted to co-op there and I checked off Langley to be the co-op place. And, of course, we had to get one semester under our belts before Langley would accept us. We had to prove that we could make the grade at college. So, off we went.

If I'm taking too much time, let me know. But it's a neat story and I like it, because a lot of the other guys that ended up in the space program used this avenue. Glynn [S.] Lunney was a co-op student from the Lewis Research Center. He got his start. He couldn't have afforded to go to college. [C.] Howard Robins [Jr.], Bill Tolson [phonetic], George Young, George Weyer [phonetic], a whole bunch of the guys were at Langley that were a part of this group came out that way. And you notice out of that group I think only Howard and myself were the ones that went into the human space flight program, the guys with Max [Maxime A. Faget] and those guys.

But anyway, I got selected, did good my first year, my first quarter I mean, at Tech. I think I got two As and three Bs or something like that, which astounded me. I didn't really think I could do it, but I decided I didn't want to stand on a corner. I didn't want to work in the Newport News Shipyard. So I said, "Hey, this is my one shot. I've got to make this go." So my grandfather bought me a desk and fixed up my bedroom like a little study, and they wouldn't let anybody come around while I was doing homework and stuff. So they were protective. They said, "That boy's going to work and go someplace." So I said, "All right, Granddad, we're going to do it."

So we made it. I went to Langley for the entrance. I reported for work out there on December—I think it was December 18, 1953. Now it's also interesting, because the five years that I was a co-op student, because I was working six months out of the year, those years counted toward my federal retirement, and I only had to put in six months to get that credit. At that time I had no idea at all what that would mean or whether it was any good. I was just happy to be doing something. But the key thing about the NASA, or the NACA Langley program was that we started during our freshman year.

What they did is they rotated the co-op students for three quarters through the shops. They had the machine shop, wood shop, and the metal shop. And that gave the budding engineers—they wanted to humble us a little bit, because the workmen and the craftsmen, we got to meet with them. And it was always the craftsmen versus the engineers. The engineers would come in to tell the craftsmen what they wanted, and as soon as the engineers were gone, the craftsmen would get together and say, "This is what we're going to do." And that's the way it worked. And they would tell the engineers, "This is the way it's going to be designed, guys." A lot of times the engineers were right on, but a lot of times the craftsmen knew how to do it. And these were things like airfoils for the wind tunnels, models to fly over in Wallops [Island, Virginia], electronics to do testing and things. So it was very precision, very intense kind of machine work, woodwork, and metal shipment work.

But the thing it did for us young guys, it got us to see how engineers came back and applied their trade, and it also got us exposed. Like I started meeting—I ran into Bill [William M.] Bland [Jr.] and some of those guys in my early career. And I got to go with my project—I was helping a craftsman build a model wing foil for him that he was going to be flying at Wallops Island. So I got to fly over to Wallops Island on the Goony Bird with one of the famous pilots now that was an old Langley guy—I don't know whether it was [Ray W.] Hooker, one of the guys. I'd have to go back. But they would fly an amphibian plane from Langley, and he would bank that sucker and land on a pond right behind these little scrubby buildings on Wallops Island where they would actually then launch some rockets and do flight tests with telemetry and things like that, which would come back later, because I think that that connection between Langley and Wallops was very instrumental, because the Pilotless Aircraft Research Division [PARD], where Max Faget and Bill Bland and Aleck [C.] Bond and those guys work, that was their job to fly pilotless aircraft models, and that's where Mercury was born. And that's where they did a lot of the ablation material work.

I and some of the other co-ops, not just myself, but I got to actually work on some of those models. Must have been '56 or '57 when I had gone through the shops and then I went through the transonic wind tunnel where Dick [Richard T.] Whitcomb had just won the [National Aeronautic Association's] Collier trophy for the Coke-bottle effect [area rule] in supersonics. And you talk about turning a young kid on. That's where I got turned on to supersonic and high-speed aerodynamics. And I was really in there, I really liked the math. I really liked the research, the whole thing about high-speed aerodynamics, which would later come into that's what space flight is all about. Getting out of the atmosphere and coming back is high-speed aerodynamics, that's what it's all about. You don't get but one shot at it. It's not like you stay there, you zip through it and you zip out, there's heat, there's all these interactions between the atmosphere and the body that you're trying to get to space.

Once you get to space, like [Eugene F.] Kranz says, it's a very benign environment up there. So we always had this philosophy, later on when I was in mission ops [operations], it's always abort to orbit. Get to orbit then decide what's—you know. You don't want to abort during the launch or anything, because you have to make too many decisions. And it was always this "press to MECO" [main engine cutoff]. Get your butt to orbit and then set there and figure out what you gotta do.

But, the co-op program, it must have been '56, but I went over with Jack [C.] Heberlig, and a guy, he was doing some work for Edison Fields, and they were testing some models with different ablation material. And I said, "Well, how you going to do that?" Well, he explained it all to me. We went over to the shops because I had worked there and I knew the guy that was working on it.

So when I went over there, he already knew me. And that impressed Heberlig that here, you know, these young guys know what they're doing. And I explained to him, because the engineer was saying, "Well, Clay can tell you why we can't do it that way." Because he was talking about trying to bond something on, and it was just not the way to do it. I knew the craftsmen, they knew what they were doing, and I said, "Let's let those guys tell us how they should do it." And Jack was smart enough to agree to that. So that got those guys in. That was their trade, they knew how to do that.

But anyway, they bonded, and Max had the guys looking at all kinds of different materials to see what might be a candidate ablative material, because that's the mechanism he had picked to reduce the heat transfer on a body coming back from space. He had figured that that was the cheapest, fastest, most technologically quick cut to doing this that was possible, by just coating the underbelly of a blunt body with some material and then have it ablate off, rather than having to work the dynamics of the heat going into the body and then having the inside systems try to reject that heat.

So the entry heat and the max Gs were the big things that I found out even before I graduated. So I was going back to college, and the other guys, and we were actually coaxing our professors to do more work in high-speed entry, analysis, things like that. They wanted us to do airplane body stuff, but we were starting to get away from there, because we said, "Hey, high-speed research is the coming thing. Space is coming. It's going to be here."

But, anyway, Jack Heberlig and Bill Bland were flying four-stage rockets. Bill [Robert O.] Piland was the senior lead project engineer under Max Faget, and Bill later became the head of the Apollo program, after George [M.] Low and some of those others. He was in that range somewhere. I can't remember exactly where it was, but Piland was one of my heroes of the space program. He was a very quiet guy, unassuming, didn't want any medals or any of that stuff. He just believed in good competent work and then he really did it. I've never heard Bill really get all the credits and accolades he should have gotten from those days. He and Bill Bland were two super people.

We went over there and we actually—they said what they do is "We'll fly two stages of the rocket up, pick up speed almost straight up, and then as it uses gravity to come back down, then we'll fire the test samples into the atmosphere and get them up almost not quite to circular entry velocities, but very high," that they could get comparisons of the samples, how they ablated away and did those kinds of things.

So here it was, and that's another thing that as we got into the Mercury Program and we did, you know, the earlier kinds of testing with Little Joes and Big Joes and those kinds of things, they took some of those kinds of concepts and just evolved them. So Max and the guys that were doing or setting the stage for this, had started many years ago. They had this dream that somehow or another to get a capsule and get a man into space and get him back, you had to protect him. And the heat and stuff.

And it also so happened that I went to that aerodynamics conference after I'd graduated. You know, we'd graduated and started into, and it was the aerodynamics of space, and we got into that where all of these experts, H. Julian [Alfred J.] Eggers, and [H. Julian] Allen and those guys, had done a lot of the calculations and the equations for entering bodies, blunt bodies, how they do that. And we went and took their programs and things and brought them back, and incorporated them into our mission analysis trajectory programs to do the heat calculations. And then when the engineers came along and discovered what those operations [unclear] did, they took all that stuff to start doing their heat transfer calculations, and doing that working with the other guys. So it was always a team effort. Nobody claimed it as their own. It was just whoever got there and had something that they were doing.

