ORAL HISTORY TRANSCRIPT

J. THOMAS MARKLEY
INTERVIEWED BY CAROL L. BUTLER
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BUTLER: Today is June 24, 1999. This oral history with J. Thomas Markley is being conducted in Plymouth, Massachusetts, for the Johnson Space Center Oral History Project. Carol Butler is the interviewer and is assisted by Rebecca Wright.

Thank you for joining us today, Mr. Markley.

MARKLEY: You're welcome.

BUTLER: To begin with, how did you become interested in aviation or even space?

MARKLEY: I never was, really. It's one of those happenstance-type of opportunities. When I was in the Marine Corps, I served in a sort of advanced group in rocketry, so I sort of took my interest. That was in college. I kept looking to go on, and I was really going to become a schoolteacher. After I was offered the salary I was offered, I decided that I could not afford to be a schoolteacher.

So what happened was that I decided to apply for, put an application in to the government, just on a lark, in the spring of 1956. At that point, I just filled out the thing, sent it in to Philadelphia, and got about ten job offers.

BUTLER: That's great.

MARKLEY: Immediately, for the government, all around. I sort of sorted through those and picked out the ICG [acronym unknown] rocket program that was going to be done at Fort Churchill [Hudson Bay, Canada] for the International Geophysical Year, and I actually went down and actually went through the interviews and decided that seemed like a pretty good, exciting job to give myself some experience.

Then at that point the idea was, was coming out, was in physics and math, was to go on and do graduate work in physics. At that point the government was very liberal in paying for it. Somewhere along the line I got a TWX [teletype transmittal; pronounced "twix"]. It's not a fax anymore; it was a TWX, from a guy called [W.] Kemble Johnson, who was the administrator at NACA [National Advisory Committee for Aeronautics] at Langley Field, Virginia. He came and said, "We have a job offer opportunity to be an aero research intern, aeronautical research intern." The starting salary was the same, and also he said, "We'll give you a promotion within six months to another raise." He put this in writing and said, "Give me a call."

So I said—well, first of all, I decided, who is NACA? Never heard of them. So I went down to the library and looked up NACA to find out who they were. There were two offers. One was work in the United States. The other was going to Fort Churchill in the winter and White Sands [New Mexico] in the summer for sounding rockets. I decided that I'd probably to stay down in Langley Field, Virginia, was probably not a bad idea. So I went for an interview there.

That interview was very interesting, because it was the point where I was coming out of a state teacher's college with physics and math, and all of a sudden the people I was being interviewed with were graduate students out of Penn State and Purdue and all this background. I said, "This is very interesting to see whether or not I can perform in this environment."

During the interview process, they went down and then they separated us. I had a choice between two divisions to work for. One was Pilotless Aircraft Research Division [PARD], and the second one was Instrumentation Research Division. So I said, "What's one do? One flies rockets out of Wallops Island [Virginia], etc., and the other one does instrumentation." I was good in instrumentation. I decided, "Let's go with something that looks like maybe the future of the country: rocketry." So I took PARD.

So I went over to Pilotless Aircraft Research Division and ran into two guys. One was Joe [Joseph A.] Shortal, who has written the history of Wallops Island, a lot of Wallops Island history, and he was a division chief. The other guy was Paul [E.] Purser, who, I guess, was at Langley, then went down to Houston. At that point I was then offered two choices of what to work for within the two branches. One branch was with [William J.] Joe [O']Sullivan [Jr.], which was the big balloon type of stuff he was doing, orbiting stuff, eventually orbiting stuff, structural mechanics. I always hated structural mechanics in college. The other one was called heat transfer. And I did pretty good in heat transfer stuff in college, so I picked that.

A guy called Max [Maxime A.] Faget walked in—he was a branch chief—in his dungarees, sockless shoes, and a t-shirt, white t-shirt, and that's my introduction to Max Faget. So then at that point I went up and I was assigned down to a guy called Bob [Robert O.] Piland, who was one of the program managers eventually. I started working there in the pilotless aircraft work for heat transfer. The first project I worked on was firing rocket models out of Wallops Island. I was so naive about aerodynamics that I had to really look up how you do lift and drag out of the textbooks and all this.

So I guess I started doing that, and we were very successful in doing the work. In fact, at one point I was sort of what I call the young guy of the group, the tail-end Charlie, so I got these projects that no one else wanted. One was very successful. One was the high-speed rocket launch in Wallops Island, but it was in conjunction, as I was a junior engineer,

with the chief of the Instrumentation Research Division. No one wanted to work with them because they were sort of not the right people to work with. So I was assigned to work with them, and it was very successful, worked fine.

As a result of that, an Air Force project came along. An Air Force project came along called Project Jason. Project Jason was a top-secret project which was to launch an atomic bomb off the USS *Norton Sound* [AV-11] down in the South Atlantic at the apex of the magnetic points during a heighth one evening over a Labor Day weekend, the idea being that they had proved previously, under some atomic weapon work, that if you saturated the atmosphere, the ionosphere, these magnetic layers, you could block out all communications. So the object here was to block out all communications in the Western Hemisphere so that if you had a missile launch or anything of that nature, you could essentially block communications. It was during that whole period of the Cold War and what was going on.

There was a test ban going into effect, non-nuclear atmospheric test, to start October first of that year, between Russia and the United States, and we were trying to get in and get the test up very quietly, very secretly, without the Russians knowing about it.

So the point was—and I was named project engineer for the Air Force for the job. This is two years out of college. As I said, no one wanted the project, because it wasn't technically scientifically correct for NACA to be doing that type of mundane work. So we went and we fired rockets out of Wallops Island, Cape Canaveral at that point, and Ramey Air Force Base in Puerto Rico, and we launched them one Labor Day weekend. We essentially shut down all traffic between North and South America, because the rockets at that time were not allowed to fly over air routes, and so essentially we had to go get—we went up—that was my first political—I'll get into a fair amount of political stuff here as we get into Apollo.

It was my first encounter politically of what was sort of going on, because we had to go brief [Dwight D.] Eisenhower and staff, myself as a GS-9 at that point. I think I was GS-

9. I was pretty low ranking on the totem pole. And go up and brief him, to tell him just what was going on. We got approval to shut down all the air routes for Labor Day weekend.

The project was very successful, and out of that a lot of stuff worked. It really worked. We blocked out communications, etc. It finally was released probably about ten years ago. At that point, that sort of put me on a different mode from the—I didn't recognize it at that point, but it put me in a different mode from the rest of the NACA scientific community types, because at that point I was more operational oriented at that point and a little more worldly. My orders at that point, which was unreal at the time, was written by NASA headquarters, and it was to allow me to travel anywhere necessary in the Western Hemisphere. They gave me a book of what they at that time called TARs, which is unlimited travel, and they gave me $2,000 in cash and just said, "Go do what you have to do for the Air Force." So the thing turned out, that put me in sort of a different operational mode at that point.

At that point then Bob [Robert L.] Krieger, who was then branch chief within NASA, within PARD, requested that I go to work for them at Wallops Island and doing operational work, marine safety officer, things of that nature, which we did. We did a fair amount of good work. I signed a lot of contracts or agreements with the CAA, FAA [Federal Aviation Administration], and also with all the Air Force and Navy.

Part of the problem is even during that period of time, when we were dropping missiles out of Wallops Island, we had to be very careful we didn't drop in an area where Russian submarines were, because we were afraid we may have an opportunity to have a misfire and then go into war. So we had to do a lot of coordinating work and really time missiles.

As a result of doing all that work, we saved Wallops Island. Wallops Island was to be—the Air Force and NASA, NACA, there was a major political battle going on between the Air Force and NACA at that time. Very few people probably understood it. I'm not sure

I really understood it until, relatively speaking, as you get a little more into what goes on in the government industry. The battle was that the Air Force wanted to shut down Wallops Island and not have any launch facilities that NACA would have independently on the East Coast. We successfully, through Washington and a lot of facts that we gathered, we were able to sustain the firing schedule at Wallops Island.

At that point I was also dealing with a guy called Bob Piland, who became a program manager, and Bob at that time was in the White House on the President's Science Advisory Committee. I think he was dealing with [James R.] Killian and I'm not sure whether [Robert C.] Seamans was involved in that or not. But anyway, so Bob was there, so I was very frequently in Washington visiting the senior people, I'd go to the White House and visit Bob and get working.

At that point, Max Faget called Bob and said, "We're going to form a Space Task Group for Project Mercury." It wasn't Project Mercury. "We're going to form a Space Task Group." I'll go back to a little bit of history prior to that. At that point, we were having dinner one night, and I'm with Bob, and Bob said, "What do you want to do for your career? Do you want to stay at Wallops Island or do you want to help us go into space?"

I said, "Well, I trust you and Max, so I'll go with you and Max." And at that point I joined the Space Task Group as the executive engineer of the Flight Systems Division. So that's how I got sort of the operational side, then to become like an executive engineer, then I'll go from there a little later how that then became involved in the Apollo Program.

Prior to that, some very interesting things occurred. There were sort of interesting parts going through with NACA and leading up to Project Mercury. I remember I was making a speech in my college in Pennsylvania at the time the Sputnik went up, and I remember getting a call from Max and Bob, saying, "We've got a whole bunch of work we've got to start working on." I mean, no one had given them directions, just saying, "Do

something." I mean, literally no one had said—you know, out of the government, once you think about doing something like this.

And the next thing I know, we start talking about launching a rocket out of Wallops Island, and then we started working on putting man in space. We had this blunt-shaped nose we'd been doing. That whole blunt-shaped nose came out of a program that we were doing for [Admiral Hyman] Rickover on Project Polaris, the idea being that we were doing heat transfer blunt-shaped nose cone work out of Wallops Island to see if the nose cone would survive under ICBM [intercontinental ballistic missile] type of reentry. So we were doing all those nice heat transfer studies.

In doing that, the idea then was to reduce the size of the rocket booster to go aboard a submarine by some sixteen feet, because instead of having a nose cone going vertically, this was to do a rounded blunt-shaped thing which we very successfully designed and put aboard. That was really a lot of work, the heat transfer, and Max Faget and Bob Piland were doing it.

Very interesting during that period of time is that here I was working with some great physicists at that point, after studying them in college, and they were being brought on board for doing scientific work during the summers. I'd always be assigned to one of them because no one wanted to work with them, so I worked with people that wrote textbooks I took in college. It was just a great, exciting time period.

The other thing, too, is where I took some notice, probably, or got noticed from Max and Bob, was not only the operational work, was sort of a "can do it" type of atmosphere. For instance, I recognized that to get a model launched at Wallops Island or to get in what they called the pre-flight wind tunnel, which was mach 2 at that point, doing heat transfer studies, that there was always a period of time where no one was up there doing test work. I couldn't figure this out, why people didn't go up. I finally figured it out, was because it wasn't good fishing season. So I decided that, well, if that's the case, then I was going to go up when people weren't there, and I'd get all the attention I needed and get my models

launched, which I did. So I got models, launched models and more rockets into Wallops Island. Sort of a pain to get up to Wallops Island. You had to go by ferries and things of that nature.

The thing was that I remember one day I was out in the model shop at Pilotless Aircraft Research Division, and I looked up and there was Max up on top of the mezzanine platform, flying paper plates, folded paper plates out over the thing. He was flying them out just like you would do like a frisbee, you know. So I said, "Max, what are you doing?" He says, "Well, I think we can design a manned spacecraft that will come in one shape using this configuration." So that's the whole story of the configuration, the one-shape configuration. That came out of that whole heat transfer program.

So then Max really became the real—he and Caldwell [C.] Johnson really became the two major designers of the Mercury spacecraft, which ended up being the Apollo spacecraft, and probably Gemini took a lot out of that. So it was very interesting.

Then we got started. Then we ought to think about launching something to see whether it works in suborbit. Still there was no real—which I knew about, there was no real authority. I mean, people probably knew this was going on. Bob Gilruth probably knew it was going on. So I remember we started designing something we could fly suborbitally out of Wallops Island. We were down there working on it. The guy who designed it, his son was Joe, so we called it the Little Joe Program, which was the suborbital flight program. But it was very interesting. It was a very closed community in that whole pilotless aircraft division. So that was some of the background of how we got into the blunt shape and the [unclear].

At that point I went over to work across the field at Langley, the temporary buildings over there, and we had the three divisions. I think Max Faget headed up one, and Chris Kraft headed the other one. Then at that point we started bringing a fair amount of Canadians, like Owen [E.] Maynard and people of that nature, which were just outstanding, outstanding

people. I just could never believe how the United States got these guys out of this air group out of Canada, because, in retrospect, I read a fair amount about it years later, about how they canceled the program and had all these extra people. It was a blessing. It was a real blessing to the United States to have them come on board.

So we worked on Project Mercury, and it was like a heyday type of thing. I was not involved in the award of the McDonnell [Aircraft Corporation] contract or anything of that nature. I sort of worked more for trying to put together the first flight manuals, first test fight manuals, and sort of the bible of what contains the Mercury. I also did the project work for John [H.] Glenn's [Jr.] flight, project background work on that flight, and I worked on some stuff down at the Cape on safety stuff in blocks and things like that, as I had done at the Cape on Project Jason.

So at that point, right before that point also then, NACA then became NASA in that period. I forget when it was. It had to be '58, in that period. T. Keith Glennan came on board as the administrator. The reason I remember that, because I named my one son after him. Anyway, so he sort of started NASA. Then we got going on doing the Mercury and Mercury stuff. I remember [Alan B.] Shepard's [Jr.] flight and things like that. But we just worked on the mundane.

One of the things that I did during that period, there were three of us who were executive engineers in the divisions. There was myself, Chris [C.] Critzos, he probably retired from NASA, and Norm [Norman F.] Smith. We were all three—the title "executive engineer" didn't mean very much. What it was, we were the "gofers" for the division. We did everything. We planned facilities. We were going to go to Goddard [Space Flight Center, Greenbelt, Maryland], so we planned Goddard facilities. We had to hire a large number of people, and my job was to go out and hire these people, visit the colleges and bring them all in, get them educated and trained. So it was just a mundane what I call administrative-type thing.

I think the next thing that occurred was no one—finally Congress came down through NASA, NASA came down and said, "We need to put a budget together on the Mercury Program," and no one wanted to touch the budget part of it, so a group of us sort of chipped in, put the first budget together. That was sort of what I call dirty work within the team. But someone had to do it, and so we just jumped in and did what we had to do.

The other thing that was interesting during this period, but later I'll come to it a little more, is that we were very naive. It probably was the best thing that occurred, the fact that we were naive. We could never understand why things couldn't be done. We had no experience behind us that was failures. Everyone had been fairly successful in their career within NACA, and just never could anyone think back culturally why this didn't happen. So we had no what I call historical bad points about working and the work ethic. The work ethic was just outstanding. We worked day and night, never thinking anything about it. No overtime or anything of that nature.

So then as we got going on the program, the Mercury Program kept going, and then I remember to this day in the hallway on Langley Field, Max Faget walking down the halls saying, "You know, there's no reason we can't put man on the moon." We all looked at him, saying, "Don't you think we ought to do Mercury, get Mercury successfully done?" He said, "Yes, let's start now worrying about it." So he formed a small group of a couple of people, [H.] Kurt Strass and a couple of people, just to start thinking about Redstone Mercury at that point.

