

ORAL HISTORY TRANSCRIPT

JOHN D. HODGE
INTERVIEWED BY REBECCA WRIGHT
GREAT FALLS, VIRGINIA – 18 APRIL 1999

WRIGHT: Today is April 18, 1999. This oral history with John Hodge is being conducted in Great Falls, Virginia. The interview is being conducted for the Johnson Space Center Oral History Project, by Rebecca Wright, assisted by Carol Butler.

We certainly thank you for taking time out of an afternoon to visit with us for this project. We'd like for you to begin today by sharing with us how you first became interested in aeronautics and then eventually space flight.

HODGE: Okay. Whenever I give speeches about what I've done in the past, what I tell people is that what you think you're going to do, you never do. Planning for stuff is okay, but you've got to be prepared that something else is going to happen.

I grew up in England during the war, during World War II, and was on the science track in classic grammar school in England, in high school. I was very good at math and chemistry and things like that. I decided what I wanted to do was to be a biochemist, so that's the way it was going to be.

Then the war ended just before I went to college, and in England they had a rule that said that 90 percent of the positions in the universities were going to be reserved for the ex-service people, which was fair enough. I mean, they had been fighting for five or six years, and most of them were old men like twenty-four and twenty-five years old. So there was only 10 percent of the normal spaces available for kids leaving high school to go to university. It didn't matter how good you were. So I was very lucky to get a space of any kind, and the only thing I could get into was aeronautical engineering. So I became an

aeronautical engineer. [Laughter] That's the first non-planning thing I did, and that's how I got into aeronautics.

Then when I was through with that, through with my degree, I went to work for Vickers Armstrong. They were the people that built the Spitfire, Super Marine Spitfire. Vickers was part of that company. I worked for them for two or three years, and then my wife and I decided to get married. We were going to go to Canada for six months, sort of clean things up before we decided to settle down, and that was in 1952. We've never been back since that. [Laughter] We've been back for vacations, but not to live. So that's another thing you don't plan.

I worked for an aircraft company there. It was a very good job. We built a supersonic interceptor fighter, which worked extremely well, it met all of its specifications, and just as they were ready to start producing it, the government canceled the contract. So there we were, all of us out of a job. We had just adopted two kids. [Laughter] So there we were without a job and didn't know what to do.

The NASA people came up to visit us, to see if they could get some people, because although it might seem strange, Bob [Robert R.] Gilruth and the guys couldn't hire people. Nobody wanted to work in the space program. I know it sounds strange, but that was a fact. There's a piece of the American civil service law which says that once they've advertised and can't get people, then they can hire foreigners. That's the only way you can get into the U.S. Government as a foreigner. Of course, there were about 1,200 engineers in the company at that time up there, and they'd all been fired. We got fired over the PA [Public Announcement] system, as a matter of fact. That's an interesting, sad story. [Laughter]

But the guys came up there, they interviewed fifty-five of us on a Friday, and on Saturday morning they offered thirty of us jobs, a full civil service job, no probation or anything. It was very interesting. I thought, my God, that's an efficient country. Anybody that can do that in the civil service is going to be going places. Of course, it was the only

time it had ever happened. [Laughter] As far as I can tell, it's never happened since and would never be allowed to happen now.

But thirty-five of us got those jobs, and we were all down here within—that was February. I was the last one to go down because I was a sort of backup back there, looked after everybody and all the wives and things, and all that stuff, and then when it was through, I went down. That was in April. We arrived the same week as the first seven astronauts.

So when people say to me, "How did you get to the space program?" I say, "I was fired." [Laughter] So once again it's this question of, it's not a planning thing at all.

WRIGHT: Was it your choice to stay back and help get the arrangements made?

HODGE: I was a sort of number-two guy of all the people. The most senior guy was Jim [James A.] Chamberlin, who, unfortunately, you're not going to be able to talk to, but a super guy, very, very bright guy. I was sort of the next guy down the list, is what it amounted to, so he opted to come down here, I opted to stay up there till everybody was cleared up. That's what we did.

On top of that, of course, we were in the middle of adopting our kids, so it was appropriate for me to stay at that time. As it turned out, I came down before we—I think we had sold the house, but hadn't got everything organized, and we didn't have a passport for the second of our babies, and we couldn't get one. We couldn't get one because they wouldn't issue a passport in her original name, and they wouldn't issue a passport in our name because she wasn't adopted. So it was one of those neat Catch-22s. So I got a frantic call from my wife that says, "I can't get a passport. If you want to stay down there, fine. I'm not coming without her." [Laughter]

So, anyhow, just quite by accident, she got the passport about a week before the—you have a four-month window to come in. About a week before that. She got it, and put the

kids in the car, with the dog and cat and goldfish, drove down to Newport News. The last thing she said to me before I left was, "Whatever you do, don't buy a house before I see it." And, of course, I bought a house. [Laughter] It was kind of fun. So that's how it all started.

You asked about Sputnik. To be quite frank with you, in Canada I think it had virtually no impact at all on anybody, and even us as engineers, we knew it was going on. It was just one of those things. At the time that we all got fired, I hadn't even realized that NACA [National Advisory Committee for Aeronautics] had become NASA, and that was about like four months before. It was October of [19]'58, yes. We got laid off in February of '59, and most of us were very familiar with NACA, because NACA was a sort of marvelous place. They produced technical information that was second to none, and what was even more marvelous about it was everybody could use it.

This airplane that we designed up there was largely designed as a result of the technical stuff that came out of NACA. Not the design itself or the requirements, but the sort of details like wing platforms and wing sections and operations. The aerodynamics of the stuff was very largely NACA, and mostly out of Langley [Research Center, Hampton, Virginia], actually. The intake stuff, which is what I was doing, I designed the intake system, we worked with Lewis [Research Center, Cleveland, Ohio], because they were the engine people, and we did all our engine testing there and all of our airplane testing down here at Langley. It was a very successful airplane.

Anyway, so from the point of view of Sputnik in space, it had no meaning to us at all and wasn't terribly interesting, to be quite frank with you. We were kind of ticked off that we couldn't go out and do airplane design anymore, because even down here there were two or three companies that were closing up. I think Northrup [Aircraft Corporation] had closed up. Consolidated Vultee [Aircraft Corporation] down in San Diego [California] had closed up. So the whole system was shrinking. Despite the fact that NASA, then the Space Task Group, in particular, was looking for people, they wouldn't join the space program.

We joined up in the normal process, which says, if you don't earn any money, you don't eat. [Laughter] So we didn't come to the [United] States particularly because that was the first thing on our minds, but because we were offered jobs. Then we just sort of joined in. The marvelous thing about it was that, first of all, we got hired so quickly, over that weekend. And then when we got here, see, there were ninety people in the Space Task Group at Langley, and when we arrived, we were thirty, so they went all the way up to 120 people, and we were 25 percent of the Space Task Group at that time. It was really an interesting situation. We also became an integral part of the organization immediately. There was no sense of moving in or anything like that. [Telephone interruption]

Okay. I think the thing that impressed all of us more than anything else was that we became a part of the organization immediately. One of the reasons, apart from the fact that they were a bunch of very nice guys, they really were—I came in to work for Chuck [Charles W.] Mathews. We had three divisions. We had sort of an Administrative Division, a Technical Division under Max [Maxime A.] Faget, and the Operations Division under Chuck Mathews. We had so much work to do.

Of course, NACA had never done a project like this before, hadn't done, really, projects at all. NACA was a research organization, so they did research projects, but it never ended up with anything, didn't build anything, and everybody was learning in the organization. With us coming in from industry, having done nothing but build things and not done research, it was a very good meld of people. It was really kind of interesting, the way that worked. Everybody had a job to do, and it was one of those cases where you sort of looked around and said, "That needs to be done," and you talked to somebody and they said, "Well, go do it," and that was it, and you went out and did it.

Travel regulations and things like that, we broke every rule in the book. We really did. We had a young lady whose name was Tony Tuccori, who was the travel person. Just one person, that was the travel office. By the time we were working there, there were maybe

200 people in the organization. But she just had a little office in the building we were in, Building 104 at Langley. How about that. Sometimes your memory does work. And like Chuck would say, "Hey, we've got a meeting on operations in St. Louis [Missouri] on the spacecraft. You'd better get out there." So you'd go out and see Tonie and say, "I need to go to St. Louis." "How much do you need?" And you'd say, "About 300, 400 dollars." She'd give you 300, 400 dollars and a book of travel tickets. You know those orange—those green books? That was money. She'd give them to you. "Give me back what you've got finished when you come home, when you come home." It was crazy.

It took them years to sort that paperwork, because they came in and audited us just before we went to Houston [Texas], and they were just shaking their heads. [Laughter] And some people got fired, actually, and it was kind of weird. We were working sixty hours a week, as you can imagine, and flying all over the place.

My family came down about two months later, I think it was like June, Audrey and the kids at that time, and I went back to pick them up. What I did, we used to have a shuttle that flew back and forth to Lewis, a DC-3, because we had a lot of Lewis people working with us. So I hopped a flight on the shuttle up to Lewis, got to Lewis, which is at the airport there, on the other side of the airport from the main terminal, so they drove me. I slept in the wind tunnel that night. They drove me around to the airport the next day, I got on a plane, went to Toronto for sixteen dollars. [Laughter] Can you imagine that? Picked Audrey and the kids up, followed the van all the way down to Newport News [Virginia], and moved into the house.

Two years later, they came back and said I was not eligible for leave because I hadn't been in the federal government for ninety days, and you can't take leave until you've been on board ninety days. And this was sooner than ninety days. Despite the fact that we were working sixty, seventy hours a week. Anyhow, they worked it all out and I didn't have to end

up giving the money back, which at that time would have been kind of expensive. All these little things that you remember come back to you when you start talking about these things.

WRIGHT: When they talked to you about the job, what did they tell you that you would be doing, since this had never been done before?

HODGE: Well, that was a part of it, because part of what they said was, we had to learn as we went along. The people that came up to interview us, there was Bob Gilruth, who was running the project; Max Faget, who was running one of the divisions; Chuck Mathews running the other division; and the administrative guy—I forget his name now—came up. Paul [E.] Purser came up. You've probably talked to him. He's a guy who always wore a scarf around his neck, a white silk scarf, all the time. So there were about six or eight of them, the most senior people in the organization.

They interviewed us, and we weren't really looking at it from the point of view of, "What kind of a job do you want me to do?" It was, "Do you have a job for me at all?" [Laughter] But what happened was, those guys picked the people that they wanted. Like Chuck Mathews picked me because at that time, in that job, I was running a piece of the flight test program on this supersonic airplane that we were doing. So there were several people like me that were in the operations side of things that he picked up. Tec [Tecwyn] Roberts was one of the others, and Peter [J.] Armitage and Denny [Dennis E.] Fielder. Have you talked to Dennis, by the way?

