NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

JAMES C. MCLANE, JR.
INTERVIEWED BY KEVIN M. RUSNAK
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RUSNAK: Today is November 13, 2000. This oral history with Jim McLane is being conducted at his home in Houston, Texas, for the Johnson Space Center Oral History Project. The interviewer is Kevin Rusnak, assisted by Carol Butler and Tim Farrell.

I'd like to thank you for inviting us into your home today to do this.

MCLANE: Very happy to have you.

RUSNAK: If we could start out with you telling us something about growing up and maybe what kind of career you envisioned for yourself, what you saw yourself doing.

MCLANE: Well, very early in life, I developed a very deep interest in aviation. Back during the Depression, my family went to live on one of my grandfathers' farms. My first encounter with, and the thing that really got me cranked up, was I ordered a twenty-five-cent model airplane kit. We were out on the farm, away from everything, didn't have anything to do, and I ordered a twenty-five-cent model airplane kit from Sears-Roebuck and built it. From then on, everything, I always had something about aviation in the back of my mind. Of course, space wasn't even a thought then, although I was a very avid reader of "Buck Rogers."

My father was a highway construction superintendent, and we were real nomads. We

moved all around the South, Southeast. One year I was in nine grade schools, believe it or not; one for three days. But that was the nature of the business. We moved from one project to another. To avoid all the trauma that that caused in my schooling in particular, my parents arranged for me to spend the school year with my grandparents in Newberry, South Carolina, where I was born. I spent off and on, not consecutive years, but off and on, I spent probably about four or five years there in Newberry and avoided moving around.

I graduated from Newberry High School. When I was a junior in high school, I guess, perhaps sophomore—I can't remember the year—I took it upon myself to build a gasoline-powered model airplane. That turned out to be about, I think, as far as I can find, that was the second one that was built in the state of South Carolina. I built it without ever meeting, until much later, the guy that built the first one.

My parents, with a lot of sacrifice, had given me a model airplane engine for Christmas, and that's the best investment they ever made. That really got me hooked. So I wanted to go to school and studying aeronautical engineering, but, unfortunately, the state schools in South Carolina didn't offer degrees in aeronautical. The out-of-state schools were a little bit too expensive for us. So I went to Clemson University [Clemson, South Carolina]—it was then Clemson College—and took mechanical engineering.

The war came along in the middle of my sophomore year or somewhere in there. I joined the Air Force in the summer of 1942. I signed up for Aviation Cadets in a program. That was the only way my folks would let me sign up. I was underage, of course, and the only way they would let me sign up was to accept this deferment that the Army Air Corps was offering to people who signed up in aviation cadets.

Of course, what they didn't realize was as soon as I was a member of the Army, they

didn't have any more say in it. [Laughter] So it was a terrible thing to do, looking back on it, but I wrote in and said I wanted them to call me up right away. Anyhow, they did call me up in February of '43. I went through aviation cadets and graduated in class 44B at Marianna, Florida.

I was real eager to get in the war. I had married my wife, Dot, in '43, and one of the conditions of the marriage was that she was not going to object to me volunteering for active duty in the armed forces. She readily agreed to that. I don't know. She wasn't any smarter than I was, I suppose.

At the end, when I finished, I went through a fighter gunnery preliminary training course, and suddenly they snapped about a third of my class out and made them instructors. I protested this very violently. I was in the group. But I couldn't do anything about it, and I taught one class of aviation cadets in advanced flying school.

Subsequently, I went through a replacement training unit in Florida and was sent to England as a fighter pilot replacement. I was lucky enough to get in a very distinguished group as a Johnny-come-lately, the 357th Fighter Group, which included people like Chuck [Charles E.] Yeager and some others equally as famous as he. I only flew four missions, though, before the war ended, so I wasn't exactly a war hero.

Our son had been born, and was born in June of '45, after the war ended. He had some problems with multiple birth defects in one leg and a hand, so I felt that I needed to get home as soon as I could to make sure he was getting the best medical attention we could. I was too stupid to realize that I probably could have gotten the best medical attention available if I'd stayed in the Air Force, but I didn't. I came home and went back and worked for a short while for my father and my uncle, who had a highway construction business.