So we had all sorts of configurations and things of this nature. I'm sure I'm out of context historically, a little bit, but a lot of configurations, like we were going to put five men on the moon, then two men. Just back and forth. It was just all sort of conceptual types of things. There were things to work on.

At that point we also brought a lot of guys in from [NASA Lewis Research Center, now Glenn Research Center at Lewis Field] Cleveland [Ohio]. Glynn [S.] Lunney and a

whole bunch of other people came in, John [H.] Disher and they call came in, and they got assigned to Langley right out of Cleveland. So we started working with them also. None of us knew where we were going to end up. We thought we were all going to Goddard, but none of us really understood what was going on. So we started this work, but I remember Max saying no reason we can't go to the moon. He sort of had that visionary type of approach. At that point there was no program funded that I know of by the government to go to the moon.

Then got a little more serious, and finally [Robert R.] Gilruth appointed Bob Piland under the Flight Systems Division to form the first Apollo Program Project Office. There were five of us who formed that office. At that point, I don't recall all the people that Bob Piland was to have, just a whole group of us. Our two tasks that we had going for us was, one, while it looks like the project is going to go forward, and go ahead. And the next thing is that we just need to do a lot of work.

At that point I got assigned to do the liaison work with Marshall Space Flight Center [Huntsville, Alabama]. That in itself was a tremendous experience. The reason I got the assignment is I showed, at least to the management there, that I could work outside the agency and still work with people and do things. So I got the assignment to be the guy who did the liaison work between Marshall and Space Task Group. I flew back and forth. I spent one week in Marshall and one week at Space Task Group, so I started off.

The part that was interesting was that we were absolutely rebuffed and rejected by the Marshall people. In fact, let me see if I have something here. You want to shut that off for a minute? [Tape recorder turned off.]

The thing that I did was—so I literally would sit and work with all the people and get through, and they were very, very politically good from the standpoint they would never give us any information. So I'd just have to sit, and finally I just weaned my way into the organization, where I'd go out and have dinner with these people at night or be invited to

their homes, and finally they left documents lay on the desk. I would pick them up, put them in my briefcase, and bring them back to Space Task Group.

The other thing was that none of them wanted to work with Space Task Group. Literally there was just absolutely a diversion. They would call me and apologize for not pulling more of the Space Task Group people in and not working, although I'm not sure whether it was policy or whether it was just individual—you know, the point. But they clearly wanted to work with the Air Force on Project Dyna-Soar [Dynamic Soaring]. They wanted to be in charge of the entire flight, wherever it was going to go.

At that point, even though [Wernher] von Braun and everyone kept saying von Braun wanted to go to the moon, everybody didn't want to go to the moon. No one wanted to go to the moon down at Huntsville. They wanted to go into far reaches of space. The moon, to them, was something that was sort of a crackpot type of thing to do for political reasons, for things of that nature. But that was my feeling. My internal feeling was that they really had all this big study work going on, all these study contracts going on about launching.

I remember the far-out one, which was—finally I got assigned to work with them on the study contracts, and I'd go with them visiting. At that point I worked my way in with them, and it was very interesting. One far-out one was one they had, a top-secret project, was on the main island of Hawaii, and they had a whole bunch of contracts and designed this ramp that came down the volcano of Hawaii, all the way down, then it came up like this like a roller coaster, and that would be the first launch, the first booster launch to get up.

BUTLER: Interesting.

MARKLEY: That was their way of going up. They were all after direct ascent, meaning they wanted to go directly to the moon, then land directly. I did hear, going back to notes I was reading through on Sunday, I did hear von Braun start talking about lunar orbit rendezvous

and what was going on. At that point it didn't make any sense to me. The real problem we were having was trying to get the Saturns for the flights together so we could put our test rockets on top of the spacecraft rockets.

A couple of things that came out of that program were very interesting. When I first went down there with the original design of the Apollo spacecraft, which housed three people, the sketches, was 154 inches in diameter, and the top of the rocket booster was 162 inches in diameter. So I thought there's no reason why we can't, the United States, get these two put together. Never happened. So everyone was committed to what they wanted to do. I think STG [Space Task Group] said it had to be that, the size, and the Saturn people said it had to be that size, so my only real design accomplishment was one day they were there standing, so I drew a little diagram that says, "Here's something in between, that will fit between 154 and 162." It was called the SLA [spacecraft lunar module adapter, pronounced "slaw"] adapter. We finally ended up with that, ended up with that SLA adapter, you know, which then housed the LM eventually, because at that point it just happened to be there from the standpoint of a structural design, had nothing to do with the fact they should have been there.

Then we got in a big battle about computers on board, who would have control of the computers. We had a computer on board the spacecraft. These are very rudimentary computers, you understand. It had a computer on board the spacecraft, a computer on board the launch vehicle. Then who was going to control the launch from takeoff up until the men took over? We'd get into these endless debates about who has command. So finally myself or someone said, "Let's put a third computer in between and let the third computer make a decision." At that point, no one decided yet who had control of the mission. I mean, it was very early. Everyone was still jockeying for position.

I remember that we just could not get agreement with Marshall on anything we wanted to really do, so what we did, we formed these liaison groups in guidance and control,

propulsion, and all the rest. And finally, just by working the two sides together back and forth, we started having task force named, individual groups, and they'd come up and start working. Well, when you get three or four rational people on STG and three or four out of MS, Marshall, well, then we put the stuff together, said this is the best way to go. Finally it started coming together as a thing.

But I remember that at the time I had uncovered a large series of memos and detailed discussions on Marshall, that says they weren't going to cooperate with Space Task Group; they were going to go on their own. So I talked to Bob Gilruth about this, and we decided we'd better get the thing nipped in the bud. So we set a meeting up with von Braun and his team, and Bob Piland represented Gilruth, myself and Piland representing Gilruth, Space Task Group. Abe Silverstein, Dr. Abe Silverstein, out of NASA headquarters came down because he was in charge of manned at that point, came down to referee. I remember we flew down in the airplane, and we had a decompression while Abe was in the head. He thought we had [unclear] or something like that. It was pretty comical.

But anyway, the next day we sat down, we battled it out, and he just said, "Look, you guys either agree or disagree. We're going to go. This is the way it's going to happen. The groups are going to work together and we're going to make it happen." And von Braun nodded his head. That was all it took. At that point we started working somewhat together, but it was still tough getting the information. It was a very secretive type of work. But anyway, that was sort of the thing.

I remember same with von Braun and his office, because I was the one setting up meetings between him and Gilruth, dinner meetings. I'd get together in Washington, D.C., and we'd have dinner meetings. They'd sit down and talk. I'd set the meeting up and I'd leave, let them—I wasn't quite at that level to understand, probably, or I'd probably appreciate it, but I would then leave. I was sort of the guy that got the two groups collectively together.

I remember sitting with von Braun when he'd be studying all the various designs, and he'd literally go up to the blackboard. He'd write notes for me and little diagrams in my notebook and things like this, you know, and got through back and forth, just him sort of saying what he thought how things ought to go, which was very good, because it gave me a sense, feeding back to Space Task Group then what he personally thought, which was not always what the Marshall Space Flight total group thought.

One of the things I found with working with Marshall Space is that you just couldn't—as Americans would do, you can't embarrass anyone at a meeting. It really was very structured. I understood that. Once I could understand that, I never embarrassed anyone in front of anyone at the meetings, which Americans all do, you know. They go back and forth. So it turned out. So that was my major first assignment that I had coming back.

At that point, they named me assistant head of the project office, and I kept looking around, saying, "Why am I assistant head, the youngest guy, probably, probably the least GS-level guy, too?" Although at that point they couldn't promote me any faster, because I got a promotion every opportunity there was a promotion, twelve months, I got a promotion every year. So they just couldn't do it, because the law didn't allow it. So that wasn't a problem. And you knew eventually that you'd come up through the ranks and make enough money.

Then the job at that point became one where we started doing the study contract work in order to award the spacecraft contract, and I was sort of in charge of putting that entire thing together over at the Chamberlain Hotel, over in Langley, because of Fort Chamberlain, I guess, or whatever the thing is. So we put that whole process together while we brought all these people. First of all, we did a lot of study work, individual studies, and at that point I was pretty well up on what's going on with the contractors, because being with Marshall and visiting a lot of the contractor plants and their study work, they were going way ahead of Space Task Group. I got to know a lot of the people. I had a pretty good feel, so I was sort

of what we called the administrative executive, to make sure that the program came off at the Chamberlain.

In the meantime, I was also assigned—couldn't chair, but I was assigned to be the secretary to the Management Committee, which was chaired by a guy, I think it was Tom [Thomas W.] Briggs. We had all these people from STG and Lewis and all the NASA people, plus some outside consultants as part of the management team. Our job was to evaluate the management proposals of the contractors. There's a lot that has been written about, you know, the contractors come in, what they did and what they didn't do, and all this.

During the period that we were putting this together, two things occurred. One was, George [M.] Low was down from NASA and he and Piland and Faget talked. They were trying to decide that once the contracts was let, they wanted a resident spacecraft program manager to go and be the resident person. So they came to me and asked if I would be willing to do that. I thought, gee, what a great experience to get out there with industry and be the resident guy. In the meantime, there was very few of us doing the program, because Mercury was going on, so there was very few people putting this all together. I think we may have been up to twelve people by then in the project office, Apollo project office. I said, yes, that would be a great assignment.

Well, in the meantime, we went ahead and we did the management proposals and everything. Since I was the total scorer of all the stuff, I had a pretty good understanding of what was happening on the program. So I looked at all the stuff and I said, "Well, it's pretty clear who's going to win this," so I went to Baltimore, Maryland, and looked for a house. So I looked around for a house up there, and I thought that was pretty good. So then knowing that the contractor would be awarded in January, I put my house in Langley on the market, knowing I was going to move. The rest of the team wasn't going to move, but I was going to move. So I put my house on the market and sold it in about a week or so, with the idea, I told

the Shepards, "Well, we're going somewhere in Baltimore. Don't worry about it." This was right before Christmas, during the Thanksgiving-Christmas time period.

It turned out that prior to that, Bob Piland called me and said, "We need to do some more rework on the scoring, on the management section of the report."

I said, "Okay."

He said, "You come in and do the scoring by yourself. No, don't bring a team in. You come in."

I said, "Well, what do you want me to tell you?"

He said, "Just come in and do a better score. I want them all re-scored. Here are some different criteria I want you to use." So I went through and redid the criteria, and the results were about the same, came out the same, who was the major winner.

So I think it was about two days before Christmas, Bob Piland called me again at home and he said, "You know, we have a problem."

I said, "What's the problem?"

He said, "How about if the contractor was on the West Coast?"

I said, "Well, that would be dumb. There's no contractor that's going to be on the West Coast."

He said, "What if there were?"

I said, "I just won't take the job. I just won't go."

He said, "Well, where will you go?"

I said, "I don't know. I'll go to Houston, I guess." I said, "Where do you want me to go? We're all going to Houston anyway. I sold my house." I said, "I don't know. I'm not going to the West Coast."

And so they awarded the contract to North American [Aviation, Inc.], which came as an absolute, complete surprise and shock to me. So you have to understand we were naive. We were looking for facts; we weren't looking for politics at that point.

So the moving van showed up on two days after Christmas and said, "Well, we're here. Whereabouts in Maryland?"

I said, "No, it's Houston, Texas. Just put it in storage. I don't know." So we just got in the car and drove to Houston. So it took about a week and we drove down to Houston, stopped off at some places along the way. Got to Houston, got an apartment down there, stayed there.

So I went out to the—they had a number of hangars in Houston that were being used at Ellington Air Force Base, sort of housed. So I went out there and started looking around and I saw all these people. I said, "Where are you from? What do you do?"

"We work for Space Task Group."

I said, "What do you do?"

"Well, we're here on a procurement. We're out of administration."

I said, "What are you doing down here?"

"Well, we're out getting buildings, constructing."

I said, "You're doing what?" I thought I had a pretty good idea of what was going on within STG. They were just out of control, totally out of control. It absolutely was the—you have to understand, and I think you probably appreciate, NACA and NASA was very moral, very conservative. You just didn't stand up—I mean, if anyone was outrageous, I was the most outrageous person, probably from work I was doing. I was very conservative. So I called back Piland and Faget and Gilruth, and I said, "You've got a bunch of people down here running around." I said, "No one knows what's going on."

They said, "Okay, you're now the man in charge in Houston."

I said, "What does that mean?"

They said, "Just take over and get it done. Just get these people settled down."

So I called a staff meeting, called all the people in this big hangar. I said, "Tell me all what you do. Who's the leader of any group here?" Well, they had none. They had people at

Langley hiring and saying, "Go do this, go get this building, go get this." So I said, "Just stop everything. From now on, nothing gets through unless it comes through me." So we got that thing sort of mentally down, and I finally called Gilruth. I said, "You've got to get someone down here."

He said, "No, you said you can handle it while we get—" Mercury is in its heyday now. Mercury is in its heyday.

So I'm down there maybe two months, two and a half months, and tried at that point, deciding where to build a house. We're going out to Farm Road 502, where I was going to be, you know. There's a story there I ought to tell you about, how it was selected. Anyway, so my version of how it was selected.

Bob Piland called me, said, "You know, we have no one to go out at North American to manage the contract. Would you please go out and spend as many days as you want, come back, fly back and forth? I don't care how you want to do it. Please, would you go out and get the thing set up at North American?"

So I found a good guy, a contracting officer, a guy by the name of Hank [Henry P.]Yschek, who was at the center. There was a guy I hired out of University of Pittsburgh, Ray [Raymond R.] Clemence, a bright aeronautical design guy, a year out of college. So I grabbed onto those two and I said, "Hey, you guys, you're going to California with me for a while." And we did. We went out to California.

So I went out. I said, "I'm going to go out and I'll get a place to set up and some offices." So I went out, and the first thing, there's North American, [J.] Lee [Leland] Atwood was then chair, [Harrison A.] "Stormy" Storms, who was the president of the Space Division, welcomed me with open arms and put me in this great big palatial office which was probably twice the size of this room, you know, with two secretaries outside. I'm thinking, "What am I doing? I'm here to get this program managed." So I finally said, "Look. What I want to do is, you have a contract that you submitted to NASA. I have the contract in front of me. This

is everything you're going to be doing for the program, so I want to go now and validate everything that's in this program that you said you have."

"You want to do what?"

I said, "I want to start and get through and validate. This is what you said you're going to do. There's the number of facilities you say you have ready to go. Here's the number of people you have. I want to look at all those things for you. I want to go through and validate it."

And they said, "Are you sure you want to do this?"

I said, "Yes, I really want to do this." I mean, no one told me to do it. I mean, I decided that that was sort of a logical thing one would do.

So the first thing, I said, "Let's start with facilities." I said, "Here's a list of all the facilities you have available for the contract." We went around and could find none. Couldn't find them. They were like a place for Saturn II, Saturn IV. They were doing the work. "Well, eventually that was going to be yours," you know, as opposed to this. I said, "Okay, let's talk about the staff and who are on the staff." Couldn't find the staffing available.

So this went through, and I said, "Maybe I've got something wrong in my head, you know, here, what's going on." So I got on the phone back to Langley, and I said, "You know, I don't want to come back there, but let's discuss what is here and what you think you have with this contractor and what isn't here." And they were impure. They just didn't believe it. They were in shock, I'm sure, at that point.