WRIGHT: No.

HODGE: Oh, you must. He's down there in Houston. Terrific guy. Absolutely fantastic, a real character, a great guy. I guess Peter's still down there, isn't he, Peter Armitage?

WRIGHT: I don't know. I'll find out.

HODGE: So Max Faget picked up really the technical guys like George Watts, was one of the technical people that he picked up. Dave Ewart. A Canadian guy [Owen Maynard]—gosh, I forget these names. He was a born Canadian. As a matter of fact, he retired recently and was going back to live in Canada. Rod [Rodney G.] Rose went to work for Max, I think. Yes, he went to work for Max. So that was the way they split them up. I don't think they picked up any administrative people, as I recall, because most of us didn't know anything about federal government anyway, so it wouldn't have been much use. So we sort of shared between Max and Chuck.

I had done a lot of different things when I was up there, so I was sort of a "man of all trades, master of none" kind of thing, and Chuck asked me to become his technical assistant, so he was sort of really only just beginning. They'd only been in business for like five months and hadn't done any operational planning at all. Chris [Christopher C.] Kraft [Jr.] was running the Control Center Branch, so his job was to design the Control Center that eventually went in at the Cape. Jerry Brewer was running the remote site design. So I went in sort of a coordinating between them in order to make sure that the Control Center could talk to the network and all that kind of stuff. Chuck Mathews had done the original network design, and all we had to do was get ready.

The funny thing about it was, they had just let the contract in February of that year, and the contract was for 19 Mercury spacecraft for 19 million dollars. That was it, 19 spacecraft, 19 million dollars. Of course, when we got down there, and it wasn't that the other guys didn't know what they were doing, it's just that they had never been in the business of manufacturing products and so on. So there was no provision for test equipment to check it out. None whatsoever. There was no provision to launch the vehicle. That wasn't

part of the cost. And so there was no provision for how did you accept it once it was built. How did you know you got what you bought? That kind of thing.

So a lot of our work was associated with this, deciding how we were going to get the spacecraft down there, how we were going to check it out, did we need a contract for it. Because eventually that 19-million-dollar contract became 100 million dollars, was what it amounted to. And that was because of "Oh, I forgot" kind of things all the time. That's sort of what we did as much as anything else.

I remember George Watts did all the structural assessments, flight assessments, how much could the vehicle turn and twist, and what does the strength of the Atlas have to be. Because that was a big part of the problem, as you know. Probably had all kinds of technical jargon on that thing.

It was kind of neat. We were having a ball, we really were. Of course, the wives didn't think much of it. Having adopted two kids, we got down there and the inevitable happened: Audrey got pregnant. Just before John Glenn's—no, about a year before John Glenn's flight. So that we had the new baby when John Glenn flew. That was Nicky, the one you just met.

I was going to go to Bermuda because I ran the Bermuda station as a flight director at that time, because the reliability of the communications with Bermuda was very low, so we needed people there. We couldn't rely on the telephones. In fact, as I recall, there wasn't a cable, even, to Bermuda at that time. They eventually put one in. So we had to be a sort of autonomous center that could run the mission if communications failed or the Cape failed, so we became a backup control center as well. That was the concept. So I was going out to Bermuda all the time. Of course, Audrey was saying, "Yeah, yeah, yeah, how hard you're working," and all that stuff. [Laughter]

WRIGHT: In Bermuda.

HODGE: And then about two weeks before the baby was due, I was still going to Bermuda, and I had a stomach ache, and Audrey said, "Well, drop by the hospital and get yourself a blood test." So I went down there, and the guy said, "Take your clothes off. We're going to take your appendix out." She says, "Boy, isn't that like a man. Two weeks before the baby." [Laughter] So I was in the hospital at Newport News, and I called up Chris and I said, "I can't go to Bermuda, because I'm just about to have my appendix out." He said, "Okay," and that was it. [Laughter]

WRIGHT: When you all moved to the Langley area, did you form a sense of community?

HODGE: With each other, you mean?

WRIGHT: Or a larger community with those already there as part of the Space Task Group.

HODGE: The Canadians immediately integrated with the rest of the people. In other words, it was more a relationship with the Task Force than it was with each other, although, of course, there were friendships there, as you might suspect. It was very much an insular group, the Space Task Group was, even insular from the Langley Field, the Langley Research Center. We were real oddballs. You've got to remember that. This kind of an organization had never been in NACA, and Langley was still really NACA, not part of NASA, and we were one of the early ones to start running programs. It was quite different than the Research Center.

So by the time we moved down to Houston, there were 900 of us, I think, and we went down lock, stock, and barrel. That was an interesting thing, because the question was, how did we all get down there and under what circumstances, and did you still have a job if you decided not to go. Those kind of questions were fairly important.

A fellow called Wes [Wesley L.] Hjernevik, that you may have heard of and will probably get some data; if you don't, ask Chuck [Charles F. Bingman] to tell you about him, because he worked with him. He came down from headquarters because we were so screwed up from an administrative point of view in the Task Force. He dreamt up this wonderful idea, and, of course, from then on I've always mistrusted these administrative people. [Laughter] He says, "Your job no longer exists, but there is a job down here which is exactly like your job, but it's in Houston. If you'd like to take that job, you can. If you don't, well, then your job no longer exists." It was sort of we really didn't have a choice; we had to go down there. Although a few people didn't want to go, and they were nice enough to find work for them around. But virtually everybody went.

I arrived in Houston—as I say, I got down there in June, and again I was one of the last ones because we were still flying the Mercury spacecraft at that time, so although the technical people had finished their work and they were working on Gemini by that time, we were still flying Mercury. So the operations people were the last to go down to Houston, and that was, I think, the end of June we went down there.

WRIGHT: And that year was?

HODGE: [19]'62. We were all over Houston. It was weird. We had about eighteen or nineteen places, and everybody was sort of self-contained. What tended to happen was that each of the organizations were their own little fiefdoms. See, at that time I was assistant division chief, I think. I can't remember now. Chris, I think, was a division chief, yes, because he took over from Chuck Mathews. Chuck got sidestepped. There was a big argument about that. I can tell you about that, too. I don't know how much of this kind of stuff you want to hear.

We had the front of a warehouse. It was called the Stallmyer's Building. I don't know what kind of a warehouse it was or what they sold. It was white goods of some kind, but what we got was the front end of it, which is what was the reception area and then the offices upstairs. That was where my division was at that time. But of course you're separated from everybody else. Essentially what happened, you got your own budget and you did your own thing, and nobody bothered you as long as the work was getting done. That's the way it worked out.

WRIGHT: Was there a time when you all met together to exchange ideas?

HODGE: We had lots and lots of meetings, as you might suspect, and that was really the trick of the way the organization worked, was if you had a problem, you put a bunch of people together to solve the problem, and then when the problem was solved, you all went back to what you were doing before. Very, very efficient organization, lasted about three years, then became very, very inefficient. I have often said that NASA went from birth to senility quicker than any other federal organization I've ever known. It really became a solid bureaucracy very quickly, which is too bad, because those original days were a hell of a lot of fun. I'm sure a lot of old guys like me say that. I mean, you're going to find that it was certainly never quite like it used to be, but it really was special, I can tell you.

Then we moved into the new facility. None of us knew where Houston was. It was the sort of thought, somebody says, "We're going to move to Houston," of course, they had this fake search to decide where we were going to go, and we were going to go to San Francisco [California], we were going to go to Tampa Bay [Florida], four or five places, all of which sounded exotic to us, and there was Houston tacked on the end. Of course, I was stupid enough not to realize that when the chairman of the Appropriations Committee came

from Houston and the Vice President came from—chances were we'd end up in Houston, which, of course, we did. I learned a lot about the federal government in the process.

WRIGHT: In a very short time.

HODGE: A very short time. So we ended up in Houston. I don't know if you've seen some of those early pictures of the site. It was a marsh.

WRIGHT: Cow pasture, I think is how it was referred to.

HODGE: Cow pasture. That's what it was. And wet. That was a stone road that went down there. NASA Road 1 was [FM] 528, and it was a stone road that went down to the bay there. There's a story that says when they came in, the first thing they had to do was make the land suitable to build on, which meant they had to drain it, all that kind of stuff. They put pilings in. A big machine came in to drive the first piling, and they put it down and hit the top of it, and it disappeared. [Laughter] That's an apocryphal story, but that's what it was like. It's still pretty muddy, actually, occasionally down there.

WRIGHT: When you were in Langley, before you moved to Houston, were very involved with what was going on at Langley and then, of course, down at the Cape [Canaveral, Florida]. Could you share with us how you were able to accomplish so much, being so far away?

HODGE: Well, that was an interesting point, knowing how to do that. Let me go through a little bit about what happened. Chuck Mathews was the division chief. Headquarters was worried that we didn't have enough operational experience and that we needed somebody

with a bit more experience, and they brought in a fellow called [Walter C.] Williams. He was running Edwards [Air Force Base] at the time. Have you ever heard—he died four or five years ago, I think. A brilliant guy, very heavy, very arrogant, couldn't stand Chuck for reasons that I never really understood, and took very much to Chris, who was a charmer in a way, although Chuck Mathews is an absolute 100 percent gentleman, a real nice guy. And rather than cause trouble in the organization, Chuck became Max Faget's deputy, and Chris took over the Operations Division. Walt Williams became deputy of the Task Force. So all these intrigues were going on all the time, they really were. It was a very interesting kind of thing.

There was always this question of should you bring people in. It was an insular organization that tended to want to promote from within, and yet we clearly didn't have the capability and you had to bring outsiders in. So it was very difficult for an outsider to jump into that. You asked the question of did we, the Canadians, become cliquey. Well, we didn't, but I'll tell you, the Space Task Group did when we got down to Johnson [Space Center (JSC)], to what was the Manned Spacecraft Center [MSC] then. It was very cliquey. I mean, we were unique in NASA at the time, and there wasn't anybody else. As far as we were concerned, we were NASA, and that was the only thing that counted.

It was a very, very insular group. In many respects, that was good news because everybody worked together. Nobody was out to get anybody else, and it was terrific. But to get into that group was very difficult from outside, although to get into the group from outside from other NASA centers or from headquarters was difficult. To get in as an outsider, from industry, it was fairly easy, because, as I say, we were about 900 when we went down there, and in three years we were 5,000. So it grew by a factor of six or seven in three years. And we all had authority to hire. I was hiring people right and left and center. You didn't have to go through all this crap that you do now to get somebody on board. And we got a lot of good people.

In that three years, to give you a sense of the people in my division, because Chris became an assistant director, and so the three divisions, under Chuck and then under him—I lost my train of thought there. Was hiring like mad. We were doing our own hiring. But to give you a sense, in that period I had—Glynn [S.] Lunney was in the organization when I came in, so you know him. Arnie [Arnold] Aldrich came in at that time. Gerry [Gerald D.] Griffin. I'm trying to remember. Cliff [Clifford E.] Charlesworth came in. All these people who eventually became Center directors or running the program were all branch chiefs in my organization. It was amazing when you think about it. And those guys were mostly hired off the street. It's incredible. Really good people.