So anyway, back to '56, we were still going along. And [Yuri A.] Gagarin went up in fifty—where am I at—fifty—when did Gagarin go up, '57?

RUSNAK: No, I think it was '61.

HICKS: No, '61 is when Gagarin. But, oh, it was the other satellite that went up, just before we had graduated. It was Sputnik. Sputnik went up. So that again put the emphasis, in my last year and a half at Tech, here again, I had sort of forgot about some of the stuff that Max knows, and I was really concentrated on the high-speed aerodynamics and the tunnels, and the Dick Whitcombs, so I was ready to go back when I graduated into high-speed aerodynamic research in the tunnels and things.

So that Christmas before I graduated in June, that Christmas before, I went back to Langley, and here were Max and all these guys looking at the ICBMs [intercontinental ballistic missiles], the Atlas, the Redstone, the Thor, the Jupiter, all of those missiles, and they were coming up with nose-cone concepts to replace them with a capsule that could fly on those systems, because the military had those. That was something, they were high performance, but we were only going to be talking about a capsule that weighed about 2,000 pounds, to put a man up there for maybe three to four orbits, they were talking about.

That's what the guys said, that we're getting ready to work there. "We're getting ready to put a man in space." And I said, "You guys are nuts." "Well, you gotta come join us. We need you."

So in June, when I got out, I went over there and I said, "You guys still need somebody?" So they said, "Yep, come on." So the group was forming then. This was before N.A.S.A. NASA was formed from NACA in October. Like I was explaining a little bit ago, the Langley guys always had this strict discipline of reports and techniques, the research. Their careers were based on this discipline of reporting test research, having data, going through an analysis, having editorial boards come in and review your stuff, challenge it, do this, and it would take two years for a guy to get a report out.

Well, they were trying to get promotions and things, and it would take a long time. So in June when Max and Chris [Christopher C.] Kraft [Jr.] was started, the flight research guys from the other side of the field, Chris and Chuck [Charles W.] Mathews and some of those people worked out at Dryden [Flight Research Center, Rosamond, California]. They would fly airplanes to do research, which was another way. And, of course, Langley was high-speed airplanes. But they were really looking at the high speed high-speed stuff, you know, the jets and the Bell X-1 and those kinds of things. So Langley had its fingers already in that kind of activity that was going on. It wasn't Dryden in those days; it was just Edwards Air Force Base [California]. But they were working with a lot of the Air Force guys.

And that's where a lot of the contacts with the Mercury astronauts and some of the early astronauts—those bonds began to form from Sig [Sigurd A.] Sjoberg and Walt [Walter C.] Williams and some of those people working at Edwards Air Force Base, with those kinds of people doing flight test research, which was basically what we were going to be doing. NASA had never really been into the operations business, so we looked at Mercury as being really a flight test program, and just trying it out. And at that time we didn't really know where we were going with humans in space. We didn't even know whether it would work or not.

So, first of all, the first thing we had to do is—we even were looking at instrumenting chimpanzees. And they started doing a lot of that work over at Wallops, because on the Little Joe project and some of those other—we were going to instrument up the chimpanzees and then later on fly them. The humane people never really got a hold of that, because I think they really lost a lot of chimpanzees, just trying to instrument these little suckers. It was a learning experience.

So a lot of people say there's a lot of chimpanzee bones spread along the beaches over there, that the humane people never found out about, you know, because it was like Ham or one of the other guys, remember when they put him up there, the electronics failed, and he kept hitting the things to get his reward, and all it does was kept juicing him back, and that poor little guy almost bloodied himself to death trying to hit that. You know, he really—it was sad, but, you know, it was just one of things that happen.

But so the chimps, the medical guys—so we were getting exposed to that. But in June they were started and Max decided to take of his group of people away from the Pilotless Aircraft Research Division and start moving some of the flight research people and the PARD people at Langley over to the Unitary Plan Wind Tunnel, to get us all in a group, because he was seeing at that time they were starting to make approaches to NASA Headquarters [Washington, DC] about doing a human space project. But at the same time the Air Force had the MOL [Manned Orbiting Laboratory] program going. They were in the leader's seat. But [Robert R.] Gilruth and Charlie [Charles J.] Donlan and their strategy, and the guys at Headquarters was that, okay, what the Air Force was doing was a military program. What they were going to propose is the civilian program for space, get the military out of it, let the civilians run it.

[Dwight D.] Eisenhower was in at that time, and they were making proposals at Headquarters which were then going to the White House, and Eisenhower liked that approach rather than letting the military run it, and the ramifications of all that that he might get into with treaties and with spying, and with all that other kind of stuff. They decided to go with NASA's approach, that these guys seemed to know what they were doing.

Well, the Caldwell [C.] Johnsons and the Max Fagets and these clever guys were making up these charts on Thursday and Friday, going to Washington on Saturday and Sunday, briefing those guys, and coming back with, "Here's what we need to do next," blip, blip, blip. And they were sort of carrying the ammunition in the small nucleus of what we call the Space Task Group that was formally formed, were working on these things, over on the Unitary Plan Wind Tunnel on the second floor.

We had these big offices with nothing really over there, just desks and a few computers, telephones. Everybody shared a telephone. You didn't even have a private telephone. And the computers, you had to go to the central computing to get work done. So a lot of it was what we called chartsmanship. And that's the idea that first came up that the way we would communicate is come up with charts and things. Even viewgraphs weren't back in those days, but it was handwritten charts and figures and things, because they'd use these plot boards, or these big artwork kinds of things. They were very pretty, but it would take time to produce those things.

So Max and those guys said, "We need some way to communicate that's fast and quick." So they came up with briefing charts. And that became—I think the space group were the guys that started all that. Of course, the rest of the Langley people looked down at their nose at this scrubby group of people because we were doing things that were not regimented, not disciplined along the lines of strict research, strict engineering, proper discipline, proper review, proper facts. A lot of the stuff everybody challenged, but that's what you wanted. You just wanted to throw out stuff, get people to think about it, and then we'd work the details later.

So they were in that mode of turn around things quick, come up with concepts. Caldwell Johnson, he would draw the things up, come up with good ideas. Engineering, Max would be at that. And that's the way the space program was sold. That's how human space flight—those guys invented human space flight. And we think that that whole group, we helped invent the whole industry. It was very neat.

One of my first jobs, when I came on as a—actually graduated in June with those guys, Bill Bland said, "One of the things we want to do with this capsule is we want to put it into space, but we don't want it to stay up there. It's gotta come down. If anything goes wrong, we don't want people sitting down saying, 'Oh, my God, you know, here comes the dead guys.'" He said, "It's morbid, but we gotta think about that. But we also gotta put it up high enough in an orbit that it actually doesn't come down. So, why don't you, Clay, go away and figure out what we need to do."

So that's they actually told me to do. That was sort of my project, to go from a GS-7 to a 9. He said "You work that out and we'll take that as your project." Because that's what they did directing Langley guys to get a 7 to 9, had the work projects and go through a review board to get approved to go the next higher level, so that was the way we were going to do it.

So that's when I started looking. The Cambridge Research Center had naval research labs. They were the guys responsible for all the density measurements, the altitude profiles. They actually had started cataloging and had equations and motions that, you know, equations that actually had the densities that you could put into a computer program.

At the same time, over in the flight research in the electronics part of Langley, they had some guys over there working that used to work with telemetry. They were already working with the case mechanics, space mechanics, equations of motion, and they had some of the elementary—that was John [P.] Mayer and Bill [Howard W.] Tindall [Jr.]. You'll hear those names a lot later, and you've probably heard them. But they were over there in that separate group, working that kind of stuff, and they began to get sucked into the space group with their programs.

I started and I found out with my research that they were the guys that had the computer programs at Langley. So I went over and started working with John Mayer, who was already working stuff with Max Faget and those guys. So John and I began became real close compadres. He liked what I was doing and said, "Those are the things. Yeah, Bill Bland and those guys are right on. We need orbital mechanics. We need to work these."