Next thing I know is, after I did that, I got assigned to a better office, which was about the size of that one in there, a nice one. I mean, it was okay, down in the floor. I wanted to be down in the floor where the work was going on. They gave me my badge.

I remember the next first major incident we had then was the fact that Hank Yschek, who was probably ten years my senior, was an Air Force procurement guy, very, very savvy,

very good, but he had his background, and his boss came out of the Air Force, another guy from out of the Army. All these guys they brought into procurement came out with background experiences of how they dealt with these contractors. I mean, I'd never dealt with contractors outside of McDonnell-Douglas [Corporation], you know, which was pretty low key compared to North American Aviation, from being conservative, and North American being fairly wild. That was my contention at that point.

So the first thing they brought down after there for two weeks, they brought down an invoice for five million dollars to be paid, and I said, "Well, what's this invoice?"

Hank says, "This is the start of work. Just sign it."

I said, "No, I'm not going to sign it. I want them to tell me what work they did."

So I went up to program manager John [W.] Paup, said, "John, you know, with all due respect, you want five million, what did you do for it? Give me the detailed work stuff you've done."

He said, "Tom, you just don't do it that way."

I said, "Well, that's the way we're going to do it. That's the way we're going to do it. As long as I'm concerned, you can get me thrown out of here, you know, if you want, probably, you can probably get enough political pressure. That's the way we're going to do it."

About another week, they come back and they have a list of what stuff they're working on, and I said, "Fine." I mean, I really could care less what they work on, just so long as they got in the habit of doing it. So we started off and got that worked out. So that was sort of my first introduction, you know, to how the old procurement group of NASA and the Army and Navy worked with the contractors as opposed to what I was used to working with, the little work I did with NACA or NASA, where you paid for what you got, more of a work ethic standpoint. So that was sort of a first incident.

The second incident occurred when I'm out walking through, talking to some of the design engineers, electrical design engineers, and they said, "Have you heard that we're moving? They're going to move all the ground support equipment [GSE] to Tulsa, Oklahoma."

I said, "You're doing what?" I said, "No, you can't do that. The contract calls for all work to be done in Southern California within these facilities. You don't want to separate out what works here and what works here, etc." I said, "I just don't believe that. That's a rumor mill."

So I went up and saw John Paup, a good guy. John was an ex-B-52 pilot, a good project guy. Anyway, so John says, "Tom, that's not true."

I said, "I'm telling you, John, I'm telling you what I'm hearing on the floor."

He said, "Tom, I'm telling you, that's not true. I'm going to tell you it's not true. I'll tell you my job raise it's not true."

I said, "Why don't you go check it out."

So he went topside. He came back about half an hour later, his face was ashen white, and he said, "You know, Tom, I think it is true."

I said, "Well, I'm not going to let it happen. I'm just not going to let it happen."

He said, "Well, you know, you can't stop it."

I said, "Yes, I can, because it takes my contract signature, takes my NASA signature for you to move any work out of this plant."

And he said, "Oh, you're going to get yourself in major trouble."

I said, "Okay, fine. I'm just telling you, that's what the contract says. Now, if you want to get the contract changed, you go back to NASA management, with Gilruth and Piland and them, and Faget. If they want to change the contract, if they want to do that, that's fine with me. But right now that's my direction, and my direction is what's in the contract."

Well, that stemmed in from a couple of incidents that occurred, because then next week I was back in Space Task Group, and by March or April or May, I think it was during that period of time, after the contract was awarded, I think Gilruth and his staff moved to some little building they have, fancy, looked like a Frank Lloyd Wright building in Houston. So they were there, and I'm not sure where we were. We were on Gulf Boulevard or something like that, Gulf Building or something like that. I was back and forth.

So I came back, and at that point Charlie [Charles W.] Frick came on board. Charlie came on board and everything, so Charlie called me in the office and he said—no, I'm sorry, Bob Piland called me. Bob says, "Tom, you know, this GSE work for Tulsa?"

I said, "Yes."

He said, "What is it you're objecting to?"

I said, "Well, I'm objecting to the fact that, number one, from just a design and structural integrity, we ought to have the same electrical engineers design the GSE as we have designing the spacecraft."

He said, "That makes sense."

I said, "That's number one. Number two is that there's not enough total electrical engineers to go around anyway, so therefore I'm concerned we're going to have enough staff. And three is, the contract says it should be designed out there."

He said, "I need to tell you also, von Braun has allowed North American to move some of the S-IV work to Tulsa."

I said, "I don't care. Von Braun can do what von Braun wants to do. I have no argument if he wants to do that, but I'm not going to allow it to occur. Unless you tell me to do it, I'll do it. You tell me to do that, I will do it right now."

Then Charlie Frick called me. He said, "Tell me a little bit more about this GSE in Tulsa."

I was naive. I mean, the best way to handle this, I was so naive. I said, "What do you want me to tell you?" I go through the same story.

He said, "You really feel strongly about it?"

I said, "Yes. You tell me whether I'm right or wrong."

He said, "No, you're right."

I said, "Okay. There's nothing I'm going to change my mind on."

Then I think Gilruth calls me in. He says, "Tell me a little bit about that Tulsa GSE stuff."

So you go through this thing. I said, "Bob, why don't you tell me what's going on. Three of you now have told me. Obviously someone wants to move the work, wants to move to Tulsa. Tell me what's going on."

He said, "Let me tell you the bottom line. The bottom line is—" And I'm trying to remember the senator's name from Oklahoma at that point. He was chairman of the Senate Space Committee. He said, "They refused to allow any appropriation for NASA to go through until we approve work for Tulsa."

I said, "Why didn't you tell me? Look, I got that. I'm not naive enough to know that. Fine, if that's really the case. This was going on for six weeks, you know, to two months. Why is it that we're—"

He said, "No one can overrule you on this. You're right. So we just can't overrule you on this because you're technically correct on what you're trying to do. But this thing is political."

I said, "Well, okay. I understand that. I don't mind that at all."

He said, "But do it correctly. Don't throw your hands up and say, 'Okay, move.' You decide what gets moved there. I want a good technical decision from a program manager's decision."

I said, "You want me to do that? I have authority?"

He said, "Yes."

In the meantime, a call comes in from North American, and they said, "Tom, we want you to fly to Tulsa."

I said, "Look. I've got some stuff going on. I'm not going to have time. Be up there in a couple of weeks."

They said, "No, we want you here tomorrow. We've got an airplane standing by for you. Got an airplane standing by for you at Houston to fly you up. We just landed and we have three of our senior people aboard," one who I became very good friends with and trusted, Bob [Robert E.] Carroll of North American. "Bob Carroll's aboard, and they want you to go up there and take a look. They know the decision's been made and you have to make the decision what goes, but they want you to go take a look at the place."

So I grabbed my staff members, and so we got in this airplane. I remember it was a DC-3 and the seats were backward, and we flew up to Tulsa. Got off the airplane in Tulsa and the mayor of Tulsa was there, the governor of Oklahoma was there, and the red carpet was pulled out, and we walked off this red carpet into—I mean, I just couldn't believe it. And there you are, twenty-something-year-old guy. I said, "I guess they want the work pretty bad."

So we then went through the plants, saw it together. Turned out, in retrospect, it was the best decision ever made, because they built the SLA adapter there and they built the GSE. They had a better work ethic than North American people did in California, much better work ethic. We got better work done there. In fact, when I came back to Raytheon, we hired a fair amount of people out of there. Very good people. In retrospect, it was a great decision, but the anecdote going up to it was really how I got there.

Going back, let me go back, just get back a little bit, why they picked Houston.

BUTLER: Yes.

MARKLEY: First of all, I'm sure that a lot of people probably—let's get back. Why did Apollo Program ever happen? A lot of people have their own—to me, the reason the program happened was a confluence of events. It's like anything else. Even the Littleton [Colorado] shooting, which is going on now, was a confluence of events that kept piling up from all sorts of—no one thing probably made that happen. There's a confluence of events that made that tragedy occur. I think the same thing on the Apollo. You had the Sputnik with Russia; you had going to the moon, you know; you had the Bay of Pigs, which [President John F.] Kennedy had to get over very quickly, with that whole disaster. You had the Southwest politicians who wanted to have control of Congress, both Senate and the House, who wanted to build a canal off the Mississippi, to build a canal, which was done during this period, the canal barges, because they were going to barge the stuff from Tulsa down, across, for the Saturn IV. That whole infrastructure thing was done.

So that whole confluence of all those things come together at the right time, really made the thing happen. People just opened their pocketbooks up. But I think it's a confluence of events like that, that makes things in history happen, not the fact—if those things hadn't occurred, it didn't matter what Max Faget said about going to the moon; it just never would have occurred.

Then the reason that happened was, there's only one moon. Had there been two or three moons, we'd probably still not be there, literally. We'd have had big debates about which moon to go to. So a lot of things were like all coming together at the same time, you know.

Now, going back to why they picked Houston. I worked a lot on the site selection criteria with Wes [Wesley L.] Hjornevik. I made a fair amount of visits, you know. They considered Beltsville [Maryland]; they were considering the San Francisco, Oakland, Bay Area, Navy depot; Louisiana. Houston was sort of far down the list. If you look at the

criteria, the criteria had about three or four major criteria. One, it had to be an all-weather climate facility. Houston probably fits that. It's all weather. It's a little hot, but it's all weather. Second, it had to be near water for portability. Well, Clear Lake surely has water. Third, there has to be a major university for education, and clearly Rice [University] must have fit that, which I haven't quite figured that one out yet. They clearly fit that one. And, fourth, it had to be a in mid country, mid part of the country to travel. Clearly, [Vice President] Lyndon [B.] Johnson clearly had that mapped out. So, I mean, it was all clear to me that clearly it didn't matter, us going through this whole charade of going to Cambridge [Massachusetts] and all these things. It was already won, where it was going to be. It was going to be in the Southwest. If I look back in retrospect, you can see it and do it.

So anyway, going on, then, then on the—I came back from North American. The other thing about North American, interesting, I don't know whether you ever saw this symbol.

BUTLER: No.

MARKLEY: This symbol came out for a couple of months out there. I got a hold of it. They made hats up. It's absolutely appalling to me, you know, that they were this crass about what they were doing. I went and confiscated all the hats, about five hundred of them they made, and I just confiscated them. I just went in the office of the HR PR people out there and said, "This is terrible. What you've demonstrated to me is demonstrated your true nature as a contractor." And they were tough people to deal with. I mean, eventually it worked out fine, but they were just tough people to deal with. I was never sure where they were coming from, except to them it was a government contract with money. Then you still had some pure people like Charlie [Charles H.] Feltz and John Paup and Norm [Norman J.] Ryker [Jr.] and

people like that, really were dedicated to putting man on the moon. The whole group culturally was bad.

In fact, while I'm talking about North American, it would not be beyond them to blackmail us. There are three incidents I remember. Well, four. Actually, there are four. Three incidents that I remember. The first one, we were out there working, a group of us, and working at a place called Tahitian Village, and having dinner. There were like three North American and four of us. About four or five girls came into the place. They come over and sit down at a table next to us. The next thing we knew was that pictures were being taken, which I later got a copy of the picture, in an envelope sent to my house, which shows us with the girls out at the end of the table. It was, as I said, very, very careful. We went out and had dinner. We just were very careful, you know, about what to do.

And the other one was, the second is, was the fact I had North American people come to my house, and sort of saying, "You know, you're out of line with what you're doing within NASA."

Then the third episode was when the senior North American people came, right after the Apollo fire, and offered me a great promotion to Washington, D.C., if I would have stepped away from being as critical as I am. I mean, I wasn't critical; I was just doing my job, being as critical. And I actually wrote some memoranda about that one. And they were not above this. That was the West Coast mentality.

In fact, talking about that real carefully, if I took a look at doing work across the entire country—and I'll get into that a little later—of North American, McDonnell, and Grumman [Aerospace Corp.], the absolutely true culture, the way you can see in the work ethnic between the three of them, it just blew your mind to see the difference in work ethics, in practices. Clearly, Southern California at that point was not dear to our hearts. I mean, I was well over my house moving, so that wasn't a problem. We were in the middle of it.

But then the fourth incident occurred with Hank Yschek and myself. We were having dinner one Saturday night in Tahitian Village again, restaurant. No, I'm sorry, it was some other place. It doesn't matter. We were having dinner, and we were there talking. We were negotiating a fifteen-million-dollar add-on contract, fifteen to twenty-million-dollar add-on contract. This is three years into the program, two or three years into the program. And we're sitting here talking about this. We're back and forth. So then we were at the bar talking about this. We had asked for a table, so they gave us a table, and we went over to this table. And when we're sitting there, I was looking around. To Hank I said, "Man, look at all these nice-looking young guys coming in here, into the bar and everything. Don't you think it's unusual, these nice-looking guys and they have no dates?" It wasn't a gay bar. I mean, it wasn't—I mean, it was that point. And he said, "Yes, it is." We didn't think anymore more. We had dinner.

So Hank had a car and I had a car. So he got in the car and took off. But I noticed when I went outside, about four or five police cars, so Hank and I turned left, went down, started down Lakewood Boulevard. Police car in front and police car behind me. I didn't think anything about it. I made my left-hand turn. I noticed I had a police car behind me. Didn't think anything about it, you know. We're going back to the hotel and we weren't drinking or anything like that. I told Hank I'd meet him in the Village coffee shop for a cup of coffee before I went to bed. So we're driving down. I don't see Hank in front of me. In the meantime, I'm here and another cop car came in front of me, another one came in front of me, and he slowed me down.

So finally I'm now—and a third cop car comes up the left-hand side. Then they pulled me over, lights and all of this, hands on the steering wheel, shotgun in your face. And they said—to make a long story short, we were picked up as drug smugglers. The point was that when I got out, I said, "Yes, I'm a federal officer."

They said, "You're what?"

I said, "Officer." So I had my stuff and everything. So I said, "Just call the FBI office in Los Angeles."

They said, "Do what?"

I said, "Just call the FBI office. There's something wrong here, obviously. Something fundamentally wrong here."

So anyway, turned out Hank got the same thing. They stripped the car and everything like that, torn apart. So finally the captain or the police chief showed up and he said, "Mr. Markley, I truly apologize. I really apologize all over."

I said, "I just want to know what's going on."

So we had a little investigation, and we feel that someone on the phone system at North American called and ordered that we probably were—I mean, it was not beyond them to—not the senior people. I'm not sure how, but it was the culture. Anyway, so it just was things like that would occur, and we had to be extremely careful when we were doing it, as opposed to Grumman. I mean, they were fun people. I mean, they never offered you anything, never took you anyplace. Maybe a pizza if we were working overtime. But it was a fun—I mean different in the culture part.

So I came back to Houston. The other thing, before I get going, there's another interesting part to the story. I just had my note here, because I wanted to talk about it, is after we awarded the contract, we had no statement of work on the project. So Bob Piland came to me and he says, "Tom, would you write a statement of work for the Apollo Program?"

I looked at him. I said, "You want me to sit down and write the statement of work?"

He said, "Yes, go write it."

So I labored this thing, labored this thing, and finally about a week later, Bob said, "Is it done yet?"

I said, "I don't even know where to start."

He said, "It's pretty simple-minded."

I said, "What do you mean, simple-minded?"

He looked at me and he said, "Yes, well, think about it. What do you want to do?"

I said, "Well, we're going to put two men on the moon."

"Right. Are you going to get them there safely?"

"Get them there safely."