You probably don't know Harold Miller, although he was the guy who invented the simulation system down there, very, very good guy. One of the first guys he hired was—he became deputy on the Space Station Program, has recently retired [Carl B. Shelley].

WRIGHT: How did you find these people? You mentioned they came in off the street.

HODGE: They made application. We went through the applications, we picked the guys who were in the top of their class, and told them to come in for an interview. We had an interview with them, after which they came on board just like that. And we really got some good people. I mean, I have to say to a large extent it was sheer luck.

It was interesting, because although at the time that we came on board nobody wanted to be part of it, by the time we were down in Houston, we'd already started to fly and we were getting a lot of publicity, particularly astronauts. I mean, that was the key to this publicity. It became gamesmanship, in a way. The reason they gave us so much freedom to do this was because it was helping us with Congress. Then the guys straight out of college started to flock to us, so we were able to take—Gene [Eugene F.] Kranz was the other guy.

Gene was a branch chief under me. Glynn, Arnie, Gerry. Incredible, when you think about it.

WRIGHT: Yes, it is.

HODGE: So I'm sorry, I can't remember—

WRIGHT: We were talking about Walt Williams.

HODGE: Right. So there were these kind of things going on as new people came into the organization. The trick was, how were we going to do our job in operations and arrange for the move, and where were we going to do these things. We had made a decision that there would be—or Chuck had made the decision there would be a Control Center down at the Cape, we'd have another backup Control Center in Bermuda, and then we had a half a dozen or so stations around the world on a couple of ships. The thing was set up.

Really, he did a fantastic job in setting it up, because we had contact about every twenty or thirty minutes for the first three orbits, and then after that we only got to see them once in orbit, so it was ninety minutes. The trick there was to make sure that all the decisions were made by the end of the third orbit, because it was going to be ninety minutes before you got to see them the next time. Now, that was okay, because the first few flights were only three orbits anyway, so that was okay. But as we moved on and we had longer times, we had to be more careful about making sure everything was okay.

The other thing we had was this communications problem. People forget that in 1959 and 1960, there were virtually no cables around. You were talking to everybody by radio, a very inefficient way to do it, and the people were only seeing the spacecraft for six minutes in a pass. You were lucky if you got six minutes, as a matter of fact. So there was very little

time to do anything, and half the time you were losing communications, so every group had to be sort of autonomous, is the way we were operating it at that time.

We were doing that at the same time we were planning moving. We were doing the initial planning for the Gemini spacecraft. In [19]'61, the Apollo Program was announced, so we were participating in the original studies for the Apollo Program. I mean, that's a huge amount of work. As I said, by the time we moved down in September, there was still less than 1,000 people and we had three programs going. So everybody had plenty to do, and it was great.

I think one of the things that really disappointed me as we started to move down was the enormous influx of people and inability then—you had to get into the management business, as in the business of setting the jobs up and letting people go do them, and it became very bureaucratic very quickly. By the time we got 5,000 down there, it was hopeless. I guess we must have had at least that number of contractors. In the Flight Control Division I had about 200 contractors, and I had about 50 Air Force guys who were doing the Blue Gemini. Have you seen the Blue Gemini Program? So they were coming in to learn from us on how to do that.

That was kind of interesting, because just before we started to fly, I had started to write the initial mission roles. That's not what we called them. We didn't know what they were, really. I remember talking to Chuck. I said, "We've got to do something here, because we need to know when it's okay to lift off. Clearly, we're never going to be in a situation where 100 percent of the things are working, so under what conditions will you say go?" And so I started to write a set of notes. It was a memo which I have downstairs somewhere, that says, "Okay, if one of the stations is out, then we'll fly. If Bermuda is out, we won't fly. If the C-band radar at the Cape is out, we won't fly. If the S-band radar is out at the Cape, we will fly." So I wrote this memo down. "That sounds like a good idea."

Gene Kranz had just joined us, and, boy, he took to this like a duck to water. It was incredible. Because from then on, there was absolutely no problem with mission rules. Gene took that job on and produced them immediately, started to produce them, and they became—well, I'm sure you see what they are now. It's about that thick, as I recall.

What we did after that, and it became the essence of the way we did business in the operations game, every time somebody dreamt up a problem, a potential problem, we'd get a group of people together, appropriate people, and we'd sit down and argue it out until we decided what we would do if that problem occurred. Sometimes we found things in the spacecraft that said, "We've got to fix that. You can't allow that to happen." So we'd go over and see Max Faget's people and say, "We found this problem. You really need a redundant circuit" or something like that. So they'd do that. But most of the time we'd end up having written a rule associated with that. Gene has a very orderly mind, did a fantastic job of putting that together.

What happened was that everybody that participated in those discussions began to understand how we came to a conclusion. What that did was that if something happened that we hadn't talked about, everybody knew the way we had come to those conclusions and were able to come to a conclusion as an individual, or two or three people, in a way that twenty or thirty people had done previously, because there was a sort of way of thinking of the whole thing. That was really a secret, I think, of the whole flight control business. The mission rules, of course, became the hallmark of the organization.

Incidentally, another thing that was going on before we left Langley was, we were designing the Control Center, the new Control Center. So that was going on at the same time, and that was part of the Flight Control Division's job at that time, to design the Control Center. The original contractors were—Philco, I think it was, were working for my organization. So there was a lot of work, when you think about it, a tremendous amount of

work. Boy, it was fun, though. And that was it, I think. You had to have fun, you really did, because you couldn't have lasted out. And that's what we did, we had fun.

We got it all worked out that we would go down to the Cape and do the checkout there. The other part of that thing was the question of how did you check out the spacecraft when you got to the Cape. We called them capsules in those days. [G.] Merritt Preston was a guy from Langley who had taken that job on, and he was Chuck's deputy division chief. He and I shared an office for a couple of years and got to know each other very well. There was very little planning had been done when we arrived in February-March period, about how many weeks you were going to take to check it out; what the checkout consisted of; what kind of tests do you do; how do you integrate the flight crew part of the program from the ground crew part of the program. Then we started to invent this whole process of simulation.

Merritt Preston, "Press," he ended up going down to the Cape, and then a group of people from McDonnell-Douglas¹ went down there, and they started what is now Kennedy [Space Center, Florida], but it was one hangar in the old Air Force test base at that time, and it was Hangar S. In Hangar S they did all the checkout, and "Press" ran that thing. But we started to think in terms of simulation, and so we would do these sort of practice launches that were integrated with the Control Center. Then when the simulated launch occurred, from that point on what you did was you ran an imaginary mission, and then you'd have a group of people who were dreaming up problems.

When we started doing that, we did it with what we called a paper simulation. In other words, we had one of the hangars at Langley. I can remember a bunch of blue curtains hanging up, with each piece, "This is Bermuda" and "This is Australia" and so on and so forth, and then they had, seemed to me like hundreds of young ladies who were running around with signals. So we'd write the paperwork down and they'd take them off and send

¹ McDonnell Aircraft Corporation merged with Douglas Aircraft Company, Inc. in 1967.

them around, and we'd do that for the mission. That was the beginning of the whole simulation system, because it got very sophisticated, and is very sophisticated now. But the first ones we did were these paper simulations. It turned out to be invaluable, absolutely invaluable. I don't think we could have done it without those simulations.

So the question then was, when we moved to Houston, where should we put the Control Center? Because we had been running down to the Cape, and the integration between the Cape and the checkout people, the flight control people and the checkout people at the Cape, was very important. That closeness was very important. And from a crew point of view, too, because they were down at the Cape as well.

So Chris wrote a letter to Gilruth that said essentially, "It doesn't make any sense for us to go to Houston. We need to go to the Cape. What's more, the flight crew." And Gilruth said, "Absolutely not. I don't care how logical it is, how much it makes sense. If I own the astronauts, I own the program. And we're going to go to Houston." [Laughter]

WRIGHT: And off they went.

HODGE: Right. And that's what we did. But it was interesting. Gilruth always comes across as, you know, a nice, quiet old man. I don't know if you've read any of the stuff about him. That was one of the things that I was really mad with the guy who wrote the MSC thing, MSC history, because Gilruth was not a nice little old man. I mean, he was a real tough cookie. He was a nice tough cookie, but he played politics with the best of them. That was one example where there was absolutely no question.

Walt Williams wanted to go to the Cape, Gilruth's deputy, and so that really got to be pretty bad. Walt, what he really wanted to do was separate the operations' function from JSC so there were really two JSCs. In many respects there still is two JSCs. But it got so vicious

that Walt eventually left and went to—I think he went to Aerospace. But that split between engineering and operations continues to this day.

The big fight that took place was the question of who controlled the budget, and were the operations decisions made independently of the technical decisions in the spacecraft. Of course, the whole concept of program management came up. When we were at Langley, it was a program. That's all it was. It wasn't really an organization in the normal sense; it was a program. So everybody had a budget and everybody did their own thing, and everybody acted independently. When we went down to Houston, we became an organization and we had three programs, and you couldn't run three programs the way we had run one program, so you had a Program Office. On top of that, headquarters insisted on having a Program Office because they wanted to fund the money down through the Program Office.

Then typically what happens is the Program Office got fairly arrogant about who got the money, and so started to fight with the line organization, so it's a classic line-staff fight, a management fight. I'm using all these words, but they're real. They really are.

In the meantime, we were having arguments about the fact that the operations group should be separate from the Program Office, because we were the only ones who really had multiple programs running at the same time. Good argument. And since Gilruth wouldn't let us go to the Cape, he did back off and let us have our own budget. So what happened was, headquarters gave operations a budget and they gave the program a budget for the construction of the various vehicles and test programs and things of that kind. But it always remained separate. And you'll notice even after Chris took over as Center director, that split stayed.

The other thing was, they always kept the astronauts separate from the rest of operations, and that had partly to do with publicity, partly to do with the facts that Bob Gilruth and certainly Chris wanted to keep personal control of that situation. And George, of course, was doing that and went after Chris, absolutely ruthless, I have to tell you. I mean, if

he didn't do what he told him, he didn't fly. That was straightforward. I'm sure crews will tell you about that, if you want to talk to them. You should talk to some of the crews.

HODGE: So that was how the organizational things started to happen, and with Gilruth making the decision not to allow us to stay at the Cape, we had to design the Control Center, which we started about six months before we left Langley. Then we had to work on this communications problem. That was the biggest problem of all. In fact, what we did was we put a land line in to the Cape, sort of almost dedicated land line.