So we had the basic orbital mechanics, but we still had to do the ascent and the entry kind of stuff. That's why we needed the aerodynamics, the density profiles, the ablation stuff, the stuff on the Earth to figure out where these things were going to come down. Where were they going to fly over? Where would we put the tracking sites? All of those kinds of things. What inclination do we fly at, which was based on performance. And so we started, you know, those questions came on out and we just wrote them down because, first thing we wanted to find out, what orbit do we want to get this thing into, and start figuring out that.

So I went out to a conference at Rand Systems in 1959, after we had actually—NASA had been formed in October. We had gotten the go-ahead. They were already starting to line up the astronauts to come on board. The guys that were working were already cranking away. They were moving out and doing things. So I went out to this conference and I got listed as Dr. Claiborne Hicks. I think I was some pipsqueak, and I looked at all these guys, Allen and all these people, and we went around the room one time, and I had enough naivete to stand up. People were introducing themselves, and I said, "Well, I came from the NASA Langley Space Task Group, and we were going to put human beings into orbit and we wanted to do the aerodynamics of entry and ascent."

And there was a lot of mumbling in the crowd and everything, and then there was a cheer. Everybody clapped. And I went back and I told the guys, "I was really astounded." I said, "People were coming up to me saying 'Great project. NASA needs to do this.'" And I went back and told the guys, Sig Sjoberg and Walt Williams and those guys, and they said, "Well, maybe this thing is going to go. Maybe we've got something." Because here were all these high-ranking people, if you see on that list that I gave you, that were very influential. And here we had exposed them to what we were doing. The project wasn't getting that much exposure. It was getting some, but the big deals hadn't come down yet.

It was just another thing, like MOL. Nobody really paid any attention to that. But here were people that were interested, because they would be learning a lot and we contributed to their disciplines. It would just open up all kinds of new research and new things, and they were bright enough to realize that, that even though you're not doing humans—but Eggers, Allen, and all those guys at Ames [Research Center, Moffett Field, California] that were doing all these fancy equations, they'd been thinking about these things. And they came up and I realized that they had—I'd been looking in the Langley library and already pulling out their reports and having our computer programs go back and take their stuff to put it into our programs. And before long we had a set of calculations. We'd gone to GD [General Dynamics]. We went to Martin, got their ascent, even though it was confidential. We all had to get cleared by the military. We had confidential—had to write that all over everything, which caused us much pain. It caused me getting all kinds of citations for leaving shit out on the desk and almost—Kraft would have had to come down, "You guys have gotta put this stuff away," you know. And it wasn't exactly those terms. You know how Kraft talks. It was a little bit more colorful, a lot more colorful than that. "Goddamn you guys, get that shit out of the way." You know, "You're going to all cause me to lose my job." And he said, "If you have to, don't put confidential on everything." But I shouldn't say that. [Laughter] That might get him in trouble.

But, anyway, we got it. I came up with all kinds of charts of W-over-C_{DA}, which is weight over the drag coefficients. And these were on charts. About four or five years later I did all the altitude things, and we picked the altitude. I put my little report together, and the guys gave me my 9 promotion. It was about four or five years later that I saw four or five papers published in AIAA [American Institute for Aeronautics and Astronautics] and other things, where guys were first starting to do that on their own. But we had done that and just gone on because we had gotten where we wanted.

But John Mayer was working—I was then working very close with him and Bill Tindall, and other guys were starting to come on board. Charlie [C.] Allen came on board, Ted [H.] Skopinski came on board, Carl [R.] Huss came on board. So, starting in October '58, those next two years was growth. People were just coming on board, new people. So you had so many things. So a lot of those things we were talking about, the aborts, the ascent, a lot of the other problems with tracking stations, now we were getting other people to help. So they started getting into it.

So John was using me to sort of lead up the Atlas Program, run the Atlas trajectories, which were going to be the ones for the orbital missions. Ted Skopinski took over the role of being the lead engineer for all the Redstone and the Mercury, the Mercury Redstone, you know the suborbital-type flights, and some of the Little Joes and those, where I would do a lot of the tracking. Because I'd been into the aerodynamics, I got into the orbital debris. I got into the range safety stuff. I was going to the Cape [Cape Canaveral, Florida] meeting with Air Force, all these highfalutin guys. Here I was a little pipsqueak engineer. I think I weighed about 110 pounds, and pimples all over my face and that kind of stuff, you know. And a big—what do they call those kinds of things—you know, pocket?

RUSNAK: Protector?

HICKS: Pocket protector, with all the pencils on it. Man, I was the perfect nerd-type little guy. And, I remember one time when Chris Kraft, when later on we were doing some stuff with the Apollo service module about coming back in and maybe doing damage to some of the cities or stuff, so he had had me doing the calculations to figure out what the probabilities, what the dispersion patterns would be coming through the atmosphere as it broke up, the orbital debris kinds of things that happen, where if we dropped a service module and did the entry at certain ports, would Florida be impacted, or how long, you know. And then figure out the reliability.

I got into all kinds of statistics and probabilities, and I found out that our probability of hurting somebody with the service module in any kind of Apollo mission was like one in a million. You had about a fifteen—no, it was even more than that, it was about like a thousand more chance of getting hit by a lightning bolt, an individual, than you would be of hitting by—and I went through this rigorous thirty-minute thing at one of Kraft's staff meetings one time. My last chart had that ending line. In fact I said, "In fact, your probability of being hit by an Apollo orbital debris piece was about like 2,000 your chances of getting hit by a lightning bolt."

And Kraft sat there and he listened to that. And he says [applause], "Out of the mouths of babes." He said, "That last chart, Hicks, was all you needed. You didn't have to go through all that other crap." [Laughter] "So you took thirty minutes to tell me about all that stuff." So I went away—and it was good, because what he had said was I'd—being an engineer, I was trying to go through my methods. The old Langley approach where they drummed it into you: present your case, build it, sell it so they believe it. But Kraft's point was we were moving—"Give me the bottom line. Just tell me what it is, and if I don't agree with it, I'll come back and make you prove it to me." But he did say, "A good job," so that pleased me.

But we got into that. We got into the Mercury Program. There were other things going on. One of the things—we talked about the ablation material. And while I was still a co-op student—let me go back again. Because one of the other things Max had was going on over at Wallops, is they had what they called a high arc jet-type system, with a hot furnace, and what they were doing were putting samples, would come up into the airstream of this very hot flame, and they would sit there and measure how long it took for them to vaporize, until you could not longer see burning or stuff. And we had these samples which we were responsible for, which we went to the shops again, had the people work that up.

So, as a co-op student, on one of my trips over there, what I did was fly with the samples—the engineer there at the thing was putting them into the stream—but my job was to lay on a bunker back behind the thing with a sandbag. I had some binoculars and a stopwatch. And they would put the sample up in the stream. It was my job to sit there and time it. And when it was gone, I would look at, see how many seconds it was, and record that. And then I would take that data and fly back, and I'd put it in a report and send it to the guys. But that was one of my co-op—and that's all I needed to do was visualize it, observe it, and record it. But those guys were using it.

But what it did was it allowed me to talk to the guys. I learned as a co-op student, they used me because it was cheaper to send me over there for a week, in the desolate—you know, the married guys didn't want to go over there and live with the mosquitoes and the crawfish. At nighttime, all you could do was sit there and look at the stars, wasn't anything else to do but read books, you know. Cut out my dating life a lot, but I wasn't going anywhere at those times. I was too excited about just being there and talking to some of those old guys and doing that stuff.

But that was just another example of the kinds of things at Langley did with its young engineers. They let them do things. They gave them jobs, and particularly the guys working the space stuff. They weren't the shoddy old stodgy engineers that went straight by the book and everything. They were cutting corners. They were looking at shortcuts. They were looking at ways to get there quicker, to beat their competition, which then wasn't the Russians, but it was the Army and the Air Force and the military side, to keep our hands in the human space flight.