"Then what are you going to do?"

"We're going to bring them back to earth."

"How are you going to do that? Are you going to kill them or what?"

"No, we're going to do it safely."

He said, "Well, what's wrong with that statement of work?"

"We're going to fly two men to the moon, we're going to land them on the moon, we're going to bring them back safely to the earth."

He said, "That's it. That's one paragraph." And it served us for five years as a statement of work, and every time we had contract discussions, the contract discussion was, "Look. You said you were going to do this. Here's the statement of work up front." So we used that statement of work for five years and it never changed. When you think about it, it's pretty simple-minded. Bob said, "There's only one moon."

I said, "Right." So anyway.

Anyway, I came back. Charlie Frick was back, and he sort of wanted to reorganize and brought a lot of his Convair [Division of General Dynamics] guys in, which is an interesting story in itself. Very few outside people who came into the program lasted.

BUTLER: That's interesting.

MARKLEY: Very interesting, yes. I mean, in retrospect, I could tell you my later days why I suspect that happened, but at that point they would come in and they had their own way of

doing things in a vendor community or a contractor community, it just wasn't the NASA way. It wasn't sort of the Gilruth, Faget, you know, Chris [Christopher C.] Kraft mentality. We worked, we had a mind-set, we fought a lot, then we'd generally all come back together and things went and worked out well. We sort of had our mission and knew what we had to do.

I remember this guy came in, his name was Paul Warse [phonetic], came in as chief of systems integration, and I was named assistant chief of systems integration when I came back. I sat there working for this guy. I said, "You know, I'm not sure what he's doing, but I think I can do the job about ten times better and about half the people." It turns out, in retrospect, I was reading through my notes, he wrote me one of the grandest promotion memorandums I've ever seen. [Laughter] So, no, I don't know where Paul is these days.

But they would bring in what they wanted to do. It just did not fit within the structure, the conservatism, and in doing things. For instance, I got shot down way back in my NACA career by Bob Gilruth one time when I signed—when you're a young engineer coming up through the ranks, you had to write a report every three months on your progress, what you've done. That's how you got promoted. You got promoted back in NACA by publishing papers, not by operational work. So I remember I signed in red. That created a total conflict within NACA-Langley, to sign something in red as opposed to dark blue pen.

BUTLER: Oh, my gosh.

MARKLEY: And it was a very interesting—and the same thing even when I worked for Gilruth directly, I went through the tragedy, the fire on the pad and everything. It was interesting to see that even when I did something there, he would call and say, "Did you sign this or scribble it?" He said, "Did you really read it?"

I said, "Yes, I read it."

He said, "Okay. I just wanted to make sure." He instilled that, to make sure you understood what you wrote, make sure what you sent across. So I came back and worked for them.

In the meantime, at that point, the North American proposal that was accepted for the command and service module, if I remember correctly, was 450 million dollars, plus or minus. That's the build the spacecraft, go to the moon and back. We kept refining the statement of work, restatement of work, and all this. Then when they come in with the next proposal, it came in at 980 million. This was six months later.

BUTLER: That's quite a difference.

MARKLEY: Quite a difference. This will be interesting, because [D.] Brainerd Holmes was really involved in this whole contract negotiation thing. So we're there—I mean, I'm not involved in it at that point, but I get a call from Charlie Frick. Frick brought me over. He said, "We need to have someone negotiate this contract."

I said, "Yes, you probably do. Can I help?"

He said, "No, we want you to manage it."

I said, "Charlie, I've never negotiated a contract in my life. I've never negotiated a contract in my life."

He said, "Tom, go do it. Just tell the people what you want. Just take them, whoever you want. You do it."

So I said, "Okay." So we decided to go do the negotiation at the Rice Hotel in downtown Houston, thirteenth floor. We took over the entire floor. One half was sleeping rooms, the other half was rooms for end-total negotiations. I had a team there of about six or eight people, plus people I called upon from the center. We started this negotiation.

You have to remember, Mercury was still going on, so you couldn't pull in guys like Chris Kraft. You couldn't pull in all these. We just had to sort of do it ourselves. We started this negotiation, and we started out saying, "We're going to negotiate," which we started out by work packages, which is truly unusual. Fact is, North American had never done it before. I'm not sure the government had ever done it before. I knew no other way to attack an 800-million-dollar proposal than a bite at a time. You just take it bits and pieces, and eventually you add it all up. Well, that isn't how the government and industry negotiate; they just have to total numbers and profitability and that's it, within reason, you know, of the budget, to go back and forth. I decided that wasn't the way we were going to do this.

So I remember the first negotiation was on life support system, or crew systems, and [A.] Scott Crossfield, Scotty Crossfield, [unclear] X-15, he and I became very good friends, Scotty was the first guy in, so this was with Bob Curls [phonetic] as the sort of negotiator, who I'd just met about two weeks before that, and he had a whole team of contract people. They had about thirty or forty they brought in from North American. We sat across and said, "We're going to do this work package. We don't agree with that, we'll start off."

I said, "Scotty, you had forty people here doing reliability analysis."

"Right."

"What do they do?"

"What do you mean, what do they do? They do reliability."

"Tell me. Show me details."

And finally Scotty was there for a day and a half, and they took him back, because he said, "You're right. I don't think I need more than eight or ten." [Laughter] So he clearly went.

Well, that thing, we negotiated for three months, two or three months, work package by work package. We ended up around 600-some million dollars, 640, something like that, on a CPFF [cost plus fixed fee], non-incentive contract.

Two incidents occurred there. One was one that I wish I had, which was really—I'm trying to think who has it. Contracting officer. I'm trying to think of his name. Anyway, it was Hank Yschek's boss. But he had a bell, a great big bell, and every time he had a meeting, he'd ring the bell and everyone would come down the hall, and that would be the start of the meeting.

Well, halfway through the negotiation, Bob Carroll came in. You have to understand Bob Carroll's background. I don't know whether you're going to interview Bob Carroll or not. Clearly, he clearly has more history of what goes on in this project probably than anyone. He's out in town. I didn't bring my notebook with me. Sedona. He lives in Sedona.

Anyway, Bob came in one day, and his background was the fact that Bob was not only one of the better negotiators in the country, he's probably in the number top ten in negotiation in the country, and he teaches courses around the country, in the world, on negotiations. So he was their negotiator, and they brought him in. He was a great guy, a bright guy. So he came in one day and handed me a stack of books about this high. I said, "Bob, what's this for?"

He said, "Look. Obviously we're not going to win. You're going to get through this work package by work package. Here's a whole book on how to negotiate."

I said, "What are you giving it—?"

He said, "You ought to read through it, learn how to negotiate."

I said, "Okay, I will." So that night going home, one of my deputies was Jack [John J.] McClintock, and Jack and I lived out in LaPorte [Texas]. We'd drive home at night, so Jack would drive home and I'd get the book and read what we're going to come up for the next day, and I would take it the next day and I'd literally use it, make a little crib card, actually learned to negotiate out of that book.

So when it was all over with, one day we had sort of a celebration one night, the things were all done, you know, and sitting around talking. Bob said, "Where did you learn to negotiate so well?"

I said, "Bob, you gave me the books, so I read them." But anyway, he knows a lot about it.

But anyway, we negotiated that contract. We had a big battle over about what the fee would be. I know Brainerd Holmes handled that portion of it.

At that point, then I think my next job after that is I became project officer on the command and service module. Okay? And in that, the first change control, the first change article, CCA number one, which I signed, was to change the life support system from a two-gas system to pure oxygen. Never again in my life, because during the fire I had to get back and recount all this, why we changed. I remember it was very detailed. So I became the command and service module manager.

That and, if I remember, Bill [William F.] Rector [III], who came in from Convair, was the LM [lunar module] project officer. We just had the LM project, so I handled command and service module, he handled the LM. I was in that job for a fair period, until Joe [Joseph P.] Shea came in. In between, Bob Piland took over again, and Joe Shea came in. Then Joe reorganized the thing. He asked me if I'd run what they called the Program Control Division, which I did, and that had command and service module project officer, LM project officer, and guidance and control project officer, White Sands, and Cape. So we had all within Program Control Division.

If I wanted to think about—I have more stuff here—but if I wanted to think about contributions to the program at that point, probably I was the business manager of the program. I literally had all these project managers working, and I literally had everything pulled together and knew what was going on across the entire program.

Next thing occurred during that period of time, which was an interesting story, and people at the center remember this quite well, was just before George came aboard. Bob Gilruth was somewhere, I think he was at Martin-Marietta [Corp.], he came back and was talking about this great management system that Martin-Marietta had. So he called Shea, Shea called me, says, "Tom, you know, Gilruth wants you to go out and review all the best management systems in the country."

BUTLER: Oh, my.

MARKLEY: "And pick one you think is good and bring it back, and we'll put it in here."

I said, "Okay." I mean, I figured that was a pretty nice assignment. So I visited GE [General Electric] and TRW [formerly Thompson-Ramo-Wooldridge] and Boeing and all these systems, and clearly Martin had one of the better ones.

So I came back and he said, "Well, what do you think?"

I said, "Well, I guess it's okay. I really don't know how it's going to help us that much."

He said, "Everyone's thrilled by it."

I said, "Yeah, but I'm not sure that's what we really need."

And he said, "Well, I have to know what's going on in this program every week, by detail, great detail."

I said, "Okay."

He said, "So therefore I want you to develop a management system. I don't care who you use, I don't care how much money you want to spend. Just go do it."

I said, "Why don't we start off first by deciding what you want and what you need, what you want as management, as opposed to me going off and bringing something in and you not liking it." Because Joe was a very difficult guy to work with. I mean, difficult—he

and I are still very good friends—very difficult from the standpoint that he was very exact and he was bright and brilliant. I mean, if you had something you wanted to say, you'd better back up with fact. You'd better be able to do it.

I'll comment back for you eventually on your question about all the program managers, what their strengths and weaknesses were. But clearly he was—so I started writing a weekly report every Thursday on what was going on in the command module, service module, across the whole country. Plus we had subsystem managers who worked for Max Faget assigned to us, guidance and control, communications. So I tried to get their input a little bit.

So I sent the thing up to Joe, and he came back all red-marked, copies of the thing. So I tried it next week. All red-marked, all this stuff came back. Tried the third week. I finally got upset. So I went to his office. I said, "Joe, obviously I failed at this mission for you. Maybe you'd better get someone else." I said, "What do you want?"

He said, "I thought you'd never ask." [Laughter] "Here's what I want." He told me exactly what he wanted, so we started off. He told me exactly what he wanted, and we published that thing for four years every Thursday except for one Christmas Eve. Every Thursday. And that became the management tool.

Anyway, I would not allow computerized systems to come into the system, because computers talk to computers, and administrators talk to administrators, but individuals will talk to—so we wanted individual contact. So every Thursday night I handed him a book this thick, and it consisted of what happened on the command and service module, what happened if there was any problems, what happens in each of those, command and service module. Each had task managers out of the center. They all gave me a page. So we collated all of this on Thursday all during the day, and that became the management tracking tool.

Then the other thing we did, which we started on at the same time, we also started on—

BUTLER: Before we go into that, if we could change the tape.

MARKLEY: Sure.

BUTLER: Okay. I'm sorry. Go ahead.

MARKLEY: So anyway, so the weekly report became really the—and the other thing that they had asked if I would come learn was PERT [Program Evaluation (and) Review (or, Reporting) Technique]. I said okay. So I came to Cambridge and spent a week with the Navy people, because really the PERT was on the Polaris program, and that was the start of PERT. So we brought PERT into the organization, and then people were asked to do PERT budgets and all this. We finally came to the point where we were very good at prediction, when flights were going to occur and not occur, just by analyzing the PERT data. It was not that difficult to see when windows were going to occur and all that. So we did a lot of PERT, and every Thursday that whole update, every subsystem program done by PERT analysis.

Actually, it turned out to be, in retrospect, that whole program, that's really where, and later in industry it became very evident to me, is where I learned program management, was in that entire program. Didn't realize you were learning it. I mean, you were doing it. And then there's another thing that I'll have to talk about later.

But anyway, going back to the contracts, we negotiated a whole series. Let me talk about the contractual nature through the whole program. We negotiated, and I would lead the team generally into negotiation, and also at that time I think I had budget control of 1.3 billion dollars or 1.4 billion that we were responsible for, for making sure the program was funded.

The first was North American. We finally ended up negotiating with North American incentive contracts. Joe Shea was really the principal guy who really started pushing the incentive contracts, and it turned out then to become the vogue. We probably had more incentive contracts on the Apollo Program than probably the rest of NASA did at that point. But we had an incentive contract with North American, very elaborate models. I still have the models in my home. It shows cost and dollars, and like an igloo, you know, you ended up—and it drove. It drove—actually, I couldn't believe it drove behavior within—and what's good about it, the reason it drove behavior, if you write the criteria correctly for the incentive contract, then what you've done is communicated with the vendor exactly what you want and what they want, so you get agreement on that. Then you can go off and do it. So we did the incentive contract.

The other incentive contract which was somewhat famous was the contract we had with Grumman. There's an incident and I'll relay the incident, because I was there and witnessed it. And Grumman came in with a contract to do the LM, and their contract proposal they won was like 350 million dollars.

But prior to that—let me go back. Prior to that, another event occurred in North American. The other event that occurred in North American was I was brought in about three months into the—maybe a year into the job of command and service module, maybe a year and a half, and John Paup, the guy, said, "Tom, I want to show you something very secret, and you're going to have to sign a nondisclosure to be in this room."

I said, "Well, what are you going to show me? Does it involve the Apollo Program?"

He said, "Well, yes."

I said, "Well, it can't be very secret, then. I mean, how can it be secret if you have it and it's on the Apollo Program and I'm the project officer?"

So he said, "You're right. Don't sign. Just come on and look."

In there is the whole lunar excursion module mockup. They were going after the lunar excursion module contract also.

BUTLER: Oh, my.

MARKLEY: So they already were going after that one, in addition, and they had good reason. They said, "Our guidance and control system will be the same, our communication will be the same," which was true. I mean, it made logical—a lot of economic sense. I remember I talked with Gilruth about that, and Bob said, "Tom, they're not going to get the contract." He said, "What happens if the environmental control system doesn't work from them? We need a backup. So therefore we're going to have two or three backup vendors," which was a good decision by Bob Gilruth. I mean, it was a great decision by Bob. I remember him saying that, because he and I were visiting environmental control systems, and he was saying about the fact that—so that was a policy-type decision, we were going to have two or three backups in everything we did. For the country it was good, too.

Anyway, so we negotiated. So I think they came up with 350 million dollars. Our estimate was 600 million. So there we are, we're faced with a contractor who's underbid, we think underbid the job, and we think we have more experience in what these things are going to cost. So now we said, "How do we raise them up so it isn't embarrassing for us in NASA?" Then go to the country and everyone says, "Well, the contractor said 350. You guys are saying 600 million." So, you know, we sweated over that and we figured out some—we kept saying, "Why don't you resubmit this bid. Why don't you resubmit that."

So then we got down—I think we got them up to 515, grudgingly got them up to 515 million dollars, something like that, which is most unusual. You go from one part of the country, you go to the other part of the country, and it's completely different. So we then decided, okay, the next thing is how much fee you're going to get on it, fixed-fee contract.

So we decided, "Well, look. You submitted 350 million. That's the fee I get. You should not get what we gave you extra cost. We don't think we ought to give you the fee for that." And that became a major knock-down battle.