One of the things we discovered in that process was that what we did was, we rented our own line, say, to California, which was one of the stations, and then we borrowed a line from the Air Force, and we thought that way we got complete redundancy, so if one goes out, we've always got the other one. It turned out the Air Force got their lines from the same place we did, and we lost contact with California at one time because a bulldozer went through the line that had both our lines in it. So we lost that.

We had to look at all kinds of crazy things. AT&T was really an independent organization. In many respects, the government didn't hire AT&T or run AT&T. AT&T did what it wanted to do and told the government that's how it was going to be. For example, we could not connect anything within the Control Center to an AT&T line without an AT&T person doing it. A lot of that's all gone now, but there was that kind of situation. There were tremendous fights with industry over things like that. As I say, in the beginning we weren't allowed to do that in the Control Center. Big, big fights.

Anyhow, we went ahead and built the Control Center down there, and I think the operations group were the last people to move in, as usual, because we sort of followed up everybody else like the Lord Mayors Show. We had the Control Center working in time for, I think it was, the Gemini IV mission, and what we did there was, we launched from the

Cape. The Cape Control Center controlled the vehicle until it took off. By that time we had Bermuda remoted, so we didn't have to have a team out there.

As soon as they took off, we transferred control to Houston, so we needed four flight directors at that time. We only had two prior to that time, Chris and I. Then when we flew [L.] Gordon Cooper [Jr.], that was a full one-day flight. We were still in Langley at the time, and we knew we had to have two shifts, and we knew that we couldn't break off. We couldn't leave the guy on his own out there. So Chris and I worked out a schedule where he took over the important things like takeoff and landing, and I filled in in between, and we worked it all out that way. We set up places to sleep down at the Cape. It was all very primitive.

But what we were learning all the time we were doing that was what we needed in the way of a new Control Center. It was that sort of stuff that really gave us the real experience. Nobody else had done this before, and although we all said, "It's just like an airplane operation," it really wasn't. It was quite different. And there was virtually nothing in the unmanned program that compared to what we were doing; it was just an entirely different kind of thing. For one thing, they had very little control once you took off. The unmanned program, you know, you waited for everything to happen. If it worked, that was fine. If it didn't work, it didn't. But in our case, we did have some control over our own future, so you needed this ability to communicate, this whole business of ground rules and that kind of stuff, and that's how we started to build the Control Center.

That was an interesting period. Designing and building the Control Center was kind of a fun thing, and I would guess there were really four people that did the bulk of what I would call the conceptual design, which is what was this thing going to look like. That was Chris, myself, and Tec [Tecwyn] Roberts, that you can't see because he died about five years ago. A neat, neat guy. I'm sure you can find some stuff. As a matter of fact, [Robert E.] Ed Smylie, he worked for Ed Smylie for some time, for about seven or eight years. "Tec" was

another one of my good friends. But he came down to Houston and then he came back to Goddard [Space Flight Center, Greenbelt, Maryland], and he worked at Goddard for many, many years after that. One of the people he worked for was Ed, so you might get some of that stuff. Anyway, he was the third member of that group.

The fourth one was Dennis [E.] Fielder. Dennis' background had been flight test. His training had been at the Royal Aircraft establishment in England. He was one of the early electronic nuts. There weren't many of those people around at that time. He got into that. He had one of the first tape recorders, for example, on an aircraft, and building telemetry systems and things like that. It used to be very, very primitive. They don't realize, there was nothing around in 1959.

The computer in Bermuda, for example, was a 7090, an IBM 7090. The memory on it was 8,000 words. Eight thousand words. My guess is that your desktop computer has probably got 6 megabytes, 10, 15. Megabytes. That's million. This was 8,000. Now, that system was the old-fashioned system where you had little magnetized rings with three wires going through it, and it operated by changing the polarity on the wires. That 8,000 fitted into a cabinet that was eight feet by eight feet by four feet. It was incredible. And the whole program was in that 8,000 words, so you can imagine what it was like. So it gives you a sense of what the state of the art was in communications. As I say, you virtually couldn't talk around the country very much. We had this problem that AT&T ran everything, so you didn't know whether you were getting safe stuff or not. They wouldn't guarantee reliabilities, no matter how much you paid. They wouldn't guarantee.

Dennis did a lot of the work that was associated with how did the Control Center fit into the rest of the world, which was really the communications part of it, and in addition to that, he really brought forth the simulation system in the Control Center. Gene Kranz later on brought in a lot of the work related to the specific design, that there would be a central

Control Center. I think we called it the MOCR in those days—mission operations control room. I don't know whether they call it that nowadays. Then we had the staff support room.

We learned that at the Cape, because we had guys from Max's organization, who were sitting at the telemetry system of the Cape watching the tapes come in, and then reading them and then talking to the people in the front room to say, "Hey, we just got this," and so on. It was all very primitive, and we knew we had to have rooms where the specialists could sit and send information through the front room. We needed display systems. That's how the TVs came in. And we needed sort of generalized information, although the big screen up at the front, that was a big hoax, in a way, when you think about it. That was just pure publicity. Never needed it, and we never really did need it, but, boy, you know, any visitor came in, including the chairman of the Appropriations Committee or the President, or Jimmy Stewart came one time, I remember, and they went back, and everybody knows what the Control Center looks like. It's kind of interesting to me that ever since that day, you look at any Control Center, it looks like that place. And everybody has one of these big screens in the front. Nobody understands that the only reason we put it there was for publicity. [Laughter] But everybody copied it, right?

WRIGHT: So as a flight director, you were listening to the folks in there other than gazing upon a big screen.

HODGE: Right, yes, yes. That was the other thing, the whole protocol of how you talk to each other. We had these loops within loops, [unclear] about ten people you talked to, and then each of those ten people had ten more people they talked to, and so on, cascading down, though you could get in and talk to anybody you wanted to. But that was sort of hierarchical, the way you talked to each other. And because we put those steps in, so that you could stand up and watch the other people, because there's something about seeing people, at least there

was in those days. The new Control Center is dead flat. I notice that. So it's quite different. I think it's perfectly okay. It's very good, as a matter of fact, a hell of a lot more technically capable than the old Control Center.

There's another story about the Control Center, too, and that was, we were sitting around deciding on sort of the final things we were going to do before we went ahead and let the construction contract, and Walt Williams was there and says, "You've only got one Control Center." It had two floors. One was the Control Center and staff rooms, first floor was the display system and the computers, and that was it. And he said, "We need another floor." And we said, "Why?" He said, "Because if one doesn't work, you need two. We can't fly without one, so you have to have two." And that decision was made in ten minutes, probably cost about 30 million bucks, I would think. Just like that. [Laughter]

But I guess it was the right thing to do. It made it a hell of a lot more difficult to run because now you had to have interconnections between the two floors, and the stuff on the ground floor had to be able to control anything on the next two floors, so we got into a situation where we'd be running a simulation on one floor and be running a mission on the other floor, and you had to split the computers up. We ended up with redundant computers. I can't remember how many we had then. Five or six. Two sets of display systems.

Now, the other thing that Dennis did was to design the specifics of the—Carl Shelley [phonetic], by the way, is the name of the other guy I was trying to remember. The specifics of the simulation system. That was when Harold Miller came in, and he hired two or three guys that were absolutely fantastic. Carl Shelly was one of them, and the guy who was the guy who became Center director at the Cape, recently became Center director [Jay F. Honeycutt]. Can't remember now. You can find it. He was one of the people in Harold Miller's simulation [bunch].

That became the sort of wherewithal for us to make sure we knew what we were doing, and the people who were running simulations had to have a very curious kind of mind,

because what they were trying to do was to fool you, of course, the whole thing was. So they were looking for ways to fool us and were always trying to prove how stupid we were, which they did very frequently. [Laughter] And very, very good.

Then we'd do a simulation. I would say at that time there was Chris and myself. We brought in Glynn as a flight director to run Gemini IV, when we first started the thing, and Gene came in as the third flight director in the Control Center. So we ended up with Chris had taken the red, I arbitrarily took blue, Gene took white because of the flag bit, and out of perversity Glynn took black. So we ended up with red, white, blue, and black. That was the first time we had four flight directors. In fact, there's some pictures around with the four of us together in the Control Center.

WRIGHT: And where did the concept for the colors come from? Was it just a way of distinguishing?

HODGE: It was just to distinguish. The idea was that we needed to set up teams and we had to call them something, and the sort of Red Team concept was fairly normal in programs. The military used them all the time. So I picked blue. Everybody picked their own colors. Cliff Charlesworth came in next, and he picked mauve. He was the next one who came in. I don't know what the other guys did after that, because I had already left by that time. So when I left, at least when I left the flight operations, we had just five of us.

We started all jobs. There wasn't a flight director's office. There was Chris, who was running the directorate; there was me running the division; Gene and Glynn were running branches. Whenever the flight directors needed to get together, we did that, so it was sort of separate from the normal day-to-day job. It wasn't until quite a bit later that we started to bring other people in.

So the simulation became really the heart and soul of the whole thing, and I think it's probably the most important decision that was made. Ended up costing about 25 percent of the total cost of the Control Center, the simulation system did.

Other interesting little things we did, we had this pneumatic tube thing for sending messages around. Well, nobody had ever done that before, you know. I'm sure you're young, but you're old enough to remember in department stores they had these things they'd pull and charge around the place. Well, that was the beginning of it. But what we wanted to be able to do was to go from one place to another place, like a telephone. The trick then was, how do you join things together with pneumatic tubes so that you could send it to anywhere you wanted to. Have you ever been downstairs and watched that thing work?

WRIGHT: No.

HODGE: You ought to go down there to look at it. It's kind of interesting. It's got this huge arm. I think there are about ten circuits you can get on it. It's got this huge arm which swings backwards and forwards, so that when you send something down, it moves over to the right place so that it knows where to go. It's always doing this, every time you send a message. That's why it takes so damn long. It was always getting jammed up. [Laughter] We had these specialists who would come in and know how to go find where these bloody things were so that we could send messages to each other. That's how primitive it was. Now you send a fax. You can send a fax to the next office or the next desk, but you couldn't in those days. You couldn't do that.

All part of the little things that were occurring as we were designing that, and they all led to how we would run missions. I think the heart and soul of the missions was the mission rules and the simulations. That's what it amounted to.

WRIGHT: Everything was evolving at one time.

HODGE: And continued to do so, really, I think through the beginning of the Shuttle Program, and then it sort of stopped. It was very interesting, because I had left NASA in 1970 and went to join the Department of Transportation, and it was [19]'82 before I came back, so it was twelve years. One of the first things I had to do, I was going around to all the Centers because I was just starting the Space Station Program, and I went down to Houston. I was like a kid, really, to play with my Control Center. It hadn't changed. I couldn't believe it. It was like a time warp. I went back there, it was just like it was when I left. The same controls, operating the same way, same number of consoles, same organizational concepts.

WRIGHT: That foundation had been set and had proved worthy?