The other thing that Max and those guys were interested in was how would a human being adapt to the gravity and the G forces, the whole protection of a seat, the suit, all of that kind of stuff. Of course, they had lots of guys doing the suits and the pressure garments. But the thing that—my role got into it, because I would calculate the trajectories. We had an escape tower on top of the missile, and the capsule at that time had come far enough along. I'd calculated the rocket trajectories off of that, and it would get them up about 16 Gs. So we had the profiles of the G forces.

Max said, "What we want to do is—" The Air Force had sled tests going on. Remember John [P.] Stapp, famous name from White Sands [Missile Range, New Mexico] where they would do sled tests, fire his ass, you know, down the thing and his eyes would almost blast out of his head and stuff like that? Well, we tried to get John Stapp to go to Johnsville, Pennsylvania. Well, Johnsville, Pennsylvania, has a centrifuge. They had some human test subjects, but I think they had only gotten a human test subject up to about 18 Gs—I mean 8 Gs—because that's as most as high-speed aircraft were getting into.

So we went them a letter up there, told them that we would like to go up to at least 20 Gs. They sent it back and said, "Ha, ha, ha." So the guys had to go work with John Stapp and those guys, and they got them. And we finally got a guy named Lieutenant Carter [C.] Collins. I remember him. He became the lead engineer from the Navy on this project at Johnsville. This was going on, wasn't any publicity. It was just me and Jack Heberlig, or it was Max and the guys who were designing the couch. They were looking at the leg angles, you know, the G forces, the eyes coming back in, eyeballs in, eyeballs out, how you would do this.

So the first thing we had to do if we were going to put a guy in a centrifuge, we wanted to have a couch to protect him while we were even doing the tests, much less than when we had an abort or put it on a capsule or a real rocket. So we had to make sure that that thing was going to work. So what we did is we did the calculations and everything, and we set up a profile with several couches. We had about four or five models with different insulation materials and things to go up there.

Carter Collins had volunteered. This was a volunteer program. He had volunteered to be the test subject. And I think Bill Bland came along with Jack Heberlig and myself and we stood out in the window as they set this thing up. They went up to 8 Gs first, and then they went to 10 Gs. And we had all these profiles leading up, because we didn't want to kill anybody, but we slowed—you know. We took an engineering approach. We would walk up to it, and if everything worked, all right, press on, not knowing what the residual effects might be to the guy, you know.

But anyway, we got the guy up to 16—the first time a human being had every gone up to 16 Gs, and that was Carter Collins. And once we got that and the thing spun down, we had four more tests scheduled. And Carter Collins—we called him, and he said, "Fine." He said, "Nah, the suit worked fine. The seat was great." He said he was conscious the whole time. Everything was great.

So Bill Bland called back to Max and the guys are saying, "We've got four more tests that we're going to do over the next several days to see this."

And Max said, "Well, how did the tests go?"

And Bill said, "Well, it worked. You know, everything was fine."

And Max says, "Get the hell out of there. Don't do any more. You might screw the guy up." [Laughter] "Failure is not an option. Don't push it."

So that was another mantra that the guys had in there. When you get the data and the answer you want, don't keep pushing it, you know, unless you really think something's there, but, you know. Because if you keep pushing it and playing around—engineers like to have lots of data. And those guys were starting to be engineering managers and program guys. They only had so much money to do certain things, so their mantra was, "You've got the right answer. There wasn't any problem. Don't think about it. Let's stop. It's done. Let's put it into the design system and see what the people—"

By that time the McDAC [McDonnell Aircraft Corp.] people were coming on board to do the Mercury capsule design, so we would feed that information into their engineers and they would take it.

What we were starting to do then, Kraft and they guys were starting to bring on what they called a flight control team. This was about the time that Gene Kranz showed up. I remember Gene showing up. The astronauts had showed up earlier, the Original Seven, and they were right down the hall from us and we'd gotten introduced to all of them. They were whizzing around and doing things, going to meetings and talking to us and doing those kinds of things. Then Kranz showed up and he was sitting over in the corner or something, and we got introduced. I didn't really know, but he had been a hot jockey, you know, a hot test pilot and a Korean air veteran, and had been out there. I was in a meeting with him one time, and he started asking questions. And I sort of said, "Hmm, this guy knows what he's doing."

Then I found out that they had him in line to be a flight director. What Donlan and Gilruth and those guys were starting to do was they had Walt Williams and Chris Kraft starting to look at "If we're going to fly a guy, how are we flying? What do we do?" They had a group of engineers then starting to look at different console positions, that what would be the protocol and how would we do this. We were already doing the tracking and the orbital analysis and all of these kinds of things, and the system was growing.

The sequence of events might be getting out of here a little bit, but the Canadian guys showed up, so they were doing flight tests, the John [D.] Hodges, the Jack [John N.] Shoosmiths, and the Jack [N.] Cohens and [James A.] Chamberlins, and Rod [Rodney G.] Rose, John Hodge, who later became flight director number two. Because you remember Kraft was what we called flight director number one, and Hodge was number two, and Kranz was number three. They were our three Mercury flight directors. They were our team leaders and they were the guys we had to run everything through. If you couldn't convince those guys, you gave up and tried again.

But it was really interesting, because that gave us another avenue of discipline and control, because the Retros [Retrofire Officers] and the FIDOs [flight dynamics officers] had responsibility for the mission and the trajectories and the boundaries, the aborts and all that. So they started working those guys. And Glynn Lunney, who had been with us working, and Carl Huss and Tec [Tecwyn] Roberts, who had been doing space mechanics, they picked Tec Roberts to be the FIDO, and Carl Huss went over to be the Retro.

And, of course, they all had design—anybody who had a major console always wanted to be a flight director, because that was the ultimate. Like Kraft said, the best job in NASA in those days was to be a flight director, because you had, you know, more fun, more responsibility out there. You know, it was all on the line. But the guys that we were working with, that I was working with, were fantastic, you know. Tec Roberts was a Canadian. He came down with their group. He was very solid, very conservative, very sharp, and he would question you, you know, go through and check your credibility of the kinds of things. He never said "I don't like that." He'd always come up and say, "Well, why don't you look at this and look at this. I'd like to see how this plot or this plate would look." "Yes, sir," and then you'd go back, and it makes sense. And nobody really cared. You'd get together and the team kind of concept really took hold.

Kranz started bringing in another discipline. He would set up what he called ops reviews. He would have reviews of the operations guys, would set up how they were going to fly a mission, you know, like [Virgil I. "Gus"] Grissom's flight or a suborbital Mercury Redstone flight, and he would invite over engineers from the E&D [Engineering and Development Directorate] side of the house, the doctors, and a couple of Headquarters guys, and he'd call it an operational review. We'd have this two-day session where all these people would come in and review what guys were proposing to be done, and critique it.

Kranz came up with mission rules and flight rules and flight data packages and all of this stuff. And then we got the guys that were working with the crew members of the flight plan. They thought they needed that. So they came up with the concept of a flight plan. Well, that needed the trajectory. We always felt like in my business then, which was MPAD [Mission Planning and Analysis Division] mission, the flight trajectory and the flight plan, or the mission trajectory plan, was a road map for everybody to build on. We had to have our act together before the flight planners, the simulators, the engineers and everybody else could do theirs. And ours better be right, because a lot of people were spending a lot of money.

So we were very proud of that and we felt like that we were the guys that really knew the most about anything. We got really cocky, and John Mayer and Bill Tindall. It took the flight controllers and the doctors and people to knock us down every once in a while. But it was a friendly competition that we got into, and we'd work it.

In the meantime, you know, Chris had Sig Sjoberg working, and Sig was what I'd call the ultimate gentleman. He and Kraft were a super team. They went together all the way through their careers, and Kraft ended up as the center director. Sig was the deputy, and he just recently passed away, just a fantastic gentleman, one of those unsung heroes.

When I was on the staff of Kraft, doing the advanced programs back in '68, '69, I got to sit in at all the high-powered staff meetings that they would have. Chris, in his ways, he was always very "blues-talky." You know, he would just really—the science guys were ones he didn't like. He didn't really—the science people were always putting constraints on everything. They wanted this and they wanted that. He invited them in to some of the staff meetings and they would really rip him up. And after they were all gone, he'd sit there and he'd look and, you know, Sig would have his head down and he would say, "Sig, what do you think?"