So I'm involved in it, Joe Shea's involved in it, Joe [Joseph G.] Gavin [Jr.], who was the program director, was involved in it, and I forget the guy who was president of the company, who was involved in it. So we're having these afternoon meetings about this, and I'm presenting, and Shea is just killing me. I have memos. I have all sorts of memos. He's just literally beating me up. I'm beating my guys up, you know. He says, "Get these things settled. Get it settled. Got to get to Washington."

I said, "I can't settle. I can't get agreement."

So anyway, so finally Joe flew in to Grumman and spent one afternoon. So Joe was still upset with me from the standpoint—he said, "You always get agreements."

I said, "I just can't get this one."

He said, "Well, you got to decide this." This was like December the sixth or seventh. You got to decide this.

I said, "Okay."

He said, "How do you want to decide this?"

I said, "I don't know." So we went and had dinner and came back. We were sitting there in the president's office, and the guy says, "Well, here's our number."

Joe said, "Yeah, here's our number. What are you going to do about it? You've got to make a decision. We've got to get this thing over with." Both of them agreed, yes. So we drew a dartboard, literally made a dartboard, had a dartboard there. Put the numbers on the dartboard and threw darts to see what the fee was going to be. True story.

BUTLER: Well, I guess if you can't solve it any other way.

MARKLEY: And it was a fair—I thought it was—they threw the darts. I thought it was pretty good. I mean, I thought it was a good way to solve the problem, and it turned out to be a fair fee. It wasn't as low as 350; it wasn't as high as what they wanted, so it was fair. That was sort of an interesting experience.

Then the other contract experience which was unique was with A.C. [Spark Plug Div.] Electronics, which is part of General Motors. A.C. Electronics, General Motors, they were the manufacturers of the guidance and navigation system that was designed by MIT [Massachusetts Institute of Technology]. I need to tell you a story about MIT, Doc [Charles Stark] Draper. So they were involved in doing the design work for MIT—I mean, the manufacturing work. So they submitted a bit to us, this bid, and the—I think, if I remember correctly, their number was 260 million dollars to build the guys a navigation device. And clearly I started to see a little more escalation of these numbers, because you start with doing the whole thing to go to the moon for 400-and-some million, and here's Grumman with building the guidance system for 200 million dollars. Very complex, though.

So what we used to do is, we would put together—we'd get the bids in, and I would never let our team see what the bid prices were from the contractors. We would put our own estimates together of what we thought it should cost, based on our experiences. We're gaining as much experience as industry is, because we have better and better data that we're collecting in our data file. So we put our own numbers together and we come up with our number versus their number, and that's how we would start the negotiation. We'd say, "Look." We wouldn't start with a number; we'd start through the work packages by work packages, end up where we wanted to be, and we did ours work package by work package. It may take—I may have as many as forty and fifty people on that negotiation in Houston putting that whole package together and then about six or eight of us would take it up to A.C. Electronics.

We always negotiated contracts, outside the first contract, all contract negotiations were held in the vendor's plant rather than Houston.

BUTLER: That's interesting.

MARKLEY: The psychology behind that. The psychology behind that was my people, or our people, could not go home at night. Their people were really pressuring to go home at night. So we got more concessions out of them because we were on site than if they were at our place. We forced it right through. Many, many overnights, just negotiate day and night and relay teams. So that was our psychology.

Anyway, so we went to A.C., took a team in, down, and they start off by negotiating the contract, and they said, "You know, we're not going to get through work packages."

I said, "Well, yes, you are. You're going to get through the work packages."

"Well, okay, but we really don't believe—here's our number. We're not going to budge. We already got this approved by General Motors, and General Motors says no. That's the number."

I said, "Well, there's no sense in us negotiating." I said, "I'll take my team and go home. I mean, it doesn't make any sense to me if we're here to reach agreement and you're not willing to reach agreement."

So at this level I'm still not—I'm GS-13, 14, 15. I'm not industry level, vice president level, salary, but that's who we're dealing with. We're dealing with vice presidents and presidents of the company. And we're a bunch of young guys, young people doing this.

So finally my contracting guy was there. He said, "Tom, let's offer them a green weenie."

I said, "What's a green weenie?"

He said, "You know, our number is 215; their number is up here. Let's get this done with. Let's just draw a curve that says at 215, here's how much fee we're willing to pay you. At 260, we're not willing to pay any money at all, any fees, no profit." He said, "Draw that curve and give it to them."

I said, "Well, let me think about that for a second."

So that night I went over and I had to call Joe, about seven o'clock. I was over in the head of procurement for A.C.'s office, in his office. He had a pad. Now we get the message across to him. So I called Joe, and Joe said, "Yeah." I said, "Would you stay on the line with me? Don't interrupt me. I'm just going to tell you what I'm going to do. Just keep talking to me."

"Okay. What are you going to do?"

"I'm going to draw on here what the number's going to be we're negotiating. I'm going to draw it on this pad. I'm going to say, 'Joe Shea says this is it. This is mandatory, and that's it.' I'm going to write it bold enough so they can take my pad and do the pencil on it," which they did, because the next day I went back and it was gone. So we used all sorts of tactics we could.

So we finally said, "Look." And we negotiated and negotiated for a week, two weeks. Nothing. So I just brought my team home to Houston, said, "When you want to negotiate, come to Houston."

So they came down. I said, "Just two of us are going to negotiate this." I said, "There's the number. What do you want?"

"Well, we'll take 230."

I said, "I don't care what you take. Here's what we're going to pay you. This is an incentive contract. We're going to pay you at 230. This is all we're going to pay you."

"Well, that's not—"

"That's all we're going to pay you. If you want to try for it—"

He said, "Okay, we'll take it." So they took it. They ended up the program at 220.

BUTLER: Wow.

MARKLEY: The thing being is, it's a psychology, that whole incentive contracting. So we sort of set together how to do the work packages, how to do the incentive contracting, and that was a team of people out of the program control group, basically. [R.] Wayne Young, who was there, you all don't know Wayne, but Wayne left probably a year ago, a year or so ago. But anyway, so that sort of the contracting.

The other thing, a couple of other stories about Grumman on how the name "bug" came about.

BUTLER: How did that come about?

MARKLEY: We were doing what they call a SWP program, Super Weight Reduction Program, because we had these targets. We had to get the weight down. I mean, you're literally—I forget what the number was for Grumman. Let's say it's 39,000 pounds that we had to get, if I remember correctly. It was pretty close to that. I remember the number we had going into it was like 46,000 pounds. We had to get 6,000 pounds out of the thing. I mean, you do all sorts of things and it costs a lot of money to do it.

So we were up there doing a spacecraft weight review, astronauts, ourselves, and a guy called Jack McClintock was my deputy. We were up there sitting, and we decided to take a break. We were going through the changes. It was a mockup review, going through the changes and everything. If I remember correctly, I think this is how the story went. They were going out to get pizzas for us to bring in, and we were going to have an internal NASA meeting. I forget, I think Wally [Walter M. Schirra, Jr.] might have been there, and I think

Frank Borman was there also. I wasn't sure who was chairing. I think I was chairing the meeting, the mockup meeting, or maybe it was someone on the crew.

But anyway, we were there, and Jack was sitting there. He said, "You know, I don't understand why that vehicle looks like it could fly."

And everyone looked around, said, "What do you mean?"

"Well, look at it. It has skins on it."

"Yeah, we're in a vacuum."

He said, "They're thinking like they're building airplanes, and we're not building airplanes; we're building spacecrafts." Of course, that's what Grumman's background is, building airplanes. So they were making this thing nice and flared. So everyone just started ripping off—Grumman people started ripping off the panels and stuff. Someone said, "It looks like a bug or a giant something." I think that's how the name—but it was in that type of thing where—and one of the things that dawned on me, that night I was in the hotel, it dawned on me, is the reason we were not too far off of what we were doing with the program, was the fact that we had Mercury experience, we had some Gemini, but mostly Mercury, and we were thinking a different mode about space flight as opposed to the people we were hiring to go for us, were airplane structural people. And therefore we probably knew more about space than they did, about the environment.

That always stuck on me. At that point I became much more—I became—or I had got the team, I think, more up on a par that says we're as good technically, better technically, probably, than what they are, and we're better thinkers than they are because we're thinking outside the box. And we really were. You had to think outside the box in the Apollo Program, or you just never made it.

BUTLER: Absolutely.

MARKLEY: So that was Grumman. Grumman did a lot of stuff. They just did a great job with what they were doing.

The other story I'd like to tell you about is going on to guidance and control, is why and how this happened I'll never know, but I think it was guys like [Robert] Seamans. Did you see Bob yesterday?

BUTLER: We talked to him on Tuesday.

MARKLEY: He was very influential in Doc Draper, Draper Laboratories, doing the guidance and control system. I'm pretty sure he was.

BUTLER: Yes.

MARKLEY: And I also will come back and tell you a story that will be off the record, though, on how North American got selected.

BUTLER: Okay.

MARKLEY: But anyway, the thing about Draper was that Draper was a true scientific genius and he was also an autocrat, true. I mean absolutely you did what Doc Draper wanted. That was it. So we were having problems with getting the guidance and control what they called Class A drawings over to A.C. Electronics from Draper Labs, and for some reason the guy who was in charge of guidance and control—anyway, I forget his name [Robert G. Chilton]. But he was a student of Doc Draper and Joe Shea was a student of Doc Draper.

So I was called in, said, "Go up and get the Class A drawings." That was sort of my mission. So I set the meeting up in Draper Laboratory and started about nine o'clock one

morning, maybe ten, to go through the Class A drawings. I sat there. It was just back and forth. There was nothing going on. It was all gobbly-gook. A guy called Milt [Milton B.] Trageser from MIT was there. I couldn't figure out what was going on, so I finally had lunch.

So finally I got frustrated, so what I used to do is in my suit coat pocket I carried a small American flag folded, and when I got in these discussion with anyone about nonsense of the country, I pulled the flag out, put the flag in my arm, said, "Look, you guys. We're here for a mission. Now, you're either going to make nonsense and get this one, or you're going to keep screwing around. I don't care. But look. We have a mission for the country and you either cooperate or don't cooperate. I don't care. But we're going to make it happen with or without you." And generally that would calm the meeting down. And if you were young enough to do this and bold enough, you could get by. So it would calm it down and it would be okay.

BUTLER: A good reminder.

MARKLEY: So Draper looked at this, sat at the end of the table, sitting where you are. "Son, look behind you. That's President Roosevelt decorating me." Okay? "That's Truman decorating me. There's my Distinguished Service Medals. And you're telling me that I'm not American?"

I said, "No, I never said that. I'm just telling you that we have a mission here and you all are being obstinate, out of your culture."

He said, "Well, we just can't take this. What time's your airplane?"

I said, "My airplane's at five o'clock. My mission is to be here, I'm going to stay, take the drawings with me to A.C. Electronics."

"We're not giving them to you. What time's your plane?"

"Five o'clock."

He said, "Okay. Look at the clock." Got a clock up here, a big clock on his wall. He had a step-function button on the clock, went around, just went around. Two o'clock, three o'clock, four o'clock. He said, "You'd better leave for your plane right now."

I mean, "Yes, sir." So I got up, took my flag, put it in my pocket, took my briefcase, took a couple of guys with me. Wayne Young was the one with me. So I said, "I'm okay." So I went to the airport, and at this time I figured I'd better have a beer. So we're sitting there and Wayne's sitting with me. No, Wayne got up and left. I remember he walked over.

This guy walked up beside me with a green beret on; it was Doc Draper. Put his arm around me. Said, "Son, let me buy you a beer." He said, "Look. I'll get the Class A drawings for you. I'll have them out there at the end of this week if that's okay."

I said, "Sir, that's great."

He said, "But never, never take me on in front of my people again."

So I got it. I said, "I'll never let it happen again. I apologize. I'm sorry."

He said, "I understand what you guys are doing. I'm proud of it. Just never take me on again. And I'll have them out to you by the end of the week." So he did. The drawings were out there. But he's a classic guy from the standpoint. But that clock thing was really unreal. It shook me to no end.

So I talked to you about the weekly report, talked to you about the statement of work preamble, work package management system. There was another one that keeps coming up in this, and then I'll go back through some—take a break and I'll go back through some of my other stuff here.

BUTLER: Sure. Absolutely.

MARKLEY: There was another one that keeps coming up, which was a change control, board meetings. [Gen.] Sam [Samuel C.] Phillips came on board the program in Washington, D.C., and what a beautiful, great guy he is, General Phillips. Anyway, he came on board. I think he was a brigadier general when I knew him. So he came on board and started working with me. I loved working with the guy. He was really one of the better guys that I had worked with. He came out of the ballistic missile stuff with General [Bernard A.] Schriever, doing all the ballistic missile work, and they were very famous for Air Force programs here.

They looked at what we were doing on our management systems or change control systems, and they thought we were pretty crude, relatively speaking, to these great big manuals that they had, which NASA probably has now, big manuals like this. What we were trying to do is not get totally burdensome with paperwork, but keep the program moving.

So I noticed that the pressure started coming down to set up a formalized change control procedure, which we had one, but it wasn't quite all documented like everyone wanted. There was some pressure starting to come down. Next thing I knew, I was on the West Coast at ballistic missile headquarters, going through, talking to all their people.

In the meantime, there's something in my notes that was very interesting, going back and reflecting. They kept thrusting these colonels upon us, the Air Force colonels, come down and tell us how to run the program. I'd keep interviewing them and say, "What do you do? Tell me what you do, day in and day out." They'd tell me. I'd say, "Well, you sound to me like you ought to be NASA administrator rather than work here." So we kept rejecting all these. The pressure was coming, so we decided we ought to—and I finally ended up in an off-site meeting that Joe had, Joe Shea had, with all the division chiefs, off-site meeting. He finally pointed to me and said, "Write the thing this week while you're here. Just write it and get it done."

I said, "Okay." So we finally set up this change control policy and procedure, which Joe chaired or I chaired in his absence. In fact, you go back through the history books and all

the memos and everything written, you'll see very few of my signatures. You'll see Wayne Young, guidance and control. You'll see all the command and service module engineers that worked for me, signatures, and I would sign off on what they did, but you never saw my signature, except when Joe wasn't around, then I'd sign my own. I'd sign for him and everything going on.

So in a sense, what I became was sort of the deputy executive—what do you call it—executive engineer again. Right? Executive VP. In the terminology of corporate, it would be like an executive VP for the corporation.

So we finally set up the Change Control Board in Building 2 in NASA, it's up on the ninth floor, up on the top floor of a big conference room, and we would have thirty or forty people in there, and we'd have an agenda. We researched the agenda so that when we put that agenda up, we had it researched, we knew what the schedule was going to be, the cost would be of the thing. So it was just a lot of work, and it was also very necessary. We had these every week, the system to go through.

It was very interesting, in going through my notes here, I went through all my notes. Back in September—I must have four or five boxes of detailed notes, meeting notes and stuff like that. I was going through, because one of the things I was looking for was looking for when we discussed the velcro and stuff that came up on the fire hazards. I recall going through it, because in the change control we had Mercury people, Gemini people, our own people going through all this. I recall a couple of times we had meetings about would a fire occur or not occur. They were like meetings where people would get together, so everyone rationalized, including everyone in the center, rationalized. We flew Mercury with oxygen, we flew the Gemini with oxygen. Therefore, why would we be worried about a fire of that nature on that spacecraft? So we got through that whole—I just could not find anything in my change control notes that talked about people bringing up changing this out for fire reasons. Then I'll talk about the fire, too.