HODGE: Well, that was the theory. Quite frankly, I don't think we were that clever. I just don't think we were that clever. I think what happened was, they stopped putting money into operations. We were fairly successful. The operations people were fairly successful. We really hadn't lost anybody. The worst thing that had happened was Apollo 13, and that wasn't a flight operations problem. As a matter of fact, flight operations saved the day on that one. So everybody said, "Hell, you guys don't need any more money," so they didn't put any new stuff in, which was a shame. It was a shame. They gradually did. They were putting in individual consoles. You'd go down there and you'd find everybody got their own private computer sitting on the side. I don't know whether you've seen some of the more recent things.

Then, of course, the question came along during the Space Station, do we need another Control Center? My personal feeling was, we didn't need another building, but, well, JSC wanted another building, so they got another building. [Laughter]

WRIGHT: It had certainly come a long way from Hangar S.

HODGE: Oh, no question about that. [Laughter]

WRIGHT: How was that received in Hangar S when the folks from the Space Task Group started coming down there? Were you well received?

HODGE: Oh, yes, because we knew all the guys, you see. As I say, I had shared an office with "Press," so it was fine. We got along very, very well.

Another guy you may have come across the name, anyway, he was never in the civil service, was John [F.] Yardley. Yes, he was in the civil service. He became Shuttle program manager. He ran Hangar S for McDonnell-Douglas, so he sort of worked for "Press" and the pair of them together, we had a whole bunch of really good civil servants down there and a bunch of really good McDonnell-Douglas people. Some of them became very famous, John himself.

Another guy whose name you'll hear all over the place was Guenter Wendt, who was the guy who always looked after the crew when he buttoned them up, became very famous.

WRIGHT: Those Mercury days must have been very exciting—

HODGE: Oh, sure.

WRIGHT: —because they never stopped, and you kept watching things change. Can you tell us some things that were happening during those early days that you were starting, even before it became evolving, you were creating before it could evolve.

HODGE: Well, I think the thing was, we were never quite sure—see, the reason the people hadn't joined and they couldn't get people to hire was because they thought it was a fly-by-night thing. We'd get enough money for two or three years, we'd do the Mercury Program, it would be all over. Well, we were successful, is really what happened, and so they decided—[President] John [F.] Kennedy made the decision about Apollo, but at the time that decision was made, we had not got a Gemini Program, and we all of a sudden realized that we didn't know how we were going to get to the moon and that one of the keys was going to be this rendezvous thing, and we didn't know how to do that. Had no idea how to do it.

WRIGHT: So I guess you were surprised to hear President Kennedy make that announcement? What was your reaction when you heard that?

HODGE: Well, happy, for sure. I mean, pleased as punch. And we were ignorant enough not to know what we had taken on, I think is what happened. Then Jim Chamberlin, who was the guy senior to me that came down from Canada, started the Gemini Program. There were two main things the Gemini Program was sold for—three, probably. Our guess was two crewmen. Multiple crew, is what it amounted to; rendezvous, which is how the Agena [booster] got into it; and a land landing.

It was interesting that people don't remember that the Gemini spacecraft was supposed to land on land, and it had a parachute which was actually a parasail, a very exotic deployment mechanism which would allow it to land on the desert, essentially, is what it amounted to. Never could get the damn thing working. Never could. So we ended up all the equipment associated with the land landing was left in design, because it didn't have time to change it, so the deployment mechanism was all there, but all that came out was a parachute,

just a regular parachute, and we landed in water. The guy that talk to that about is Rod Rose. He was the program manager of the parasail, I think it was called.

So, of course, what was happening was, we were learning all the time, and there was so much to do. Then Gemini came in in the middle of it, and that was another thing we had to do. That's when we realized we didn't have enough people. You didn't have time to sort of think about organizational things. You just thought about getting the job done. It was really quite spectacular.

WRIGHT: These days preparing for Alan [B.] Shepard's [Jr.] flight and those that followed, were you ever home, or were you always on the job?

HODGE: I was home, actually, fairly often, but during the early Mercury days, my job was mainly to get the—well, the job at home was to help design the sort of conceptual stuff, as far as the Control Center was concerned, and the flight control organization. My operations job was at Bermuda, so I'd go up there about once a month for a couple of days, three days, something like that, and then I'd go down to the Cape two or three days once a month, so I was home about half the time, I would think, something like that.

It was kind of interesting, because I very often took on the night shift in the Control Center, because my mind works on planning as much as anything else, and that's when you did the planning, on the night shift. So I'd be on a night shift, which meant that I was home to sleep during the day, so my kids got to believe that what I did for a living was sleep. [Laughter] So my two daughters would play "Mommy and Daddy," you know, and one of them would be lying down on the couch fast asleep, and the other one would be wandering around saying, "Shh. Shh."

WRIGHT: Then your activities moved more from the planning, as you mentioned, when you went to Houston.

HODGE: Right.

WRIGHT: You actually moved into more of the flight director duties. Could you explain how that expanded, where you were working with a different type of work?

HODGE: We didn't do much traveling after that. Once we got in, it was the mission planning. Of course, what we did was we split the missions up so that there was a mission planning function for every one of the flight directors. All the flight directors participated, but one was the lead guy for a particular mission, the same ways the crews worked, really. So Chris was running the—I think it was the Gemini IV thing out of there. I can't remember who did Gemini V. I remember I did VIII. I remember that one. I think Gene Kranz was doing the 76 [Gemini VII/Gemini VI-A] we ended up doing. That was the way we rotated, so although we all participated in all of the missions, in addition to that we had one mission which we were responsible for getting done, so that was the way we operated.

By the time we were at the end of Gemini, we started doing the Apollo Program, and now it gets schizophrenic, because you've got to remember everything about one program and about the other one as well. So I took on the Apollo Program, the unmanned Apollo part, 201, 202, and 203. Then Chris and I and Gene were going to do what was then called 204, which was the first manned one, with [Virgil I. "Gus"] Grissom and [Edward H.] White [II]. Of course, they had the thing blow up on the pad and killed them all. I was on the Control Center at the time. We were running a simulation, so it was messy. But Chris was the lead flight director of that.

It was getting to the stage where you just couldn't handle the administrative functions of running a division of several hundred people, or Chris couldn't do the same thing either, and then the operational function of planning a mission and the operational function of doing a mission. It just got too much.

WRIGHT: How did that begin to sort out?

HODGE: Well, it's difficult, I guess. Chris and I had sort of agreed that clearly this had to end; we couldn't do it anymore. We sort of made an agreement that we would end when we got the first man on the moon. In fact, what happened, I think Gilruth told him that we were not going to do it anymore, and that we had to go do the other stuff, couldn't do the fun stuff anymore. That's the first time Chris and I had a falling-out, which I find I do very often with my bosses. He appointed a whole bunch of new flight directors and I didn't know anything about it before he did that, and I was so pissed off that I decided to leave the operations game. So that was when he brought in, I think, [M. P.] Pete Frank, about five of them. Gerry Griffin was one.

I had no problem—see, I think what had happened was that the other division chiefs, there was Johnny [John P.] Mayer and Bob [Robert F.] Thompson and Pete [Henry E.] Clements, were getting mad because all of their flight directors were coming out of Flight Control Division, and they were alleging that they had people that could do it. I had no problem with that at all. What I said was, "If you're sure they can be flight directors, they can come and work for me," and they didn't want to do that. They ended up, that was then that they set up a Flight Director's Office that was separate from that point on, and reported directly to Chris and not to be.

I had another fight with him earlier. See, what was happening was, Flight Control Division got to be very powerful, because the contractors for designing the Control Center

worked for Flight Control Division. We were running the missions, and we were essentially designing the Control Center, and we were supplying all the requirements for the worldwide network directly to government from the Flight Control Division, which we were still ending up with about 80 percent of the budget, of Chris' budget. The other big one was really Johnny Mayer. He did all the trajectory stuff and things like that. And Bob Thompson was the sort of third guy that had really not a very large budget at all, because it was a very much a hands-on kind of a piece, the recovery stuff.

So Chris thought that we'd go out of balance, and so he split my organization in half and brought in Henry Clements. Have you come across Pete Clements? Yes. My nemesis. And he took over the running of the Control Center himself, not the running of the missions, but the running of the Control Center as a facility, and the requirements [that went to Goddard]. My division stayed in charge of the requirements, so they never built anything that we didn't want, but I no longer had direct control over it.

In later years I came to realize that that was a very serious mistake. I can understand why he did it, but what happens is, if all you have to do is provide the requirements but you're not responsible for funding associated with it, then you become irresponsible, is what tends to happen. And I think we were fairly light and easy about the requirements we put in. Some of them cost a great deal of money, a great deal of money, that was unnecessary. You learn those things later.

So that was when I decided it was time to go do something else. I had been bitching to Gilruth prior to that time that they were not doing any planning for follow-on Apollo missions. In other words, the whole Center was working on Apollo 11. By that time—oh, God, who was the guy who was the program manager, came down from headquarters eventually, went back to headquarters? Was with Bellcomm.

WRIGHT: George [M.] Low?

HODGE: No, not George. George took over the Apollo Program after this other guy.

WRIGHT: Joe [Joseph F.] Shea.

HODGE: Joe Shea. Right. Terrible to forget these things. Everybody knows Joe Shea. He only had red socks. So he sort of came close to a nervous breakdown, went back to headquarters.

George Low, who was a Center deputy at that time, became program manager, and George [S.] Trimble came in as deputy from outside. Nice guy. He's a guy you ought to get to, if he's still alive. He's got to be ten years older than me. Must be. And I had been working with him on—I forget what it was that brought us together. I just said, "We have got to start planning for the later missions. You cannot do this," because the second landing was four months after the first, and we weren't doing anything.

So I went to see [George]. He said, "Go talk to Gilruth." So I went to see Gilruth, and I said, "You know, we've got to do something about the follow-on missions."

He said, "I don't care. I don't want to go back a second time." He said, "If we get those first three guys back alive, we're going to be damn lucky, and I'm not going to do it a second time." It was very interesting. We had a very interesting conversation. So he said, "I'll tell you what. You go ahead and work on the design of the missions, the follow-on missions, and George Low and I will worry about Apollo 11," which is what we did.

I said, "Okay, George. Let me go do that."

And he said, "But you're not going to work for me; you're going to work separately." So they set up a separate program office, which was called—the first one was called the Lunar Exploration Program Office. We set that up over a weekend. I was amazed how quickly they do things. Typically a senior person, like assistant director or program manager,

has a great big office in the corner and all that kind of stuff. Well, they built one of those over a weekend—everything. Fancy carpets. I don't know where the hell everything came from, but they did. Gilruth told me to do this on a Friday, and on Monday I moved into the office with about thirty people.

What we did was, we started to design—Joe [Joseph P.] Loftus [Jr.], who's still there, was one of the guys in that organization. Neat guy. I like Joe. In fact, you should talk to him about that period. It was kind of fun.