And Sig said, "You shouldn't have called those guys those names, Chris. You shouldn't have said all that." [Laughter]

And Chris says, "You think so? I was just trying to get their attention."

He says, "Yeah, but you know, those guys we've got to work with. They had some good points."

And he would say, "Well, what do you think I ought to do?"

And Sig says, "I think you ought to call them and apologize."

"Shit, man." And he said, "Okay," and he'd pick up the phone right then. It had only been about five or ten minutes. I think it was myself, Rod Rose and Sig and Chris, but that gave me an insight that Chris always depended on Sig to call him, haul him in or help him, tell him when he was screwing up. And Sig liked that.

It came back a while later because I went out with the ops team to White Sands before we were going to do some of the Little Joe flights out there, and we were out there getting ready, and I think Walt Williams and all those guys—Sig was head of the ops team to get ready for the first simulation of one of the first flights we were going to do out there. We were using an old blockhouse that the Army had had, and we were sitting in that with our flight control team and all that with the guys to do that.

So Walt Williams and the [unclear] and the Headquarters guys and all those people were coming in for an ops review to make sure everything was kosher and ready. The press would be coming in the next day, and we'd have a test firing. So we'd gone through the review and walked. I'd been walking around the building and I noticed there were Coke cans and papers. It was just a trashy outfit down there. We never had anybody around.

So we were sitting in a meeting about ten o'clock that night, you know, and Sig was going over all the positions and everything, what they were going to tell these guys when they came around for the review, the briefing charts and everything. At the end, he sort of—he always opened it up—he says, "Does anybody have anything that we've missed?"

So I was sitting there like a dungster, and I raised my hand. He says, "Hicks, you got something?"

I said, "Yes, sir," I said, "I think this place looks like hell."

He said, "What's that got to do with anything?"

I said, "Well, we're trying to be a professional organization. You want people to believe in your credibility. You want people to think you know what the hell you're doing. How can you go in there with cigarette butts and smells and trash and crap all over the place? I think that's very unprofessional."

Cliff [Clifford C.] Charlesworth was a FDO in those days. He was sitting there. We were walking out of the meeting, Sjoberg says, "Well, all right, anybody else got anything?"

So we were walking back to the motel, get in the car. I was riding with Cliff Charlesworth because I was working close with him because he was sort of the FIDO on that test flight. And he was laughing. He put his arm around me, and he says, "Hicks, what the shit was that?" He says, "I'm going to call you 'Blockhouse' from now on. You're Blockhouse Hicks." [Laughter]

But the next morning we went out there, that place was spic and span. It had been shaped up. Guys had worked all night. He had gotten the Army guys out there, cleaned that place up. It looked good. I called Charlesworth "One Mile," because he was always trying to get within the impact point. I said, "All right, One Mile Charlesworth, what do you think of Blockhouse now?" So Sig had listened. But it was the same role that he had done, so I thought that. I said, "Fantastic." At least he listened and went and did something, and it made a big difference. The credibility with the big team before we got to the Cape and did all the other, it sort of set a tone and set a pattern.

That was about the time that Chris started everybody to wearing short-sleeved shirts and those thin ties. He says, "We're going to look professional." I think Sjoberg probably got back to him and said, "Rather than have guys with Hawaiian shirts and other guys dressed up and everything, our suit of armor is going to be white shirts, short-sleeved, and those thin ties." He said, "I don't care what kind of pants or shoes you wear, but that's the way we're going to start doing it. We're not going to be like Langley or be like the others. We're going to be professional."

And to this day, that's what the uniform—in fact, I think I went through NASA, until I retired I never really had a suit, did I? I had sport coats, because all I wore was white shirts and those skinny little ties all the time. It was interesting how the system evolves and the kinds of things that happen.

So that's how I got involved. We did Gemini, and it was fun. They did the first flights, and then they were saying, "Well, what kind of things should we do in Gemini?" And the Russians hadn't done an EVA [extravehicular activity] yet. But a lot of us at a meeting with Chris, Kranz, and those guys, we said, "We've got to do extravehicular. We've got to get guys outside to be able to do more things than just float around in that capsule."

This was while we were still flying—I think we were still flying Mercury flights then. I think we were trying to do the last Mercury, [Gordon L.] Cooper's [Jr.] flight, where we were trying to get him for eighteen orbits up there. We were already in Houston [Texas] by then, so we were meeting in the Farnsworth Building. We were spread out all over the place, and having those meetings. But we were over in the—what was that building? We were in Office City, right next to—and the flight controllers were in the other building.

BUTLER: The Petroleum Building?

HICKS: It might have been the Petroleum Building, yes.

FRANCES HICKS: Have you all heard of the flights down there on that Martin 407?

HICKS: The 404?

FRANCES HICKS: The 404. They furnished, for the employees here with the space center, to go to Houston to help you get acquainted with the area, pick out a home. You know, we went for like, what, a four- or five-day stay.

HICKS: The 404, that we used to go to the Cape on.

FRANCES HICKS: We weren't married then, and we were trying to find an apartment for Clay. We looked at apartments all around the area, and I was all lined up to live with about four or five other girls there. And we decided, I think it was on that trip, to get married, wasn't it? We found an apartment. Well, all the families were availed of that privilege, to go on that four- or five-day trip.

HICKS: To scout around and find places to live before we moved down there.

FRANCES HICKS: And Houston was just opening a welcome mat. I mean, we'd get free club memberships in clubs around Houston. There was an old nightclub called the Shamrock, the Shamrock Hotel.

HICKS: And the Clover.

FRANCES HICKS: What was that one that we joined? We saw all these entertainers. I mean, Houston was so glad to see us, that they had all sorts of special offers, of furniture at stores, and all kinds of things.

HICKS: Well, the astronauts were leading all of that. But they invited—there weren't that many of us, so they invited the rest of the guys to join along, so we went on that boony. Growing up in Newport News and Hampton, as to space, the people just weren't that thrilled about it, because they considered NACA engineers as weirdos, you know. Go in to buy a new car, they come in with their calipers and micrometers and measure everything under the car before they would buy one. But here, going to Houston, it was wide open and reaching for the stars, you know. It was just a whole other attitude. You go places and say, "Well, I work for NASA." "Oh, wow! Here, we'll give you 50 percent off on this, and 50 percent." We felt like we'd died and gone to heaven, you know. These people were really treating us so good.

RUSNAK: For someone who grew up in Virginia, how did you feel about moving to Houston?

HICKS: We were ready to go. My grandparents had raised me. My grandfather had passed away, and it was just the job, going to Houston, the Wild West and everything, but it was the job, still being with those people. Most of the whole group, everybody liked what they were doing. So we didn't know where we were going or what we were getting into, but we just decided that that's what we wanted to do. And so many people from outside were joining the team, that it was just—I didn't want to do anything else. That's all I really wanted to do, was do that job.

And that's why, when I got to Langley and they were forming the Space Task Group, you still had to make a decision. "Do you want to go off and be an operations guy, and a program guy rather than do research? And it didn't take me long, after going to Wallops as a co-op, seeing that side of it, versus sitting on an engineering stool and watching manometer tubes and things like that, and doing that kind of research versus what I saw coming. Once the Space Task Group took off and the astronauts showed up and, you know, there was all this hullabaloo and their stories and things, but you sort of didn't get caught up into that.

The guys were so busy working the program, they didn't get caught up in all of what I like to call the history. I don't know whether it's been your experience, but if you talk to the guys, we didn't really realize how much history we were doing. We were so enthralled with our job, that when the guys were going down the tickertape parades, we would watch it, look at it, and then go back and work on the next thing.

It's not till you become an old guy like we are that you really look back there and you say, "Well, gee, really, look what we did." Because you look at what's happened and how hard it is to do those kinds of things now, and how revolutionary and how open, and how that that opportunity was there at that time. You know, I couldn't have had a more glorious career and a more fantastic life. You know, running into Frannie, and the three girls I've got, and all the fantastic friends I've made. It's just been outstanding.