But I remember one incident, and it's sort of a [unclear] incident. It was on change control come up about putting TV on the spacecraft. We had already—communications, we were already wired in if we wanted to do TV. We didn't tell anyone; we just had the capability of doing TV. So the thing come up, putting cameras next to the first stage, putting cameras in the cockpit. So I watched the astronaut group, led by Wally [Schirra]. They just came out of their chairs and they said, "We are not going to fly with TV cameras." Absolutely refused to fly with TV cameras.

I said, "Well, what will make you change your mind?"

And they said, "Only if the President of the United States orders us to."

I said, "Okay." I mean, I wasn't about to take on Wally and the rest of the guys in that meeting. So anyway, so we ended up with TV cameras.

Subsequent to that, I was down at the Cape on Apollo 14 or something like that, 13 or 14, and I was in the bar, and there's Wally. So I said, "Wally, how you doing?"

"Fine."

I said, "Man, remember back when we had that big debate, discussion, about the TV?"

He said, "Yeah." He was laughing.

I said, "I've always been curious. I just saw you on TV this week doing the railroad shows." He did the railroad commercial shows. I said, "On TV."

He said, "Yeah, we were pretty naive, weren't we."

I said, "No, not really, but it's interesting watching this go on and the fact that everyone sort of knew there would be TVs in the spacecraft eventually, one way or the other."

So anyway, that Change Control Board was sort of impacted, and we finally put it in. It was very good. It did very well, took a lot of effort and pressure. So I noticed there's a lot of stuff during that period that we would try not to do.

The other incident that occurred, which isn't recorded anywhere I know, was the—we had a tough time trying to decide how deep the dust was.

BUTLER: Yes.

MARKLEY: I mean, as I think about it now, we had a long debate. Well, the thing was, we didn't debate it very long, because the LM had a structure that we thought we could contain the dust and everything. So when JPL [Jet Propulsion Laboratory, Pasadena, California] got ready to fly the Ranger program, they had flown one, you know, and they wanted to fly another one. I was sent to JPL by Shea and the group again to see if I could negotiate them to land where we wanted to land the Apollo. That was another one, I went out there, and [JPL Director William C.] Pickering, Dr. Pickering at that point, said, "Absolutely not. We're here for scientific purposes. This manned stuff is crazy."

I said, "Well, don't you belong to NASA?"

"Yes."

"NASA funds you, right? Don't you think those are the missions?"

"No, we're not going to do it."

So I pulled my flag out, put my flags out. He was British. He said, "I understand all that."

I said, "Well, you know, I just want you to know that we're going to get it done. I'd just like to have you land the Ranger on where we want to land the spacecraft."

And he said, "Look. The only way I'm going to do that is if I'm ordered by the President to do it."

I said, "Well, you're about the second or third person who keeps bringing these subjects up. I mean, I have to tell you, every time someone brings the subjects up, somehow it gets done. So go ahead, if you want to go. I'm going back and report that you refused to

do it." And before I got back, he called Gilruth and said they would land it, they would put Ranger where we thought we might want to land.

So that was sort of my mission in life, was sort of during that period, whenever we got into these discussions, you just go and you sort of battle your way through, and we had enough facts behind us that we'd get away with it. So that pretty well covers a large portion of those types of incidents.

Interesting, on the fire. Well, let me see if there's anything else first. Let me talk about—let me go back and talk about the thing and I'll come back and talk about the fire.

BUTLER: Okay.

MARKLEY: One of the questions was, working for Piland and Frick, Piland, Shea, Low. Turns out I was probably the only person who had continuity from the original project office to George Low. The rest of the people had gone on, Max Faget, gone on to other activities, including Bob Piland. So I was the only one who stayed the whole program continuity through that whole project.

Bob Piland was a delight, was one of my mentors, was one of the better mentors I had from the standpoint of the illustration I gave you about if you write a statement of work, make it simple-minded, you know.

The other thing he taught me, at Ellington Air Force, it was at a meeting and I was getting ready to make a presentation on the Apollo contract, presenting to Brainerd Holmes and all the senior people up there, presentation charts, of course, at that time, you know, you didn't have the word processing we have now, so it was sort of a bad thing to put together all these charts and stuff. So I remember putting stuff together and I was having trouble getting through the presentation. He says, "Look. Presentations are very simple, very simple-minded."

"Well, they are for you. You seem to do very well."

And he said, "No, all you have to do is remember what you say vertically must meet what you say horizontal, so the way it comes out at the end is like an accounting document. All the numbers have to be the same, and all the logic has to be the same. So just build your story, put your things together, and let the logic fall out."

I mean, as soon as he said that, I started putting presentations, probably put together—on that program, probably two hundred presentations, including to Congress and things like that. But he was a very fundamental type of guy, that he would teach you that. He wouldn't tell you how to do it; he'd just sort of lay it out and give the fundamentals. He was great in letting you go and do your thing and listen to you. He had his own opinion, but he would listen to you, give you a fair rein on what to do and not to do.

Bob never wanted to be in charge. It's interesting. Clearly, he could have been the program manager. He never wanted, for some reason, to take on that final act of responsibility of making the final decision, and you had to make decisions in the course of the program. So Bob was good in that regard. He also trusted me completely. I mean, whatever job or assignment, I mean, he'd let you go do it.

Charlie Frick, on the other hand, came out of industry. He was program manager on the Convair 880 program. I remember him telling me how he went down and sold them in South America and all this. Charlie's a good guy, but he had his own methodologies, and he was clearly a good project management-type guy. But he was very opinionated about how things should be done. He and the Gilruth staff, I would call it, would clash. I mean, I could watch these. He'd call me in. We'd go over the presentation. I'd say, "It won't fly." He would clash, and he would clash with North American. He would clash. You could clash with them, but you'd better clash with fact or background, and he would clash. You could see that it wasn't even long, you know.

In fact, I was his emcee at his going-away party. He was a good guy from the standpoint of being in there, and he also confronted von Braun on a number of occasions. If he hadn't, I don't think anyone else would have. So he really did confront him on a number of occasions, particularly on the lunar orbit rendezvous stuff and some of those decisions, he and Joe Shea.

When we get back, there's a story I want to ask you all about.

BUTLER: Okay.

MARKLEY: I keep being asked about stories that are true or untrue.

BUTLER: Hopefully we can help.

MARKLEY: It's about von Braun.

BUTLER: Okay.

MARKLEY: Maybe you picked it up with your history. Then Joe Shea had come on board, and Joe came out of headquarters. Clearly he was the LOR [lunar orbit rendezvous]-type guy. Joe finally put the program together, and he clearly turned out to be the best program manager I've ever worked for, including industry people. He was just absolutely great at managing and making intellectual decisions sound routine. I mean, he could see a point and come up with decision-making that when he presented it to you, you'd say, "That makes sense." I haven't quite seen it in that light before.

Very rigorous from the standpoint that we had staff meetings every Monday morning. He got that workbook every Thursday night. What did he do with the workbook? He would,

on Thursday, no matter where he was, I'd fly to him. If he was in California, that book would be flown to his hotel room, would send a courier with it. One of our people would fly it. He would work at night, and our courier would bring it back the next day, and we would dispense what he said to each one of these, 500 or 600 pages. He would get through, digest it, write back detailed notes, and we'd take those notes and send them directly out to the people in the center without ever distilling them, and they got the message very cleanly and very quickly, what was going on. He just was a bear for that. It was good, because that's what the program needed.

He was also autocratic within the center. I mean, he understood his position within the center, but not necessarily did he really decide that was the best thing to do sometimes. So he would take positions on things and he would have battles. We'd have battles, battles going forward and all this.

I think, in retrospect, had the fire not occurred and you had the decision of going with a lunar orbit flight on December the whatever it was, with Borman, then Joe probably wouldn't have done it. I mean, because he was—and people don't believe this, he was much more cautious than that, in making things correct. Very cautious about making sure we had—if we had an environmental control system, he'd get through, "Give me five failure modes. Get through the failure modes. Get through all the detailed failure modes." We had backup failure mode books on all the subsystems, which I think during Apollo 13 helped a lot on what was going on. But it was that type of thing that he would see something that had to be done and point you towards it or point the team toward it, and they would go do it. But he was clearly the program manager and really brought the program together.

I think what George did was bring the essence of the reliability stuff together in a much better manner. I worked for George, too, which was interesting. He was a different guy altogether. So I worked for these people. I worked for them directly, not like I worked for someone else. I had a pretty good feel for them individually.

Shea was, as I say, brilliant, and I watched the discussion points between he and Max Faget. They'd always clash. They were good friends, but they'd clash. And Max was a good friend of mine also. He was one of my mentors also. And Joe was a mentor of mine. Frick was not. I mean, I liked Charlie, liked what was going on, but clearly he was outside what I'd call was going to make it happen. What I learned from George was being very methodical, with George Low. So it was good working for all of them, and they all had their pluses and minuses.

BUTLER: It took so many different people to put it all together and make it happen.

MARKLEY: Let me see what else you had here.

BUTLER: I think we've covered it pretty well. You've gone through most of what I had down. One question I do have offhand, going back a little bit, you mentioned how Max Faget had mentioned going to the moon and starting that program. What did you think when you heard Kennedy give the announcement?

MARKLEY: Well, at that point we were sort of committed. The debate we had wasn't whether we were going to make it or not; the debate was what does "this decade" mean. We argued for three or four weeks. So finally I said, "Well, why don't you go ask the President?"

BUTLER: Good way to find out.

MARKLEY: "Go ask the President what he meant." He said, "I meant in '69." But it was funny, though. That was the biggest debate we had: what's he mean, '70 or '69? Someone said, "Who cares? We have all these years yet to make it happen."

BUTLER: Did you ever think about how much had to be done in that amount of time?

MARKLEY: No. You don't think about that. You just do not think of the work that has to get done. If you did, you probably wouldn't start it. I mean, clearly we had all assigned jobs. We were all young, eager. We had the ability to make things happen. This is not the U.S. Government. It clearly wasn't U.S. Government at all.

We had budgets. I can remember an incident on budgets where we had a couple of the budget years, which is June 30, I think it is, for the government's budget, June 30. We had something like 30 million dollars left over. I was on the road, so I couldn't commit it. One of my deputies, Emory [F.] Harris, who backed me up at home once in a while, was there, and he said, "Hey, Tom, we have 30 million dollars."

I said, "You call each contractor. Here's how much to give North American. Tell them to write a change order and get it in today."

They said, "What's the work for?"

"We will tell you what the work's for." I mean, in this day and age, you never could get away with that. Never could get away with that. And we could make decisions.

The other thing, let me go back and give you another thing that was the most outstanding educational part of the whole program. People keep asking, even today they keep saying, "Well, gee, weren't you thrilled with the program?" Well, you know, you're glad it's over. You stay and work and go collect your medals. And I'll tell you about why I left NASA. But you collect your medals and stuff like that, but you just don't think about what the total picture was, you know. "Weren't you thrilled?" I was so busy ten, twelve, fifteen hours a day traveling around the country, you didn't have time.

One of the things I'm going to tell you is one of the things we had responsibility for, in addition to the major contracts, is we also spent a lot of time with the subcontractors, and

we did this for two reasons. One is so we got our subsystem people from the center under Max Faget involved. I'd get my project officers involved down to a different level, because if we negotiated a contract with North American involved Collins [Radio Co.], and we'd better understand what Collins is doing and things like this. So we'd literally go visit, with the North American people. Never went by ourselves, always with North American or with Grumman. So once a quarter during the program, once a quarter I took off with a team of people, and various people met me who had their own—called Sam airplanes. You ever heard of Sam airplanes?

BUTLER: No.

MARKLEY: They're special Air Force airplanes that they get assigned to you from the Air Force, because it flies you if you're senior-level government person. They'll fly you. So we had our own airplanes, Grumman Gulfstreams and things like this.

So we'd take off and I'd fly—let's say I'd fly to Grumman, do a review, come up to Boston, do a review of MIT, go out to the Raytheon [Co.] clients and review Raytheon clients, and fly from there over to Hartford and go through Hamilton Standard's [Division of United Aircraft Corp.] on the fuel cells, the environmental systems, backpacks. Go from there to maybe back down to New York to a couple of subcontractors and then out to maybe Minneapolis to [Minneapolis-]Honeywell [Regulator Co.], and then on to Cedar Rapids to Collins. We would do that once a quarter. We visited every subcontractor once a quarter.

BUTLER: That's quite a trip.

MARKLEY: Yes, and it took us two weeks to do it. We'd literally do it day and night. But what we learned out of this, which was spectacular, was the fact that we learned more about

what was going on in the program than our contractors did, because we would pick up a problem, say Minne-Honey, which we did, I remember it had to do with green crud on an integrated circuit. We went to Collins the next afternoon, next day, and they were talking about they were having problems with the integrated circuit. We said, "Wait a minute. We just found out this problem here." They called up. Sure enough, same problem. So we were able to get experience from one, and if we found out something going on here, which made sense from a good management system or something, we would go and give that information to the next subcontractor.

So what we did was just a flow of educationally—think about this. You go around and visit all these companies and they tell you what's going on. Well, after a while we had a pretty good feel. So when we did the Thursday night report, we could actually say we visited this company here. So we had, independently, we were out with all the subs, we did that for about three years in a row.

BUTLER: That's great.

MARKLEY: It was a great educational experience, particularly for me when I finally went to industry, to learn what was going on across the program. It was one of our program management techniques we used, and we took a lot of young people. But that was a very successful program on that basis.

BUTLER: Seems like a pretty smart technique to me.

MARKLEY: It is, and it's simple-minded. I was going to tell you about—let's talk about—this comes up about the fire. [Tape recorder turned off.]

I was going to talk about the—and then I'll come back and see what we forgot. We can talk about the Apollo fire. What was interesting, going through my notes the other day, I had my travel itinerary from that week. I don't know why I saved it, whether it was I saved it in retrospect or what it was, where I was, you know, all that week.

BUTLER: That's interesting.

MARKLEY: Because there's two or three events on here that was very fundamental. One was, I was in Washington, D.C., on the Monday. The fire was on a Friday. I was in Washington, D.C., and I went up there to represent Space Task Group with Holmes—I'm sorry. George Mueller, Phillips, on spacecraft safety. And I had to sign off on the spacecraft. We had a spacecraft review of all the safety. It wasn't that spacecraft; it was the spacecraft after it. It was a major review. You go up and you sign off and you go through every detailed subsystem, and you sign off your name as to whether or not it's safe or not safe. And that was that Monday.

Then I went to the senior management conference meeting that they had, that Mueller attended, and that was the next day. I had dinner with Phillips the night before, going over [unclear] change control. Then I did a review of landing radar Orion aircraft in San Diego. Then I went up and met with the Marquardt [Corp.], review of Marquardt on their fueling systems, because we were having problems with contamination, the contamination in the boosters. I was up there doing that review.

I left Los Angeles that afternoon and flew into Houston. Got into Houston at 6:45. A couple of things stand out in my mind. One was, I got off the airplane, the Beach Boys were there.

BUTLER: Really.