We had two things to do, really, was to decide, first of all, how many missions we wanted to fly, how many sets. Where did we want to go, and was there anything else we had to do to design, to change the spacecraft? It was kind of interesting, because by that time my reputation was as an operations type, because everybody knows operation types can't design things. Oddly enough, before I joined the Space Task Group, I had virtually done no operations work and everything in my life had been design work. So you always get this reputation for doing best what you are doing now.

Anyhow, we started doing that, and we did the preliminary design, and then Joe took on the job of working on the design of the spacecraft, the LM [Lunar Module] particularly, to increase the length of stay to fifty-four hours, so it was a fairly significant change in design. I think we spent about 150 million dollars on it. My contact with the Apollo Program Office, which was run by George, was Jim [James A.] McDivitt. Jim McDivitt was [George's] special assistant at that time, and so we worked together with Grumman to get the new design put together, and then we worked with—I forget what it was called. Space Science Board, I think it was called, that was helping us design and decide where to go.

I remember we had a wonderful week out at University of California at Santa Cruz. Have you been out there? It's beautiful. It's built on an English campus thing with separate little colleges in each place, all independently of each other. Very, very nice place, right in the middle of the woods. We stayed there for a week and had about a dozen scientists, most

of whom were Nobel Science, Nobel people. Fascinating week, talking about what we should do, what we shouldn't do.

One of the guys there was [William] Shockley, who was the guy who got the [1956] Nobel Prize [in physics] for transistor. Interestingly enough, he had developed this absolute raging certainty about the superiority of the white race, and every time you'd talk to him, he'd talk to you about how the whites were more intellectually superior than the blacks. It was awful. Here's a Nobel Prize winner, you know, and every time he got in a conversation, he started talking about that. He's got this reputation. I think he's still alive.

Anyway, we went out for a week and essentially picked those things and presented them to headquarters and to George and Bob, and decided what we were going to do. By that time, Bob had realized that he didn't have any choice; he had to go back.

One little anecdote I can remember. I was going in to see Bob about some of the stuff we were doing. We used to go in and give him an update from time to time. Somebody had just brought in from the Art Department—you know we have these little badges for each mission, and this one for Apollo 11, which was going to be kind of special. Of course, the centerpiece of Apollo 11 was a bald eagle, a white eagle. He says, "Here. What do you think of this?" That's the way Bob was with things. If somebody just brought it in, he threw it across the table. I said, "You know, it looks predatory." [Laughter] And it was, because at that time what he had was—you know the way an eagle lands, with his talons out. There was this thing about to attack the moon. I said, "It doesn't look very good." And they ended up putting—I don't know if you've noticed, he's holding a branch in the thing. That's the way they changed it. Interesting piece.

WRIGHT: We want to hear more details about that mission and others, but we're going to take a break for just a second and change the tapes out.

HODGE: Sure.

WRIGHT: We were talking about Apollo 11 before we took our break. Tell us what you were doing at the time that you saw Neil [A.] Armstrong on the moon. Give us your reaction to that.

HODGE: I had left the operations organization by then while I was doing this advanced mission stuff. I did a couple of things prior to that time. I did the readiness review for the lunar receiving lab. That was an interesting one. I always managed to get crosswise with my boss. I was doing that for Bob Gilruth, and the big trick on that one was how serious were we going to be. The design of the system was very serious. It really was very good. But the real question was what we were going to do with the crew when they landed. The only way to be sure that it didn't take any contamination with you was to pick them up out of the water in the spacecraft, put it onto the carrier, and have them directly go into the trailer, which would then be taken out. And he absolutely refused to do that.

So what happened was, the crew got out in the water, got into the raft, and then were taken in, in suits, and then taken into the thing. But, of course, if you were really serious about contamination, then you'd blown it right there. But that's what we did, so it was really kind of a game after that. But it was interesting.

The other thing I did was, I ran a review of the accident of the flight, the fire. I ran that for about six months, actually. That was very interesting, too, because the question was what we were going to do about the design of the spacecraft to make sure it didn't happen again. I enjoyed doing that. It's not a very nice thing, but—

WRIGHT: How many people were involved as part of that review?

HODGE: I think we had about twenty people. It was about six months. I'm sure it's written up somewhere. I'm sure just the reports that we wrote should be around somewhere. I don't have any of those, as a matter of fact.

At the time of the Apollo 11, we were doing the design work on what was called the J missions. I don't know whether you remember those. They were the extended-duration missions on the moon. So I was in the background, watching what was going on during the time there. I wasn't going to miss that for anything. That was very good, and that was very pleasing to me to have been a part of the system, to put that together. It's good for your ego.

WRIGHT: Do you remember your thoughts at the time as you were watching?

HODGE: We just sort of did it. [Laughter]

WRIGHT: Then it was time to move on?

HODGE: That was it. Go do something else. That's exactly what happened, because very shortly afterwards, I started the next job we did after we had done the long, long mission stuff, the other J missions, was all that stuff got added back to the Apollo Program Office. By that time George left. I can't remember who took over offhand. What we did was, we started the first of the Space Station Program design missions. We had one of the largest study contracts that had ever been let. I think it was like 8 million dollars, and we did that with—what we did was, we had two studies. One was done by Marshall [Space Flight Center, Huntsville, Alabama] and one was done by us.

The guy that was running the Marshall Program and had the same job I did, which by then was called the Advanced Missions Program Office, was Bill [William] Lucas, who eventually became Center director. So I got to know him very well. We did that design.

Gilruth just absolutely wanted to have a big Space Station right then, so he didn't want to do Apollo; he wanted to do Space Station. But he got talked out of that. One of the guys who talked him out of it was Wernher von Braun, because it didn't sit well with him that he had gotten beat out on that one.

Of course, the next question was, if we actually did the Space Station, which Center would be responsible for it. That was another part of the whole thing. Of course, my problem was, I got along so damn well with the Germans. [Laughter] Spoke the same language.

WRIGHT: You mentioned earlier that you had worked or that you had a chance to visit very often with von Braun. Could you share some of those times with us and some of those days?

HODGE: Von Braun was just an incredibly charismatic guy. He just was so bold and knew exactly what he wanted. Interestingly, despite the fact that I think of guys like Chris Kraft and Bob Gilruth as all-American boys, in many respects those guys were, too. They were very much a part of being Americans, they really were. Of course, they came from a different part of the system. I suppose my ability to get along with them had something to do with the fact that I was new to the system, too. By that time we were learning how the government worked.

He just was very easy to get along with. His English was impeccable. He knew how to hire people. I got to know Eberhard [F. M.] Rees, who was his deputy there, who really was the brains behind Huntsville. Eberhard Rees was a superb engineer and a good manager. Von Braun was the front man. That's the way he operated, and did very well. Interesting guy to talk to and get along with. We were very cooperative on that program.

WRIGHT: You went through so many of the programs and the projects. You were there at the beginning and then you left, then you chose to come back. Would you share with us why you chose to make that decision?

HODGE: I left, I guess. In the first place, I have to finish up with the Space Station thing, because we did the study, we completed it, and then we had to make a presentation to Gilruth as to what the next steps ought to be. Were we going to try to sell the program or what? The presentation we gave to them, as a matter of fact, Dennis Fielder was the guy who gave the presentation, was, "We have done this study and we do not believe you should build a Space Station until you've built a low-cost transportation system."

So the first thing to do was to build a Shuttle. Now, at that time the only guy who was pushing the Shuttle was George [E.] Mueller, who, as I said, was a nemesis of Bob, but I got along with him very, very well. We had some wonderful times. As a result of that, I was pushing the Shuttle now to Houston.

I remember that presentation. We had it in the conference room between the director and the deputy director. We used to meet there about once a month and give presentations. It was my turn to be one of the organization heads. We gave the presentation and said, "Okay. What you need to do now is support the Shuttle Project." And Gilruth was livid. He was pissed off. [Laughter] And Max Faget wasn't much better off, and he said, "In my lifetime, all spacecraft will land on parachutes." That's what he said at that meeting, and I bet him a bottle of Scotch that wouldn't be the case, which, incidentally, I have never collected. [Laughter]

So that was it. Gilruth was just stomping around. I went in to see him later, and I said, "Look. We're finishing the Space Station [Study]. You're not going to sell the Space Station. Congress is not going to buy it. We are going to build a Shuttle whether you like it

or not, and if you don't support it, then JSC's out of the manned space flight business." And he backed off.

What we did was, we cooperated with the—the only reason we got the Shuttle in the long run was because the Air Force agreed to join with NASA. Then, of course, they were very upset about that later because they were not allowed to build any vehicles of their own. The Shuttle was the only vehicle, so the Air Force was forced to use a civilian vehicle, which they were so mad about and had been until recently. In fact, a lot of the problems that NASA's had organizationally in the last ten years or so has been because of that decision. The Air Force's ego was ... much too big to do that.

Of course, Max goes off and starts designing his own Shuttle, because in the past, of course, Max had designed all the spacecraft, so he wasn't going to let George Mueller up in headquarters design the Shuttle; he was going to design one himself, which he did. I don't know whether you've seen any of that stuff that he did, the flying models around the hangars down there. His was a straight-wing one, only weighing about 30,000 pounds, as I recall. Carried 30,000 pounds.

So he and Gilruth go on this thing of trying to sell that. I can remember one of the last things I did at JSC was to write a letter to Bob saying, "You've just got to cut all this out, because if we don't get the Air Force agreeing to it, then we don't get a Shuttle Program. If we don't get a Shuttle Program, JSC is out of business. So you've got to go along with what you think is wrong, even though you don't like it," which, of course, they eventually did.

The other thing I did, much to my regret later, was to suggest the concept of a lead Center organization, so that, in fact, JSC could run the program and headquarters would send money, essentially, which eventually is what happened. As I say, it turned out to be a lousy idea, as far as I was concerned. From a management point of view, I don't think it worked very well, although a lot of people would disagree with me about that one. A lot of people would. I didn't like the idea much at all. Eventually what happened was, JSC became the

greatest supporter of the Shuttle Program, and really pushed this lead Center thing. When the chance came to—we were going to do the Phase B stuff and there was going to be parallel Phase B from Huntsville and at Houston, I guess I'd upset Gilruth enough that he wasn't about to put me in charge of it, so I said "Fare thee well, sweet prince," and decided to go do something else.

I tried to decide—I had two things in mind. One of them was to go in the environmental business. There was an outfit that had just started then out in Colorado. I think it was called Hess or something like that. Bill Hess was the first leader of that organization. I had got along well with him. He was a science guy at Houston. I'd got to know him very well when I was doing the readiness thing for the lunar receiving lab. So I could have got a job out there.

The other one was in the transportation business. I thought that was closer to what my background was, so I got up joining the transportation business. It was kind of fun. I thought that we might be able to influence decisions on the technical side particularly of transportation. It turned out that was false. Decisions on transportation in this country, no matter how technical, are basically political.