I don't think it will ever happen again. I hope it would, but I think it was just one of those things in time. All the elements just came together and this group of guys seized the day. The Gilruths and the Donlans and the Krafts and the Kranzs, and the Johnny Mayers and the Ted Skopinskis and the guys that have gone before are now gone. It's just fantastic. You know, those guys sacrificed a lot.

And, like you said, to move to Houston, to give up lives and give up things here, and a lot of people did give up their families. We talked about that a little bit before. There was a lot of—the guys were so enthralled with their job and so tied to it, that it did break up marriage and it did cause family problems. There were a lot of problems there, and I saw those. When my family started coming, I made a decision to let my family come first, and I don't think it hurt me that bad. I still got good jobs at NASA. But, you know, sometimes it slows you down, because operations guys—there's a lot of work. There's a lot of traveling. They've got to go, you know, the crew. And that's always been.

But Kraft and Kranz and all those guys, that's why they liked the—what do you call them—the chili cookoffs. They would have things where families could come. Now, what other center does those kinds of things? Maybe some of them have taken it up since [George W. S.] Abbey is in the leadership role and has gotten the guys to head up Marshall [Space Flight Center, Huntsville, Alabama] and to head up—KSC [Kennedy Space Center, Cape Canaveral, Florida] has gotten its own people. So it's been coming a little bit more. But they really believed that the people working were a team, and their families, they wanted them involved. And we did things as families. We socialized together. But we enjoyed each other.

When we went to Houston, it was just a matter of getting to know other people, and we liked the Houston people. The weather was dreadful and the places we had to live were dreadful, the mosquitoes and the bugs and the snakes and the floods and all that kind of crap, but here again, it was the spirit, that the people were just—

FRANCES HICKS: The NASA people, they were all in the same communities and churches and schools. I mean, you'd run into each other everywhere.

HICKS: Yes, we sort of segregated in certain places. But we did start, you know, running into other people in the community. You started integrating yourself in with what was going on. People asked me, like you guys and other people, what was the greatest thing you remember? It was the people. It really was the friends we've made. We still have friends that are dear to us, that we've lived with their kids, and we've cried at the *Challenger* and we cried at Grissom and [Roger B.] Chaffee, [and Edward H. White II, all killed in Apollo 1 fire]. The night Frannie and I were coming back from a restaurant, and the guys were doing the test, and we heard about the Apollo fire. You know, we cried all the way home. You think about those things. Those guys were here. [Hicks cries.]

FRANCES HICKS: The families who have been our community, you know.

HICKS: And that's one of the things that Chris and Gilruth and those guys, you know, they're your friends. They're part of your family. And Abbey does that too, because Abbey has always been close to the astronauts, and Judy [Judith A.] Resnik and all those people. He'll do anything for their safety. I think he'd stand up and say "No go" for a flight if he believed that anybody was in danger. So as long as he's there, I don't worry about the Shuttle missions. I still worry about the other flights, which we talked a little bit about, the unmanned programs and the cheaper, faster, better stuff, and the de-emphasis of systems engineering and operations input and telemetry. Look at results and really make sure, you know.

Failure is not an option. You can't fail. Every mission must succeed. And it's not possibility; it's based on probability. If there's a possibility of failure, the guy's got to have enough to guts to stand up and say, "No go." And I think our project managers have lost a little bit of that, in NASA in general. I don't think the human space flight side has. I think they still have the tough guys to make those kind of calls. Until we get that kind of swagger back in our step and the engineers take back over the agency again, it's—and I think we're starting around, I think with

Rothenberg [phonetic] and Bill [William F.] Readdy and the Mars reports, and the Gentry Leaves [phonetic] reports, and those kinds of things that I see passing my computers.

I sit here doing nothing and looking at it, and I'm starting to get reawakened. I see a hope that we're going to turn this thing around. I think once we do, and we start being successful, I think the funding will come again. I think we bent over too far backwards to reduce cost and cut people off the rolls and get rid of things. We've thrown away a lot of talent. Plus we've caused a lot of talent to leave. It used to be everybody wanted to come to NASA, to do our jobs. Now guys are leaving to go to dot-coms [Internet] and things like that.

We've got to compete with those people, and the only way you do it is to have exciting successful things to do. They talk about commercialization and all this stuff and turning it over, and I don't know. I've been outside NASA now for fifteen years. Even the last years when I was looking at early Space Station stuff, the commercialization, the probability and the jobs and the kinds of things to do that just aren't here yet, you know, or people would be jumping into it.

So we've got to get off that kick, and until we get a station up there and figure out how to do things at it, it ought to just be a—there was another thing John [W.] O'Neill and I did back in nineteen—I'm wobbling around a lot, but back in '72, George Abbey had us—where was it back, maybe it was—it was Shuttle. I'm trying to think of the year now where we did that. John O'Neill was still doing flight planning stuff, and I was doing—it was right after Skylab. It must have been '75 or '76 just before Shuttle was starting up. But Abbey asked us to take a look at Station and what role we should play and where we should go, you know, where should operations and systems go. So John O'Neill and I spent about a week going through things, and we went over to give George our report.

Basically what we came up with, we said, "Well, Space Station is going to be an entity. It's going to be a happening. We need it for human space flight. That ought to be an outpost. That ought to be JSC [Johnson Space Center, Houston, Texas] facility number two. We ought to name it George Low Engineering Laboratory or something like that," to become a funding item under the stream where it got funded as another NASA center, but under JSC or something like that, because to pay operationally or to pay commercially, that crap ain't going to happen anytime soon. And we're still trying to get it up there.

But this was back then, and John and I felt like that. We said, "Hey, the Station is where it's going to be, and NASA ain't going to let JSC run everything. So what we ought to do is take the transportation system to Shuttle, since that's an ongoing thing, move all that to KSC. Move the astronauts to KSC. Move the Shuttle to KSC. Let JSC become the on-orbit center and the Mars facility center and the moon facility center, to do all those things to keep anybody else from getting into that."

Well, poor old John and I, he was taking the lead and doing the briefing, I don't think we got past the first chart with George. He saw thing transfer the astronauts, and he says, "You guys have been eating loco seed or something." He says, "This is the most ridiculous thing."

And we said, "Please, George, just let us get through to the end and show you what we were thinking about and why we took that approach, and if you don't think that's something you want to do, well, we'll back up. But you wanted our recommendation."

And he said, "All right, that' fair. I'll shut up. But I don't like it." [Laughter] Grrrrr. He doesn't say much. He was mumbling under his breath and all that stuff.

So we walked on through and got to the thing. And you know, finally he says, "Well, I agree with all that end part. Do something about the front part, because we're going to keep the astronauts," and all this stuff. "We're going to leave that here." [Laughter] There wasn't any way George—I always tell people at Headquarters when I got up here that that sucking sound you hear from Houston is not [H. Ross] Perot, it's George." [Laughter] My Marshall friends, they don't like that, but, I said, "Watch out for George. He's going to have Houston back on the map." And he sure has. Houston's world-famous and continues to be that.

We've just got to get that Station stuff up there so we can start flying to it and get us guys and gals back up there in space and learning how to operate and do those kinds of things, and learn. I think the new wave of Clay Hickses and Glynn Lunneys and the John [S.] Llewellyns and all those guys will come out of the woodwork, because this nation just breeds the kind of explorers and the kind of people that are willing to take the risk.

We didn't think we were taking risks, but I guess we were, with careers and things, of going that route. Everything could have fallen apart, and I don't know what we would have ended up, but we just didn't even think about that. All we saw was the next step. Like you said, Kraft says, "You make that next mission work, and then the next mission will always be there." And once you start failing, though, that's when the seeds come in, and that's what's happened at NASA. We've let failure become an option.

That's why Kranz's book is going to be good. I haven't had a chance to read it yet. Like I said, I always like to read those, because you always learn something. I learned so much, even though I was there and a part of a lot of that, it's hard to keep up with everything, that everything's doing.