MARKLEY: I mean, these are things that stand in your mind. The next thing I know, Bob—
what was Bob's last name? Well, it doesn't matter. He was the administrative assistant to Joe
and myself, was there waiting for me, and my family was there. So Bob was there and my
family was there. I'm trying to decide, you know, what's going on. They hadn't talked to
each other; they were waiting for the airplane. There were people in between, so I saw Bob.
So I saw the family, thinking Bob must be there to pick someone else up. Bob came over
and grabbed me. He said, "You've got to go to the center."

I said, "What's going on?"

He said, "There's an accident at the pad."

I said, "There is? Well, okay, fine. I'll go to the center." So I told my family, I said,
"You know, I'm going to the center. I don't know what's going on, but I'll see you at home."

So I arrived with Bob, went down to the center. We started tuning into the radio
stations on what was going on and everything, and it was sort of sketchy in that time of what
was going on. So we drove down and came into the center. I remember getting in the
elevator, and Kenny [Kenneth S.] Kleinknecht was there. As we get on, all these people
from ASPO [Apollo Spacecraft Program Office], spacecraft for the—all coming in to work,
all coming back to work. They were all going upstairs in the elevator. So it just turned out
that we still didn't know what was going on, and they just all came back to work.

So I'm going up the stairs, and I went in, and Shea was there. So Joe was there. So I
walked in, and I said, "What's going on?"

So he said, "Here's what we know so far. You stay right here. Don't leave."

I said, "What do you mean, stay here?"

He said, "Stay right here in this seat. Don't leave. We're trying to decide between
Gilruth and myself and Faget what we're going to do." He said, "We're going to fly to the
Cape tonight."

I said, "Okay."

He said, "I'm not sure when we're going to get back, so I'm deputizing you. You're going to run the program while I'm gone."

"All right. You got more senior people like Kenny and—"

He said, "No, you're running the program."

I said, "Got it."

So I called. So then I finally found out what was going on. So I had a fairly good-sized office with couches and stuff, and we always had, in case something like this ever occurred, we always had extra clothes around and all that. So I slept in this thing and called staff meeting the next morning, get all the senior staff together the next morning, so I went through what was going on.

One thing Joe told me before he left, he said, "Don't let the program go out of control." That was his message to me, you know.

So I got the staff together and I said, "You know, we can sit around here and not do anything or we can imagine what's going to happen with all the questions. So why don't we start documenting everything that we know. Let's start with change control order number one. Everyone's going to ask about that question. Everyone's going to ask about every question that we've done this whole program. Let's start documenting everything, and then when the press starts coming in—"

Then that afternoon I met with our press people there at the center, and I told them, "We have documented everything, and as questions start coming in, why, we will then have the data ready for the questions." So they thought that was a great idea. So I don't mean to say this facetiously; we managed the information flow going out and started to go through it.

So I stayed there maybe two weeks, never went home. Two or three weeks, kept things moving forward. Heard all this stuff going back and forth. Very few of us really know what was going on, except we knew it.

The thing that was most interesting out of that were the crank calls. First of all, some of us got crosses burned on our lawns.

BUTLER: Really.

MARKLEY: That sort of scared the families. Then the next thing was that the hurtful part of that whole thing was like the center was against the program office, you know. It's like, "The program office, you caused this. You didn't have this in Mercury, didn't have it in Gemini," you know. So that was the thing that you really had to keep the people and say, "Keep focused, you know." And thank God this thing didn't occur in space or this program would never have happened, probably.

So we'd get these crank phone calls day and night, you know, and we'd take them in. We'd listen, because you're never sure what they're going to be. All these mystics would call about they knew what was going on. I mean, we had a list of phones like you couldn't believe.

So we just stayed there. We had showers and stuff like that, so we stayed and managed all the information and all the flow for that period of two weeks. Then Joe got bumped up to Washington, D.C., and then George Low came in. I remember that was sort of—because here Joe had been sort of the real mentor for three or four years, three years or so, and then all the division chiefs would come in, in Gilruth's office, and Gilruth said, "I'll tell you everything that I know what's going on, but Joe's going to go up to Washington, D.C., and work." Of course, we sort of all knew what that meant.

MARKLEY: So that turned out that sort of a—and then George came in. George just came in and just picks things up to the right beat. Two things at that point and I'll give you a little— first of all, then during that fire thing, we decided that they were going to have to redesign, so

I appointed Frank Borman to be the—we needed an astronaut, so I appointed Frank. There was no one else there, so I appointed Frank and got Gilruth to agree to that. I appointed Frank to be the lead guy for the thing, and assigned George [W. S.] Abbey to work for me. I hired George. He was my administrative assistant. We go way back. He was a major in the Air Force.

BUTLER: That's great.

MARKLEY: Good guy. He was good. I mean, he was a good guy. I mean, worked hard. Still looks the same. Looks the same now as he did when I hired him.

So anyway, that was going through the whole fire thing. Then we started off with the redesign stuff. Of course, it was difficult because we also then had this thing called the Phillips Report, which cast a lot of blame on North American's management and management areas and techniques and things like that. I was involved a lot in that report before the fire.

I remember one meeting was in California, and we were reviewing the report. I'm sorry. No, we were reviewing North American, "we" being—Sam was chairing the meeting, I was representing STG, and Eberhard [F. M.] Rees, who was von Braun's deputy, was chairing. I think Eberhard Rees was representing Marshall. Rees and I, from days in which I was down working with them, we became pretty good friends, working together. So we were reviewing this whole thing of the management techniques.

Clearly, there were some sloppy practices at North American, and they were arrogant. You know what I mean? You could be very competent, but they had some good people, too. You just could never—just great people, individual people, but they were sort of arrogant from the standpoint as a company.

I don't think anyone knows to this date, unless someone's picked up what really happened, but it was clear that if you have pure oxygen, you have velcro, and you have combustion points, that's pretty high—and you have a pure oxygen system and you have an ignition, why, it's going to vaporize.

The second week I was having a staff meeting on the program after the fire, I remember Caldwell Johnson came in. Caldwell had taken some velcro and put it in a pure oxygen atmosphere and had a small spark away from it. We watched this confirmation just go up, I mean, just *whmm*, I mean blew up. This is in lab tests going on. "Geez," I thought, "look at this." At that point it was pretty obvious, you know, what was going on.

The hardest thing, I'm sure it was hard for the crew guys, too, then going to all those funerals. Everyone went to every funeral. It was just agonizing. It literally almost tore the center apart. I mean, it was different. Like I was with Gilruth one day. We were up at A.C. Electronics reviewing some guidance system up there, and we were having lunch. Gilruth got a phone call. The center called and told him one of the astronauts was killed in an airplane accident. Well, here's a guy who's life is gone, too, and here we were. It was a completely different atmosphere and different from the standpoint of the attitude within the center was very down. It was hard to keep everything really moving, and we had decisions you had to make with Grumman and, you know, things like that. Of course, at that point everyone got jittery about everything going on.

Anyway, it was a very down period for the whole program and for the center, but what came out of it was, you know, redesigning, which probably speeded the program forward. So it gave a breather. The program was moving at a very fast pace. I've often thought about going back and resurrecting all my schedules that I have, the first schedules, you know, where we're going to land man on the moon, going forward. But we were even for 1966.

BUTLER: Really. Wow.

MARKLEY: So I worked for George for that period of time. One of the things, that I sort of felt like a fifth wheel at times. You have all the program history, and I was sort of the most senior guy, the most senior longevity guy. I wasn't the number two. I mean, I was the assistant guy, but we had a couple of other assistants. So I had to sort of decide what could I do that could really make an impact on the program to speed it forward. We also had the Phillips Report, which had come to light.

So I decided to go to North American as much as I could, spend the time and really figure out how to make the program come forward quicker. So I would go out at ten o'clock at night and go on third shift, and I'd work third shift for about a week. The reason I worked third shift, because no management around. You'd find out exactly what's going on in the status. And out of that we were able to really decide and move things forward, what was going on.

The other thing is, let me talk about dedication of people. One night, ten o'clock, it was a Continental flight. We'd fly from Orlando to Houston, to Los Angeles. So I'm getting ready to go on the ten o'clock flight, and Rolf [W.] Lanzkron, who was running the GSE program, who later came to Raytheon in the ground support program with GE and stuff down at the Cape and the GSE for North American, comes off the airplane. I said, "Rolf, I haven't seen you in about a week." So we got talking, and Rolf's wife shows up in the back. "Rolf, what's going on?"

"Well, these are my clean clothes." He handed his dirty clothes to his wife, he jumps in the airplane back with me, and we fly to Los Angeles."

BUTLER: Oh, my goodness.

MARKLEY: And that was the dedication you had, you know. You'd work day and night with these people getting things done.

So then I sort of made my commitment. Let me talk about exiting the program, what's on my mind, then I'll come back.

BUTLER: Okay.

MARKLEY: When I came up through GS levels and everything, and Shea came on board, and Joe was there and he called me in for an interview to find out what I was doing. He said, "I see that you've run the program the longest. What can you do?"

I said, "I don't know. I handle these missions and assignments."

He said, "Yeah, but what can you do? What are you good at?"

I thought, "Gee, I don't like this guy. Besides, I don't have to work for this guy." I thought about going to work for industry about that time, because the space program was going through a lot of funding, and I knew I could go to work for industry probably in some position out there that was related back to the space industry. So I told Joe, the second or third time he talked to me, I told Joe, "Look. I want to go out and look for something."

He said, "Go out and look. You have my blessing. I'll recommend you, even." So he said, "Here's the names of people to go talk to."

So I went and started interviewing. Found out I probably wasn't as good as I thought I was, you know, which I came back and told Joe that. I said, "I found out that I'm probably—"

He said, "Good. You are good here. I want you. You stay." And that's when our friendship really started. So I always had that feeling about going to industry, and I got recruited a fair amount of times. Got recruited the day of JFK's assassination in Dallas. I was having lunch with a recruiter.

BUTLER: Wow.

MARKLEY: I just came back from White Sands, from making a presentation to White Sands. I went over to White Sands. I remember because our picture both appeared in Houston, his picture and my picture both appeared in Houston paper together.

So I've always thought I wanted to get out, because what I recognized was, I could never be promoted to program manager at NASA, because I wasn't an outside industry vice president. If you look at all the people who came into the programs, Charlie Frick, Joe Shea—George Low wasn't, but anyone who comes in and takes over those jobs were generally a vice president. Jim [James A.] Chamberlin. Vice president of industry. So I said, "Okay." I kept wanting to get promoted up. I didn't have enough experience, probably, which Gilruth never clearly recognized, but I felt that I ought to get promoted up, but I recognized that I didn't have enough gray hair.

So what we would do is, I'd keep looking on the outside. Finally I said, "Well, I'm not going to do it." The fire came, and I said, "Okay," and I committed myself to stay. So I talked to George, said, "George, look. I've always had these desires."

He said, "I really don't want you to leave."

I said, "I know that. Okay. As soon as we have the all-up flight and everything works, I'm leaving."

"Where are you going?"

"I don't know. I'm just telling you, I'm going to leave. When we have the all-up flight and it works successfully, I'll commit myself to stay until that happens," which I did. We got everything back and down off the thing. I decided to resign.

Well, I wasn't sure who I was going to go to work for, you know, so what I did is I had about thirteen or fourteen vendors that I'd worked with, the senior people, so I called

each one, asked them if they'd be a reference for me. And out of that I got about four or five job offers.

BUTLER: That's good.

MARKLEY: Yes. I found that was a good technique, incidentally. You don't go out and quit your job. So I finally decided that where I wanted to go to work was I wanted both aerospace, I wanted commercial work, so I took a job with Link [Group of General Precision, Inc.], did simulation work, with the idea that they'd let me also do some commercial work for them. So I went into that job as assistant to the president, my title, and I ended up running the total divisions for them. Then we got bought by Singer.

I remember when we got bought by Singer, I hadn't talked to Joe Shea for a while, so I called Joe. I came over. He was executive vice president at Polaroid, and then he became a division general manager for Raytheon. I called Joe. He said, "Come over and talk to me. I haven't talked to you for a while." So I got in an airplane and flew over and talked to Joe. He said, "Whenever you want to leave over there, let me know." I talked to Brainerd. Brainerd then was executive VP. Talked to Brainerd. Brainerd said, "Love to have you over here."

I said, "I'm committed over there. It's a good company. I'm number two in the company. My age looks good."

So then Singer bought us out, and since I was running about a 100-million-dollar division for them, for Link, Singer people called and said they wanted to change the accounting rules in order to up the stock stuff for a quarter. I didn't think that was quite legal, so long story short, I decided I wasn't going to work for a company that does this. So I called Joe back and

back, and I said, "I'm ready, but I want to stay till the end of the year. I want to make the fiscal, make the profit and loss, make the fiscal." So they did.

Brainerd negotiated me out of—with Singer, negotiated me out of the two things on a very friendly basis. So I went to work for Joe and Brainerd, and became Joe's deputy or assistant. Then Joe moved on, then I took over the division, about an 8,000-people division. Became a vice president of Raytheon at that period. I was a vice president at Singer, I mean General Precision, but I moved over and this was clearly being a vice president of Raytheon Corporation, clearly was the thing I was looking for.

Got that under my belt, and then they decided to go commercial. They hired a whole bunch of IBM people based on salary versus based on experience, and seeing as they were IBM, they must be good. So they did that, and they got screwed up a little bit. So Brainerd and chairman of the board and Shea asked me if I'd go and run the commercial side of the business, and I said, "I don't want to, because I'm very comfortable where I am."

They said, "That's the reason we asked you to do this, because you're too comfortable." They said, "Look. You have nothing to lose. You're the youngest vice president of the corporation. You get down, you get screwed up, you're still going to be vice president of the corporation. We don't care what you do. You either sell it, make it happen, or give it away. We don't care what you do, but get rid of it one way or the other, or make it work."

So I took over their commercial, and it was losing about 16 million dollars' revenue, losing 6 million dollars a quarter. So we built the company up, rebuilt the whole company, and I stayed in commercial business. Then I decided, after being at Raytheon and doing that and everything, and after working with NASA sixty hours a week and working at Raytheon sixty hours a week, I just wanted to take a break. I had enough stock and stuff, I could bail myself out. I wasn't sure what I was going to do. Then we ran fairly good, successful operations, so I was president of Raytheon Data Systems and president of Raytheon

Worldwide and president of Raytheon Leasing Company. So I came out of that and formed my own consulting firm.

Before I even came out of Raytheon, because of all the work in NASA and all the work at Raytheon, and I made the announcement in September I was leaving at the end of the year because of the stock stuff and being a public company, and I had enough assignments before I left that I didn't have any problem building a consulting firm, which took about three years to really build it. We did that for the last fifteen years, up until three years ago—well, twelve years. Three years ago. One of our assignments was rebuild—our client base was very good.

But one of the interesting parts out of the consulting was what we taught was program management to industry. We never took a government contract. We did a lot of government work. I worked for the Space Defense Initiative Committee under General Abrams, on the Star Wars stuff. There was eight of us on that, called the Wise Owls. We worked that with [Ronald] Reagan and stuff, and did a lot of volunteer work for the government, never charged them and never wanted to be paid by them, because they don't pay good. But anyway, we did that.