I ran a very nice group up in Massachusetts, Kendal Square, which was the Electronics Research Center, became Transportation Systems. Again, it was kind of like the Advanced Missions Program Office. We were looking ahead to say which way should transportation policy go and what changes needed to be made, thing of that kind. We were working for the Office of the Secretary. We had a bunch of people we got together for about a week and said, "Okay, what's the most important thing we can do in order to ensure we have a valid transportation system?" The answer was, "Elect a President for six years," because it was impossible to get political decisions out in four years. That's one of the main reasons that we're not able to make big strides in transportation. When we discovered that, I thought, "Oh, boy." [Laughter] "Why am I doing this?"

We ended up going to Canada. By this time I had become very interested in the whole question of the organizational aspects of high tech. How do you manage a high-tech thing? How do you sell it? How much do you put advanced stuff in? How much sheer politics is there? We'd had a lot of experience with this, it turns out. When we came to the conclusion about how to make things better in transportation, I was looking around for an organizational concept to allow some of these things to happen.

A guy came down from Canada and asked me to go work for him. He was setting up a private organization that was wholly owned by the government, an unusual situation. It's actually peculiarly Canadian. It's called Crown Corporation. They had recognized the same problem, decided that they wanted to do some advanced work in urban transportation, and they set this organization up to do it, and they asked me to go up there and really run the technical part of the organization, show them how to do it.

I thought there was a slight possibility that that organizational arrangement would be better than what we have for getting new things done. It was impossible to get an urban transportation system put together without being 100 percent tied up in politics. We have Metro here, which is, in my opinion, a disaster for Washington [DC]. It's cost billions and billions of dollars, and what it's done is, it's allowed the middle class to flee Washington. What it does is, it provides a very low resistance to people leaving Washington. So you go ten miles out, and you look at ten miles out around, just outside the Beltway, you'll find all of these places that are growing, and in the meantime, the population in Washington, D.C., has been going down steadily since Metro entered. In my opinion, it's because of Metro.

The other interesting thing is, to my way of thinking, if they were going to do anything at all, they should have put Metro out around Anacostia, which is the poor part of Washington, first, because if there's one thing it does, it increases the prosperity of the group where it goes through. They haven't finished that piece yet. The only reason they accepted it in the first place was because it brought thousands of jobs to Washington. This was [Marion]

Barry in the beginning, Mayor Barry. Of course, it was self-destructive, in my opinion. We could have told them that. But you can't change those decisions. It's very interesting the way that happens.

So I had a lot of fun learning about all that stuff. The one up in Canada didn't work either, so it turned out that despite the fact that it was a so-called independent organization, 100 percent owned by the government, the decisions were largely political.

So we came back here, and I was going to go work for Bill [William A.] Anders, as a matter of fact, at the NRC, Nuclear Regulatory [Commission]. He offered me a job and I thought that would be kind of fun running the operations side of NRC. We were on our way down here when he called me up and said, "I just discovered that even though I am chairman of the NRC, I am not allowed to hire people." I thought, "Oh, shit." [Laughter]

WRIGHT: Oops. [Laughter]

HODGE: So I went, hat in hand, back at the Department of Transportation, asked them if I could work for headquarters, and they said, "Well, since you've been bitching about headquarters for so long, we'll give you a job at headquarters and you see what you can do." I had actually fun there for several years.

I didn't tell you the headquarters bit. That's a story, another apocryphal one. In NACA, there was an office in Washington, but it was never called headquarters; it was always called "the Washington office." And the Centers never worked for "the Washington office"; the Centers did what they damn well pleased, and the Washington office's only job was to send the money.

You know what NACA stands for? It's the National Advisory Committee on Aeronautics. What headquarters did was, they managed the committee system which set the research agendas up for each of the Centers and they interfaced with Congress to get the

money. That's what they did. They also signed all the contracts. At that time, Center directors in NACA were not allowed to sign contracts, and so the one thing headquarters did, and the one piece of power they had was to sign all the contracts.

But JSC was always under Bob Gilruth from NACA. He always referred to headquarters as "the Washington office." [Laughter] He always hated them. Of course, coming out of that environment, I always thought there was nothing good about Washington. When I came back from my aborted trip to Canada, they said, "Okay, you've been bitching about headquarters for such a long, see what you can do." [Laughter] Which is what I did for a while, doing the sort of policy planning for transportation. Actually it was some kind of neat work, some very interesting stuff going on. We know a great deal about what we should do. What we don't know is how to make it happen.

It turns out that at that time, Jim Beggs was the Deputy Secretary of Transportation, so I got to know him quite well. He had been in NASA previously, but he'd also been in industry. Westinghouse, I think it was. Then he went to General Dynamics and became their head guy there, and then he became NASA administrator. By that time I realized that technology wasn't going to win the war in the Department of Transportation, so I called Jim up and said, "You need somebody to come back to NASA?" By that time he had already said he wanted to build Space Station, and he hadn't set any system up to do that. I came in, and he asked me if I would start the task force. I said, "Fine." You know, when you get right down to it, your sort of first love is what you did in the beginning, kind of thing. NASA's always been fascinating to me.

Actually, the Space Station Task Force was probably, even if you consider Control Center stuff, the best thing I ever did in NASA—in my career, actually, because Jim [James M.] Beggs gave me absolute freedom to put together the organization I wanted to put together, put together the authority structure, and to put together the idea of who's going to work for who and how.

What I was trying to do was to base it really on all my experiences, to a large extent, of the Space Task Group, which sort of said, there is so much work to do, that you don't have to manage. You just have to say what the work is, and people will go do it. It's the most efficient way to do it. And we did that for a couple of years. There's several papers been written on that subject. It was very, very successful. The people would come in, say, "Hey, you want to join this?" and I'd say, "Fine," and the first thing we'd do is try to persuade them not to join. The reason we did that was, we knew that if we did not succeed, their Centers would not take them back.

This whole idea of headquarters versus the Centers is still there. If you've got a very good guy came into a job in headquarters that was not a permanent job, chances of him being able to go back to his old job was very, very small. So we just simply tried to persuade people not to do it, and the only people we ended up taking were people who said, "Okay, that's the way it is." So they were chance-takers, which, again, was parallel to what we did in the beginning, because we were doing a program down there nobody else wanted to do.

We had this whole concept, we worked out all the jobs that had to be done, and then people would come in and they'd pick the jobs they wanted to do and go off and do it. So you didn't have a hierarchical structure at all. It was a very flat organization. We had about 100 people. Of course, we had the combined job of selling the thing politically, which was absolutely fascinating to me, selling it technically inside the organization and selling it organizationally inside the organization. By that time, of course, the lead Center had become anathema to me because it definitely had not worked, as far as I was concerned, in the Shuttle. We ended up with a wrong Shuttle and cost far too much money.

There's another story you should look at sometime. NASA wanted to have the Shuttle so much that they built the wrong Shuttle. The original idea was for it to be low cost in operation, and it was going to cost about 10 to 12 billion dollars, and when they went in to talk to [President Richard M.] Nixon about it, Nixon said, "You've got six. What can you

give me for six?" And that's when we had the stage-and-a-half system, whereas before, it was a fully reusable two-stage vehicle. When they went to the stage and a half, it put up the cost of operations by almost a factor of ten, so the cost of lowering the total development cost was to increase the operational cost, which they're paying for now. After the accident, they got so damned concerned about safety, you know, you've got twenty people looking over the shoulders of one guy putting a screw in, essentially. Those are costing 800 million dollars apiece, Shuttle flights. That was when I got terribly enthusiastic about costs. Actually, I think we did rather well on Shuttle up to the time that we sold it, which was very exciting, writing pieces for the President to put in his State of the Union message, a big party after the decision.

Then we had the *Challenger* [STS-33/51-L] accident. By this time, Phil [Philip E.] Culbertson had become the associate administrator for the Space Station. I was his deputy. He went back to the front office to help run the agency, and I took over the Space Station office for about six months. Jim Beggs quit because he was being sued by the [President Ronald] Reagan administration, by [Edwin] Meese, and in my opinion, though not in Jim's, that was entirely due to the fact that he [was] always [beating back] the Air Force with regard to whether they should have their own vehicle or not and, every time they had the argument, had 100 percent logic on his side, and the politicians wouldn't listen to the Air Force. I think that was a trumped-up charge against him, because it was eventually dismissed. But in the meantime, he was no longer NASA administrator. Bloody shame, that was. It really was. Anyhow, he had given me freedom to set everything up, and we finished Phase B shortly after the *Challenger* accident, and then the question was, were we going to go ahead and build it. We had put a nice plan together.

I really got crosswise with JSC at that time, because they were pushing the lead Center, which I thought was going to be expensive, what I called institutional theft. I scraped money off the top of the program, which put lots of money on the program. The Level 2

organization was here at Reston [Virginia] for a while. That was after I left NASA. It gradually faded away and, of course, the whole thing is now at JSC. I think that was a mistake. We'll see. It's a mistake not from the point of view it couldn't be done; it's a mistake from the point of view that it's going to be much more expensive than it need be. By that time I'd become a nut about expense.

So that's about it. I guess the whole thing has been meeting so many great people, and I started working for Chuck Mathews and stayed very close to him for years and years and years. In fact, after I retired from NASA, I was playing golf with him once a week, and then he moved down to Tennessee. They're all going down there. I think it's the golf. He came from Tennessee, I think Johnson City.

But when I was looking at the business of, well, I was fifty-eight and we'd sold the Space Station, the only way I think I could have stayed was if I was running it, because I'm that arrogant. That wasn't about to be, so I talked to Chuck about whether I should stay in and see if I could do some more, and that kind of thing, and he said, "Look. I was in the same situation. I decided that I ought to stay in for the good of the organization, and I stayed on an extra five years. The year after I retired, my wife died." He said, "I was arrogant enough to think that I could make a difference, and I didn't, and I lost five years of good time with my wife. So, quit while you're ahead." So I did.

WRIGHT: The times certainly have been filled for you.

HODGE: Oh, absolutely.

WRIGHT: From the day that they came to see you.

HODGE: When you think about it, it's just incredible. In the first place, that an absolute foreigner can come into a country and become a part of the system, a real part of the system, I mean, to me that's the personification of what the U.S. is all about. It certainly couldn't happen in England, I can tell you that. It just wouldn't be possible for it to happen. And to be accepted and sort of brought into the system, despite the fact that we're not doing very well as far as integration's concerned, if you look back over when we came here in 1959, some in Virginia were still fighting that decision, and they had closed all schools down and they had private schools going. Blacks were still sitting in the back of the bus, and Sears had two sets of washrooms. When you look at that and look at what we've got now, it may not be right, but, boy, it's a hell of a lot better than it was. And eventually it will be okay. It's just been a very hard fight, and I think everybody's got to work the problem, but it is being worked.