But the Apollo Program and going to the Moon, I don't think we saw that as an end; that was just a step. I think the guys doing the planning were really looking at the Apollo applications program to continue building that kind of hardware. And then we got caught up in this stuff of we only had so much money. And then, you know, do you pick the Shuttle or you pick the Station?

But I think if we had gone with the Apollo hardware, continued the Saturn IBs, we'd have come up with a dumb Saturn IB or something like that, which all the guys were looking at, which would have been a lot cheaper. And we could have kept throwing lots of, you know, weight up there and gotten stuff and been able to continue, because the CSM [command and service module] is the kind of module you need to fly from low Earth orbit back to the Moon. I've been involved in studies for—jeez, how long have I been doing this stuff, forty-some years, and there's not a better system than the CSM, the command module, the service module and a lunar module kind of a system to go to the Moon and to go to the planets. It just makes sense.

One of the things we had talked about when I was at Rockwell was having a common CSM, or a common command module, that would be a layout for a lunar part and other things. It would a module that could be used for tugs and other kinds of things, rather than just an end use, but be very usable, all that kind of stuff. And I think eventually you'll get there. I think you can do that with the Shuttle system. I think you can take like, you know, I've been involved with Rockwell, but I started with NASA. Max came up with the Shuttle system. It's expensive, but, by God, it works. You know, it has redundancy. Yes, we did have an accident, but, you know, we did that, and I think we made the corrections to take care of that, and we're flying. Of course, I get "pucker-up-itis" every time we fly, you know, until we get through max Q [maximum dynamic pressure] and get those solids [solid rocket boosters] off of there.

I'd like to see those solids gone, you know, with the reusable. Because I was working out at Rockwell [International] trying to help NASA get that sold, but we had to keep fighting with these people who wanted to change out the Shuttle system. They want to throw it away and come up with something cheaper. And I don't see it. I don't see anything cheaper. VentureStar, you know, they've loaded that dang vehicle down with so many technologies and they gave them that, and you can't do it all at one time.

The Russians haven't been able to do it. The Russians haven't been able to do the commercial stuff in space. Their problem with their Space Station program is they used it mostly for military, and I don't think their science and the other things they did, their culture and everything, didn't allow them to really use that system. So the argument that they've had a station, why haven't they done a lot of things, well, they couldn't do a lot of things. But I think a low Earth orbit facility was the right choice and I think it's the right way to go.

We've got to learn how to have human beings up there and live and use them, and then go to the Moon and have a facility there, and then talk about Mars. I still feel the physiology and the radiation and those kinds of things, and the trip time for the Mars is still a problem. So we still need nuclear engines. We need things like that to speed up that trip time, to really do the Mars, do that. So that's why it's so important to have the precursor missions work. You've got to have the missions to Mars continue their work so you continue that impetus to build. And this crap we've gone through now about throwing missions down the tube, thinking it's cheaper, we can just can come back with another mission, it doesn't work that way. Systems engineering is great.

Well, I've rambled on. Any other specific questions?

RUSNAK: I guess some about some of the different projects.

HICKS: How much time have you got?

RUSNAK: I think we've got a little bit.

HICKS: Okay.

RUSNAK: You mentioned Gemini earlier in talking about some of the new things they were doing, and you mentioned EVA. I was wondering about some of the trajectory-oriented things, like doing rendezvous and docking and the attempts to do that, and what was involved from your end, actually, to make these types of things happen.

HICKS: Yes. Well, as we were finishing up the Mercury missions and flying those, of course, I told you a little story about [M. Scott] Carpenter's 400-mile miss, and the fact that we did the—I had to do the analysis back, and we found out he was out in yaw, and how that all evolved. Sig Sjoberg was leading that review team, and we worked that out, and so that was a little sidelight. I'd been doing the post-flight stuff, and had always wondered, "Why are we spending all this time doing this? Why don't we just take this flight, succeed going to the next one?" And I guess that's why. You know, there we came pretty close, and it was imperative for us to go back and find out immediately why we did land long, and we did. The next day we knew, already had the answer, and we knew. The reasons were, we were prepared. We had set up to have that data. We had set up to look at those kinds of things that they did happen.

We used to tell people that in the business I was in, in those days, 90 percent of what I did would never get used. It was never 10 percent of the nominal, because we didn't have those—but when they did happen, you were glad you had that 90 percent. Many a time we went over to Chris Kraft's meeting with orbital debris, range safety, the abort, the "what if" questions, and we'd say, "All right, Chris. Here's what it cost us to do a lot of what your flight controllers ask us all the time, and what your simulators want us to look at. And we understand. We know why it's good." But everybody'd keep saying, "Why do we keep doing this way? We only use 10 percent of it. Why do 90 percent? Here's what it cost us to do it, here's the other. What do you want us to give up?"

"We ain't going to give up any of it." That was always the answer.

And that was the problem when Gentry Lee, when I was telling you about with the Mars precursor missions, where always in the back of George Low—and this was after he came down, after Joe [Joseph F.] Shea had the problems, you know, with the fire and everything. George Low had taken over the Apollo Program. And, of course, Chris' destination was always Mars. You know, that's ultimately where he wanted to go. And, go on. Go to the Moon, yes, that's a step.

In fact, Chris was one of the ones that called for stopping the missions to the Moon, for the exact reason, we've done them so many times, let's don't screw it up. Let's get onto that next step. But we got caught up in the budgets. We got caught up in all the crap, and we got trapped. But, yes, we might have screwed up Apollo, you know, if we keep flying the same missions. You just never know when a rock or whatever it is, or a piece of mortar or something, or a piece of solder is going to hang up in a—like my light switch. The other day I couldn't get it on. I finally took it apart and blew in it and put it back together, and the damn think worked. But a piece of dust or something had gotten in there. That's the first thing you do, rather than call an electrician, spend a lot money. You just pull it apart, kick it, blow on it.

But in space you can't do that to that stuff, you know. The experiences we got on Apollo with lightning, and the things going through that vehicle, you know. That stuff didn't work by accident. A lot of guys thought about those things happening, and made the different alternate circuits, the different redundancies. The same thing, [James M.] Beggs, when I went to

Headquarters, he would sit at the thing and bitch about the flight rules and bitch about JSC and bitch about the Shuttle being so expensive, and all these redundant systems. Well, heck, Apollo, we had redundant systems in the electronics and things that were required, and we had alternate paths. We had things, because we didn't want to abort during a—we knew there was a probability at some point, high atmospheric lightning and things like that are going to strike a vehicle. They strike airplanes all the time, and you have to protect for those kinds of things. It takes money to do those analyses. It takes effort, it takes engineers.

And with the Shuttle, same kind of thing. And I think with any kind of system, you've still got to have that kind of discipline in that system's engineering to ask the questions. What if this happens? What if that? All within the realm of possibility, and more so in the realm of probabilities, because some things might be possible but they're still out of the realm of the probabilities, if you understand what I'm sort of saying. And the guys would take that and then—and I think that's where Kranz's "Failure is not an option." And part of his was, "We're just not going to let it fail."

But how you make that happen is by working your ass off and looking at everything you could ever think of, in a simulation and in an analysis and in a discussion. If something does happen, you'd looked at enough avenues that they guys could sit there and boilerplate oxygen for Apollo 13, come up with new ways to scrub the carbon dioxide out of the system. Take what you've got on board and make something happen. And you go do it. You don't sit there and cry about it and say, "Aw, I wished I had this." This is what you've got, now make it work. And you know the crew is up there. They can do things, they can take it and pull things apart and put it together, and that's what the guys did. That's what they got paid for and that's why you spend that kind of money.

So all we did was get three guys back. We spent a lot to do that, but it didn't stop the program. We kept on. Made them heroes, they can write books. They get all kinds of things, their families grateful for it. You know, you got your friends back.

I think Apollo 13 was the greatest moment in flight control. It really was the shining moment. Those guys, the teams really made do what we had thought about. I remember running the abort trajectories back early in '67, '68 when I was still doing that kind of work. That's what we'd done. We said, "Well, suppose we can't fire her and we have to use the lunar module or something as an abort system, and stuff like that, if the service module is not working. How would we do it?" We'd run those trajectories.