We lucked out again from the standpoint that our total work that we got involved in turned out to be at the breakup of the Bell system. So we ended up, based on Raytheon and NASA days, with a large number of people who got promoted up through the ranks as chairmen and CEOs of the Bell system. So we ended up with a large number of large and nice clientele. One of them was the company I currently work for, [unclear] Communications, where we became—the strategy changed in six or seven companies, we sold all those companies off, put them into communication companies, which was bought off, and my job in the last three years was to make that transition complete. It was complete as of January this year.

So all the experience in NASA, really, that whole background, the program management negotiations, has really—and what I've noticed is, the people that were in that program went on and are fairly successful in their own way, if you take a look at that whole group. The other thing is, also 95 percent of them are all divorced.

BUTLER: Yes.

MARKLEY: It was amazing to watch that whole thing. But that whole background in industry, I keep using over and over again the same techniques that I used in NASA, used in industry. They work beautifully. Used them in consulting. So that was a great experience. So that's how I got back into industry.

BUTLER: That's great.

MARKLEY: And the thing was, to go back to the reason I was leaving, I wanted to become vice president, then go back in, vice president of industry, then go back in as program manager. Well, after you get in industry, then you look back and then you finally decide that that was a very unique opportunity, and it wasn't U.S. Government that we were working on. You didn't want to go back to work for them, because I remember, as I said, I was working on this defense of space.

Then I became an examiner in a Malcolm Baldridge [phonetic] type thing. I watched what was going on there. I said, "I don't believe this." And then I watched the bureaucracy there. Then I got offered a job as assistant secretary of technology for the post office, assistant postmaster general, that was it, under Red Blount [phonetic]. I went down, I took a look at that, and then also I was offered a job as White House communication guy. I

decided, you know, it isn't the government that I knew, and I'm afraid that I would be disillusioned. And working for industry, once you're in industry, it was fun.

BUTLER: That's good.

MARKLEY: But the NASA experience was probably the best overall as a learning experience.

Do you want to go off for a minute and let's see if there's anything— [Tape recorder turned off.]

—send Apollo 8 to the moon.

BUTLER: Yes.

MARKLEY: I was flabbergasted. I mean, what a bold decision. Had I had the courage to make that decision? I don't think so. I don't know. I mean, that was a bold decision. I read George Low's stuff. He was really in doubt. And Gilruth. Gilruth probably had pits in his stomach. I mean, I'm sure that it was really Mueller's decision. But that was a very bold—in fact, Joe Shea and I talked about it when the thing was announced. We talked about it. He said, "You really believe that?" I said, "Gee, I don't know." That's why I know Joe would not—I don't think he'd have made that decision.

What were you doing? The thoughts during the first landing. Well, I was at the Cape for the launch, and I was in Mission Control for the landing. I was in Mission Control for the recovery.

BUTLER: What was it like, the atmosphere?

MARKLEY: The launch thing, you know, the launch thing was interesting.   They invited myself and my family.

BUTLER: Oh, that's nice.

MARKLEY: Paid for everything.

BUTLER: That's great.

MARKLEY: And they did that every mission. I got invited to go back and go through it. You know, it was almost like a carnival atmosphere a little bit. It was funny. I mean, you can be inside where the tension was, and you're outside and you're outside watching this from the VIP platform, you know, and you're watching this thing. You just knuckle down and you say, "Hope it goes." I mean, your stomach goes—you just can't feel—anyhow, how I feel about that.

Then the thing that was anticlimatical, to me, was they landed on the moon. Okay, so what? That's what we're supposed to do. You know what I mean? [Laughter] To the outside world, everyone remembers it, but that's what we were working on so long, and I think your mind doesn't—you don't sit back and look at the big picture.

I mean, I tell people today, they say, "Where were you?"

I said, "I was in Mission Control."

"What was it like?"

I say, "It was exciting. It was scary. People were holding their breath. You'd watch people's faces and no one was saying a word. It was very scary listening to the last twenty seconds or so." But somehow we were so engrossed with what was going on, you never have a picture to stand back and take a look at it.

I had an opportunity here last year working with the South Shore Philharmonic and some guy in North Carolina Philharmonic. We did an Apollo program. I did a narration on the program. We used the various aspects of the thing. That was the first time that I was asked to do it by a conductor, and then he was asked to go down and do it in a couple of places in the South, which we did last year. Then finally asked me to do it maybe six months before he wanted to do the concert and everything. He got confused; he thought the landing was last year. So we set this thing up and I said, no, it's okay. It was Borman. I mean, it was okay. I said, "It's one year to go, so you're okay."

BUTLER: He'll just have to do it again this year.

MARKLEY: We talked about doing the Fourth of July.

BUTLER: Neat.

MARKLEY: But anyway, so when I finally had to sit down and write it, write the whole thing, then I called eight or nine of the astronauts and asked if they would give me their impressions, give me their impressions of what they thought about the program now in retrospect.

BUTLER: That's a good approach.

MARKLEY: And then I integrated that into the program presentation. Then I wrote a book on sort of the total history, a little thing we handed out to all the audience. That's the first time that I had a chance to sit back and look and take into perspective what really happened,

because before you're so involved in it, and afterwards you get out and everything going on. But that was the best thing.

Back to, as I said, it was anticlimatical. Oh, they're on the moon. Well, that's what we do. We'd been working six years, seven years, eight years to do it.

BUTLER: Wow.

MARKLEY: Yes. I was more impressed when they landed back on earth. That always was the one I was concerned about, that splashdown. The thing that was probably the one that I was called, but I couldn't go, which was on the 13 thing. I was in Europe when that occurred. I remember seeing the headlines, you know. I was in London. I came out and saw the tabloid headlines about people killed in space, you know. I said, "What's going on?" I got on the phone and called back to the center. They told me what was going on, you know. But that one was on where—that, to me, was more exciting, just going through that and what those guys were going through there, that was scary.

You know, what was interesting about that program was that the changes made in that program, the changes made on the spacecraft, most people don't understand is that spacecraft had systems on it that we obsoleted for the next spacecraft. It was hard. It takes that long to finally design something and get it in the system, test it, and get it going. It just takes a long time before you upgrade a subsystem. It isn't like overnight.

BUTLER: Right.

MARKLEY: Let me see what else here. You said "During your career, what do you consider the biggest challenge?"

BUTLER: Yes.

MARKLEY: I think the biggest challenge was keeping in perspective the entire program and not allowing any one of it to get out of phase and not allowing an area to go off, to say, "We're going to go off," to say, "Wait a minute. No, you don't understand. You've got to be integrated in here. Here's where we are in this thing."

I think the weekly report that we did, keeping everyone totally informed, from Joe Shea and the program manager down, clearly kept everyone where we were headed for. That probably was—that probably was the biggest challenge. If you take a look, I was looking through something here the other day. I was looking at the total number of work we had to do one week. We had to do the command and service module, about five or six projects LM, five or six projects guidance system, ACE [automatic checkout equipment]. You know, you have all these things going across, and you had to be in touch across all of those in a uniform manner. Also then your funding needs things. There's budget battles and cost battles, and everyone wants to make changes, so you try to decide whether change is really required or not required. So, just keeping everything equal, to me, was really the biggest challenge. As I say, I would say I ended up probably being the business manager, is the best way, in a large office.

BUTLER: Very large.

MARKLEY: A very large office. And being the ears and eyes of politically what was going on at the center. I was fascinated by the cooperation with Chris Kraft and Max. I mean, we got in battles. We got in knock-down, drag-out battles, you know. It was fun. I mean, no one got excited. We went out and had a beer and had dinner together, you know, at each other's houses on weekends. But during that period, why, they really worked hard.

BUTLER: That's good that that relationship existed.

MARKLEY: We started in Space Task Group back at Langley.

BUTLER: You knew each other well enough.

MARKLEY: I think the other thing, "What is your greatest accomplishment," so I think the communication, weekly report, all the incentive contracts, keeping that on base.

And the other thing, I think the real thing was, like my wife keeps asking me, "What did you really do?"

I said, "Nothing. I didn't do anything. I just made things happen across the board."

She said, "Well, technical?"

I said, "Yeah, I spent time technically, administrative." But the thing was, how I really got started and got my career moving quickly, was the fact that NACA and the scientists thought that doing operations or doing budgets and doing that type of work was sort of dirty work. I mean, they didn't want anything to do with it. No one wanted to put together the first Mercury budget. That was beneath them. Why are we given this money? Where are you, God? Give us this money. So they didn't quite understand we had to go back and justify.

The other thing would be, also on just another thing, is "How do you see the future of space flight and International Space Station?" You know, I don't know. I think if I take a look in retrospect, I'm not sure I have a clear vision of this. If we put ourselves back to 1490s in Columbus' day, sort of parallel back 500 years back or wherever we are today, is that I don't think people yet clearly understand the importance of the Apollo Program relative to what Christopher Columbus did. In fact, if you're back in those days, thinking about

what's going on today, why do it? Christopher Columbus was crazy guy, he didn't even know where he was going, blind-sided, finally got there. Well, how many years later? Four or five hundred. So will there be manned space flight? Absolutely. Can we afford it? I don't know. But clearly it's going to be something going on.

The International Space Station, that's going to be a challenge to get that funded and keep it going. I remember—I'll give you my analogy. I remember back when we started the program, and I became sort of a spokesman, because you have to understand there were not many people in the program, so someone had to make a presentation on the Apollo Program, and I got elected, generally, to make the presentations on the Apollo Program. I mean, I made presentations all over the country and I would do analogies back on why we're doing this, etc.

But I remember the one question that always came up: You're wasting all this money. You know, it's a question that comes up today. You're wasting all this money for putting man on the moon. Why? And my answer, I always go back and say, well, okay, we've got a billion, couple of billion dollars a year. I said if I gave the country here two billion dollars, what would they do with it? You think they'd go and eradicate poor housing? Do you think they'd go and eradicate something else?

Now, in retrospect, I didn't realize what the greatest advantage was of the Apollo Program, what came out of it. Two things came out of it. One was clearly a whole new set of people's experiences and techniques, like myself, that went into industry and really revamped industry and brought industry and made us a better country as far as competition. I mean, to me, the whole thing was the secret to this whole program, was really the people.

People say, "Why didn't you stay at NASA?" I guess I could stay at NASA. I was a GS-16 or 17 or whatever it was when I left NASA, at 19,000 or 20,500 a year, or whatever. I think the administrators made 21,000 or something like that. So I guess I'd still be there and collect my badges and heroic medals. But the point was, I think the people that come out of

that were the greatest thing that came out. Plus there's just a lot of stuff that comes out, of medicine. I mean, velcro, clearly. But, you know, a lot of things. Integrated circuitry. Computer stuff. None of that was moved forward. Ablated heat shield-type stuff for airplanes and stuff like that.

And yet it's interesting, two things move countries ahead technologically: wars or some program. We either had wars or we had the space program. That's why when you take a look at the International Space Station, it's just going to be long, drawn out, but it'll happen, 2000 and something, I don't know when, but it will happen. There's always a debate, whether you want to put humans up there or not put humans up. I don't know. That's one of these battles that you have a hard time really explaining to people.

The thing that was interesting, and I still had, even when I talk to people about it, because I came out of the program when Borman—you know, the Borman-type thing was going on. When I came out, I remember my wife saying, "What's next?" I said, "There is nothing." "What's next? There's got to be." I said, "Trust me. I've been there. There's nothing going beyond this. They may have a space station, but there's nothing beyond this." Because everyone was on this hype of Mercury, Gemini, Apollo. There's got to be something out there. There was nothing. I mean, everyone was concentrating on the lunar landing.

I know a good friend of mine, Jack [C.] Heberlig—I don't know whether Jack's on the program to get interviewed or not.

BUTLER: Yes, he is.

MARKLEY: He's a very good friend of mine. Jack and I went to college together, were classmates. He clearly has a better perspective on this program than most people you ever talk to. He's very good at it.

But anyway, I just think even if space flight will occur, it's going to be sometime in the future, and someone's going to fund something. The thing that I think, you know, there's another aspect to this which is a little bit off, but not quite off the subject. When we were working on Space Defense Initiative Committee with General Aberson [phonetic] and the group of eight of us, we recommended to Reagan that he go and give the Soviets all of our secrets on the space defense stuff, which he did.

BUTLER: Interesting.

MARKLEY: Yes. And the theory was this: if we and Russia could control space back in that period, if we could get together, we're going to outspend them. They couldn't keep up the spending, we knew that. We had all the technology. The other thing a lot of people don't know, they shut down one of our satellites with laser weaponry, and so what happened was, we said, "If you go tell them what we're doing, they won't believe it, where we are." They had a report. He went and—whether he went or Secretary of State went, they had a discussion about, "Here's where we are. Here's where we're headed for." And that's what really started bringing the whole thing to closure. Our idea was, if you're up there together with the Russians and then you have the Third World countries, which they were worried about, too, they were just as concerned about the Third World countries as we are, then we have control of the Third World countries. You sit around and you zap them off. I mean, so therefore I think the International Space Station may have some sort of a peaceful mission that says, "Hey, we're up here," and something like that. But I think it has to have a mission defined.

BUTLER: Yes. Absolutely. When you look back, you said you started out in wanting to be a teacher, and now you've ended up in a completely different area. Would you have ever even imagined where it could take you?

MARKLEY: No. No. I always looked at—I had this vision. First of all, the Apollo Program gave me, with the work I was doing there, gave me a sense of general management perspective that you would never get even if you went in industry and started up through the ranks. I mean, you have to think about it. If you're a young person and you're the assistant head of the Apollo Program Project Office, you're out meeting with vendors and you're at this level, I always keep saying I've worked my career going down. Seriously. You start off, you're a very senior-level government person, and you work your way down into being a consultant or something like that, you've worked yourself the whole way down the chain of work.

I keep saying every new job I get is less and less, you know, from the standpoint—and I think what it was I always looked forward to is like when I went to Link, I wanted to learn commercial, I wanted to learn something about industry. I wanted to learn a small company, not huge. Like Boeing offered me a job. I can imagine being at Boeing, you know, or General Electric, and they offered me a job, and I could just see that—again, messed in that thing.

I remember my father-in-law, way back—he's dead now—but I remember him saying—I learned this in college. He said, "You want to go to a big college and be a small fish in a big ocean, or you want to go to a small college and sort of be a big fish in a smaller ocean?" So sort of interesting. So I always figured if you go out and you do career-wise, so when I went to Link, I did that. At Raytheon I really had no tops. What I'd always do is, I didn't care about my salary level because I knew eventually my salary level would keep going up. I always took a job a little lower, but I used my experience, my past experience.

The reason I went to work with Link was even though they still had the NASA stuff going on, I knew I could leverage on my NASA work into something like that.

But, no, I never thought where I would end up. Even now, my wife says, "Why did you ever leave Raytheon? You were a senior guy at Raytheon. Why would you want to leave?" Well, you know, it was a challenge. The challenge is I want to go out and run my own company. But I've also run my own companies and also went broke running my own companies. So that was an experience, too. A group of us put a fair amount of money into— and the lesson we learned from that was the fact that you take on something and do something because you're good at something else. You'd better understand what you're doing before you do it. And I think out of this whole thing is, I've leveraged out of the Apollo Program into industry. I've leveraged industry into industry. Then I used industry and Apollo experience in the consulting business.

BUTLER: I guess that's a good example for people just to learn from what you do and to—

MARKLEY: And just keep going.

BUTLER: And keep going with it.

MARKLEY: It was an exciting career. Still is.

BUTLER: Well, that's good to hear. Very good to hear. Thank you, and thank you for joining us.

[End of interview]