WRIGHT: So many of those issues were being brought to the country to review at a time when you were very busy putting people up in space.

HODGE: Yes. In a way, that was kind of a sad situation. My wife talks about this very often. When we were at Houston, she said the only thing that counted was the Apollo Program. That was the only thing that counted, and by the time we left in 1970, that was the height of the Vietnam War. They didn't even know the Vietnam War was going on. It's incredible when you think about it. So, I mean, it really was dedicated. We talked earlier on about this business of being a tight-knit organization. It was and it still is. I'm not sure if you notice that down there. As far as they're concerned, I think, Manned Spacecraft Center is NASA. Ask anybody what the first word from the moon was said. You know what it was?

WRIGHT: Houston.

HODGE: Houston. [Laughter]

WRIGHT: Speaking of missions, do you have a favorite one that you were involved in? Does one stand out more to you?

HODGE: One [Gemini VIII] stood out more because I dumped Neil Armstrong into the Sea of China. [Laughter]

WRIGHT: Would you like to share the details of that?

HODGE: That was the first Agena mission, and it was just great for me. We'd done a lot of planning. It was going to be a terrific mission. Everything started off okay and it went well, and the rendezvous took place. It was interesting, remember I told you this business of after six orbits you start to run off the thing? Well, this was, I think, on the sixth orbit. So we're coming over Southern Africa and then the next time we're going to pick him up was a ship in the Sea of China, and then Hawaii, and we didn't see him for another ninety minutes. There was about twenty minutes between Southern Africa and the ship, and the last thing we saw was that he had docked and it was working.

HODGE: Everything was fine, so everybody was cheering and all the rest of it. And the last thing we said to Neil—and I regret this because I don't know how much it had to do with what he subsequently did—was, "Keep an eye out for the Agena," because we were worried about the Agena, whether it was going to take off and do stupid things. And then, of course, it started to roll up. Next thing we heard from the ship was—it was tumbling, it was rolling out of control, and he lost all of his reaction control system and half of the reentry reaction

control system. Of course, there's six minutes of talk to those guys. We weren't talking to them; they were talking to them and sending us messages because of the way the thing worked.

So we had another twenty minutes until he got to Hawaii to decide what we were going to do, because we had to make a final decision by the time he got to Hawaii. You never saw such intensive meetings as that twenty minutes. Bob Thompson was out on the recovery side, because we had the recovery thing next to him. Chris was in the back room, and Gilruth was there.

It was interesting, I think things have changed quite a bit, because the flight director really was in charge in those days. Nobody came in and said to me, "Here's what you have to do." Everybody stood out of the way, which I always admired people for, Gilruth and Chris and those guys. They just said, "It's your mission. You do what you do." I don't think they do that anymore. I think there's a lot more sort of corporate kind of decision-making. It's a hell of a lot safer than it was.

Anyway, it seemed obvious the only thing to do was to bring them down right away, as soon as we could, anyway. And the first time to bring them down was in the Sea of China, which is where that ship was and where Bob Thompson had a destroyer in the same place. Just one destroyer, as I recall. So we had like about eight minutes over Hawaii to talk to them and tell them what we wanted to do, and feed all their retro information, when they should fire rockets, what angle they should be at, what time, all that kind of stuff. So we said, "That's what it's going to be."

Now, this also happened at change of shift. We had been on the White Team. The Blue Team had been on about nine hours. The White Team had been due to come on before then, but because of the mess, it hadn't changed over. So since we were quite tired—Gene was the next one, he was the White shift, and he had been training for the reentry, so I said, "Okay, the Blue Team sits aside and stays here and tells everybody what's happening, and

Gene takes over and does the reentry," which he did. So we had two control teams in there for that last couple of hours.

He fired the retro rockets over Tibet and had no way of knowing whether it worked or not. Went into blackout over China. The question was, would anybody find him? [Laughter] It turned out it was all very accurate, and he landed close, fairly close to the destroyer, and they picked him up. So if anybody ever says what did I do in the space program, it was make sure that Neil Armstrong was around to fly on Apollo.

WRIGHT: Did you have a chance to visit with him after that flight?

HODGE: A little. I never got very close. I got to know the astronauts very well, of course, but I never really got personally close to them. We did a little bit. Wally [Walter M.] Schirra [Jr.] lived very close to us, Gus Grissom lived very close to us in Newport News. So we'd sort of go to parties together and things of that kind. As a matter of fact, I think Al Shepard lived over there, too.

But as time went by, having been in the airplane business and working flight tests, test pilot business, it's one thing you learned as an engineer, was that pilots are going to die. That was the nature of the game, especially if you're working on high-performance airplanes like I was, fighters. And, sure enough, you'd lose the odd flight test guy every couple of years or so, and you have some responsibility for that. Very often you will say, okay, the pilot shouldn't have done that, but you shouldn't have designed an airplane that allowed him to do it.

And what you had to do was insulate yourself from that, because, I mean, it would kill you. It would killed you if you take the whole thing—it nearly did Joe Shea. Joe Shea took the fire very personally, and he ended up with a very bad situation. So I deliberately did not get close to the crew. I mean, close enough to be able to work professionally with them,

but not in a sort of friend kind of a thing. And the reason for that was, as I told another guy who wrote a book about this—I don't know whether you've read that one, Murray's book on the race to the moon [Charles Murray and Catherine Bly Cox *Apollo: The Race to the Moon*].

WRIGHT: Yes.

HODGE: I got to know him very well because he didn't want to write that book, but the company that he writes books for said he had to write it, so he said okay. He and his wife got together and started to take tapes, and he came over here with his wife one night and I gave him a list of 100 names or something like that to talk to. He became incredibly enthusiastic about it. He ended up with 170 of those tapes, and he had no way to write the book that they asked him to write with all those tapes. [Laughter] So he just had to subdivide it down. I don't think he made any money on it, but he is the biggest space cadet you ever saw right now.

One of the stories I told him was this one about the business of getting close to the astronauts. What I said was, as an engineer in the airplane business, you have to learn to die a little bit every day, because you know that you're going to lose somebody. You know you're going to lose somebody. And if it comes to you all at once, it will kill you. Joe was never able to do that. It was really the difference between the guys who came out of the electronics business and the guys who came out of flight operations in industry, airplane business. So, yes, we talked about it, but not over a beer. [Laughter]

WRIGHT: Before we conclude today, I was going to ask Carol if she had a question or two for you.

BUTLER: Looking back over your career with NASA, would you ever have imagined where it would have led you?

HODGE: Oh, absolutely not. As I said, you know, I was going to be the greatest biochemist you ever saw, and I was going to invent DNA, which eventually that group of my generation did. There was no way I could think in terms of getting involved with space. In 1949, we hadn't even flown faster than sound. To say that within twenty years we'd be landing on the moon, no way.

As a matter of fact, I use that on speeches, especially to kids at school very often to say that the reason you go to school is to learn how to learn, and that's all, because twenty years after you get your degree, you will be doing things no one even thought about. I tell them, when I graduated from college, there were no electronic computers. There were only wire tape recorders. Virtually nobody had a television set. Nobody had flown faster than the speed of sound. The kids look at you and say, "Oh, that's not possible," you know. But that's true. That's the situation.

So I say there's two things engineers have to do to learn. One of them is that whatever you learn in college won't be enough; you'll have to learn something else, and that's what you will be doing for the rest of your career. The other thing is to learn how to speak and write, because the people who are going to provide you the money won't understand what the hell you're talking about. You'd better learn how to talk and write. [Laughter]

WRIGHT: When you speak to students, what do you tell them that you've done? Or how do you describe yourself to them?

HODGE: Oh, I guess, an engineer. Science and all that kind of stuff. Tell them to do that. It's interesting, my grandson, who is eight, I talked to his kindergarten class. That would

have been about three years ago. It was the whole class, so there was like four separate classes, 100 kids. So I talked to them and it was kind of fun, you know, and I was amazed how enthusiastic these kids were. That was only four years ago.

Anyhow, this year he volunteered me again to talk to the kindergarten class. So he calls me up and says, "I've told the teachers that you will come and talk to kindergarten class again." I said, "Okay, I'll do it." And he joined me, which was kind of neat to have this grown-up kid in third grade sitting in with the kindergarten kids. I started to talk to them, and I never talk down to kids. I always treat them as though they knew what I was talking about. So I was talking at a fairly high level. It was fun. I really enjoyed it. So I sort of talked for three-quarters of an hour, an hour, or something like that, and still keeping their attention. Six-year-olds, usually you've got maybe half an hour if you're lucky. Said, "Okay, ask questions." And some kid looks me straight in the eye and says, "How do you feel about black holes?" [Laughter] Six years old. Incredible.

And in that room, had four—what is the new Macintosh? iMac, it's called. Four of them, that the kids use on a daily basis, and were totally competent with the mouse and doing their classes, the whole thing. And that's in the last three years. My grandson never had one of those.

And in that same school, they have a Young Astronauts Program, and one of the local companies is financing it. They've got a guy who they provide to teach the kids. They've got a Shuttle mock-up, and they have a Control Center with about twelve positions in it that are directly connected to the switches in the mock-up, and they run simulations. These are all kids in grade school. Absolutely incredible. Just amazing. And very enthusiastic. I was beginning to worry whether the enthusiasm for the space program had sort of died away. Don't think so.

WRIGHT: It has to be rewarding, because some of the foundation that you set in place, your grandson's going to be able to—

HODGE: Yes, it's kind of neat. Yes, it really is. It's nice having grandchildren. What I like most about them is, they can come here and they can have fun and I can spoil them, and I can send them home. [Laughter]

WRIGHT: Spoken like a true grandfather. [Laughter] We certainly thank you for your time this afternoon. We've learned so much, so we thank you for all your words. We will be passing them back on to you again.

HODGE: Okay.

WRIGHT: Are there any thoughts or anything else that you'd like to add that we might not have covered?

HODGE: I don't know yet. I think probably the best thing to do is to think about it. Then if I've got any other subjects that we don't seem to have covered too well, I can do that.

One of the things that might be worth putting in, and we can talk about it later, is this whole business of how do you go about selling a high-technology program in the U.S. Government environment. That's a very interesting story in itself.

WRIGHT: Yes.

HODGE: And that was fun, too, because now I have all this enormous stock of knowledge. The only thing I care about is, I've got to get my golf score down to 85. [Laughter]

WRIGHT: It's also nice to hear through all the years you worked and all the hours that you worked during those weeks, that there is the word that you seem to enjoy using a lot, that you had a good time. You had fun doing what you were doing, taking ideas and turning them into reality.

HODGE: Yes. It's very rewarding. It's very rewarding.

WRIGHT: We look forward to reviewing this and hoping to talk to you again. Thanks.

HODGE: Take care.

[End of interview]