Now, with Jerry [C.] Bostick and the guys that were the FIDOs and the things for Apollo 13, they kept noticing that each time they would track data back, the trajectories were off a little bit. They kept thinking about that, and finally they woke up and realized, well, yes, the service module was still there, because it was outgassing. It was putting in a vector component that they hadn't thought about. We'd just shut it down and that's what we'd done on our other calculations. But after a while when you looked at it—so they had to keep that thing back to make sure that when the command service module came back in, it hit that corridor. And it worked. And that's what we were working in the back room, the whole time.

So a lot of the other stuff that was going on in Apollo 13 I never even knew about. We were so caught up, and I was at that time, even though I was on the staff of Kraft, I was still helping the trajectory guys, because I was one of the guys that helped organize the auxiliary control room, and we were running a lot of those cases off line to do that, because you couldn't do that with the real time system, because we were putting in different components of the outgassing to make it match the real—and once we did that, we knew then, from on, to make the predictions the next day. And that's what the guys worked out. So that they wouldn't be off, we wouldn't have an error in it, for the actual entry when they got ready to come in. And you just did it. It was part of what you were supposed to do.

I think that's what Kranz always said, "Just go do your job and make it work. Don't tell me—don't come back with excuses." That's what John Llewellyn was so fantastic, because he sort of jumped in there on Apollo 13 and worked with some of the teams, and he was just adamant enough and hellacious enough and scary enough to scare the hell out of everybody if they didn't do something the way he thought it should be done. And you force the system to do it. They forced them to come up with the right answer. John was a very valuable guy. He was Retro number two. It will always be a craw in his—[Laughter] that Carl Huss was number one. I said, "John, you deserve to be number two." Carl was really number one. And Carl would have been a good flight director, but he had that heart attack and he never got a chance to—Kraft didn't want to—Kraft really liked Carl and trusted his judgment, and he didn't want to put him into that kind of stress situation. So Cliff Charlesworth and some of the other guys moved in there and did those kinds of things. But you had a group of people that were willing to do.

I remember when Sjoberg called me over, I was working Charlie Holland and the guys on Skylab. We had just gone through that. I was working payloads for the Shuttle Program, and Sjoberg called me over. He was running Flight Ops at that time, and he says, "I need your help."

I said "What do you want me to do?" And that's what you did in those days. When Sig or Chris or George called you and said, "I've got something I want you to do," you didn't say, "Aw, I don't want to. I like what I'm doing." You said, "Yes, sir. What do you want me to do?" They called you over there.

But Sig wanted me to go over and work in the Shuttle Program office, to take over for Shuttle mission to do the integration between E&D and FOD to work out all the problems that were going on, and about how long you going to keep the doors—they even opened the payload bay doors the first time out. Max didn't want to do that, but Kranz wanted to, because he wanted to stay on orbit. "Let's get up there and get the doors open and see what we've got," without a criteria.

Max just wanted to go up there, don't mess with anything. "If we have to come back, just turn around and come back."

Kranz said, "No, no. If we go up there and something's wrong, it's probably going to affect us on the way down, too. So we want to stay there. To stay there, you've got to open the doors."

Max was afraid to open the doors because of the sun and all the other—you know, the heating and the barbecuing and all the stuff, and the latches and everything. Suppose they don't work. Then you've got to do EVAs. Do you want to do all that on the first flight?

But they finally demonstrated enough confidence in opening those payload bay doors, and it was part of my job working for Deke [Donald K.] Slayton and Don [Donald C.] Cheatham and those guys in the program office, under Bob [Robert F.] Thompson, to work out the mechanics, with E&D guys, of making sure that those doors could open, and doors could now close, and that's why we ended up with a successful first flight.

But we had what we called mission project staff engineers. The young guy that was there working it wasn't really doing the kinds of things that Sig and George and Abbey and those guys felt like should be doing. Since my background—I'd been in mission analysis, I'd worked Skylab, over in flight control, I did a lot of the science stuff at that time when I moved back in from being on the advanced programs, so about '72 I went back into the line, went back into the Flight Control Division, rather than working in Mission Planning Analysis, because John Mayer says, "You've done this. Don't come back over here. Go somewhere and have some more fun." And that's what Kranz says, "Come on over here with us."

So I went to work for Gene in flight control, working on Skylab. The big thing then was, how we going to work with a scientist? If you remember that mission, it was a headache until we got Bob [Robert A. R.] Parker, the astronaut, to be—we called him Dr. Science, but at least he was a Ph.D. astronomer, astrophysicist, whatever. The science guys would believe in him. And he sort of became the key guy to set up the planning and the workout, the resources between the earth resources guys, the sun, the ATM, the Apollo Telescope Mount, guys that wanted to look at the sun all the time. You had the guys that wanted to look at the Earth all the time. You can't do all of them. And then you had the guys doing the auxiliary experiments, the other kinds of things that go into the airlock and that kind of stuff.

Bob Parker, bless his heart, was the guy that made Apollo successful. He was the guy that kept those scientists and worked out during the night, you know, the resources and with the heat shield problems and all the kinds of things. We got 100 percent of the EREP [Earth Resources Experimental Package]. We got 100 percent of the sun stuff, and we got 100 percent of the—we got more than that, probably 125 percent, kept all of the scientists happy. And that's what mission ops was supposed to be. That's what Skylab was all about. It wasn't just to get the thing up there. It was to see what you can really do in space. Can you do real things in space for a long period of time?

Dr. Bob Parker made that successful, with an attitude, "We're going to get everybody. You may not get it all at this time, but we'll get you something next time." And the scientists trusted him, that they would get their time. He worked it and made it happen.

Skylab was more fun because we'd get to watch them. Did you ever see the movie clips, the downloaded TV clips of some of the stuff [Owen K.] Garriott and all those guys were doing? You talk about fun in the middle of the night, watching what had happened during the day. That was dessert on the job, you know. After you get through planning the next day, and I was one of the formal managers, worked with Neil [B.] Hutchinson's team on the last mission, and I worked with the other teams during the other three missions also.

But I think the first time we flew I didn't get to fly because I got the mumps, that's what it was. I missed the launch because I got the mumps from my daughter. My dad told me I'd had mumps and I was going around—and man, I got sicker. I was so sick. But because the flight control teams are the way they are, they just moved me out and somebody else moved in. And I finally came back in after they'd—of course, they'd had the heat shield problems going up. And John Llewellyn got involved in all of that with the airlock. Because being a Retro, and he was into some of the science stuff then, he'd really been working on the airlock mechanics. And that's the way they had to put the shield and other stuff out through that thing, the makeup shield and all that stuff. And John took over that.

So here again, when you're in a crisis and you look at who steps up, it's the guys who are going to get things done. And John Llewellyn did it again. He was one of the guys that was in there, running amok. You had to really collar him down, but he made things happen. He just made it happen, and did a good job. Another unsung hero.

RUSNAK: That's right.

HICKS: But Chris and Kranz and all those guys, they loved the guy. They got his car tags back many a time for it. I told you about him drinking the Maalox—you know, the Pepto Bismal and putting it back in the tube. One time he got there late for a shift, and he got so mad because he didn't have a parking spot, that he pulled up on the curb, back at Building 30, it was just before you come into the back side, that little area. He pulled his little MG, one of those little two-seaters with a—pulled it right in there, just left it on the sidewalk, right up on the—and went in.

And, of course, during the thing somebody called Kraft and said, "This is unacceptable. Your guys are doing this."

And Kraft goes walking down to Llewellyn and says, "John, you've just lost your JSC pass for three more months." He says, "I've got to take it away from you. Go out and get your damn car off of the sidewalk."

And Llewellyn would say, "Why'd he do that? I wasn't hurting anybody. Damn car. I had to be here. My job is more important than anybody else's." [Laughter] He felt like that.

You know, but Chris would say, "All right, John." But he would come back later and pat him on the back about something, so John would feel happy and wouldn't be worried about it. Interesting.

RUSNAK: It certainly sounds like it.

[End of interview]