They encouraged me greatly to go back to school. I had two and a half years of mechanical engineering, but they said, "If you go back and study civil engineering, we'd like for you to come back to work in the company. We need a civil engineer to support the company."

So I did. Didn't forget about the flying, though. I stayed in the reserves. I got about six months or so away from graduating with my degree in civil engineering when the company went broke. So that relieved me of any obligations to go into the civil engineering business and, instead, I interviewed with—as a matter of fact, Paul [E.] Purser, one of the guys here, interviewed me at Clemson to go to work at Langley Field [Langley Aeronautical Laboratory, Hampton, Virginia] in the structures business.

I hadn't realized it, but about half of the people, maybe more than half of the people, who were employed by aerospace companies as structural engineers are really civil engineers. So I went to work in the Structures Research Division. Joe [Joseph N.] Kotanchik was there, although I didn't meet him, but there were a number of other people who came here to JSC later on who were.

When I got in there, they put me at a desk and handed me a copy of [Stephen] Timoshenko's *Theory of Elasticity*. The guy who was my mentor in the division said, "Now, what we want you to do for the first few months is to work every problem in this book." He'd asked whether I'd studied that in school, and I said no. So he said, "Well, just start at it, right at chapter one, and work every problem in this book."

Well, that was not the kind of—I had a grand plan. I was going to go to NASA—NACA [National Advisory Committee for Aeronautics], rather—and work as a structural engineer and get a little basics in that and then go to work for an aerospace company. I thought that was the way to go. Well, sitting there at the desk with that copy of

Timoshenko's *Theory of Elasticity* in front of me was a very disheartening experience.

I'm really not a very good student, never have been a very good student. Although I made very good grades back in Clemson, it was really difficult. And that was the most boring thing, nothing but sitting there with those partial differential equations. So I sort of hit the panic button. I said, "You know, this structures research is not what I thought it was at all." Later on, I talked to Joe Kotanchik after we were here, and he said, "I wish I'd known you were there and felt that way about it. I would have put you into some experimental work," which was really what I thought I was getting into. But he didn't. I didn't meet him, and I was still discouraged.

So, George [E.] Griffith, who later came to Johnson and was an engineer in the Structures and Mechanics Division, was a deskmate of mine. He sat right across in the big bullpen area. I confided in him one day about my desperation about being in the wrong business. He says, "Well, I can get you moved out."

Incidentally, there wasn't any such thing as quitting the job and going to work somewhere else, because nobody paid moving expenses, and I had depleted what little resources I had in getting up to Langley Field with my family. So he said, "I know a fellow over in the Construction Engineering Division who they design all the wind tunnels and everything, structures around the site." He said, "They probably would like very much to have you." He says, "I'll call him." His name was [J.] Gordon Griffith," who, incidentally, eventually came here to JSC.

He called Gordon, and Gordon said, "Look, I don't want any more of those castoffs from the Structures Division." [Laughter] So George said, "Well, he really isn't a castoff. How about just talking to him anyhow."

So I went over and interviewed, and the net result of that was that I did move over to the construction engineering business, and that was a lot of fun. We designed—the Unitary Plan, had been approved, and Langley had several wind tunnels associated with that, the four-foot supersonic tunnel and some others. We were doing all the design work on it, a good bit of it in house. It was before they really contracted out very much. I worked a little bit on that, designing some components for that and several other little projects around the Center.

Everything was going all right, except my family was starving to death. When we moved up there, the starting entry grade for engineers, professional people, we were on a special schedule, a P schedule. I was a P-1, and if I'm not mistaken, when I went to work there, the annual salary was less than $2,000 a year, either less or just a little bit more [actually $2644.80 p.a.]. They did give us a raise. Congress voted a civil service pay raise shortly after that, but we were just going downhill as far as resources were concerned, and my family sort of kept us bailed out. But we were getting pretty tired of living on nothing at all.

So I started casting about for something else to do. My supervisor there in the section had been this fellow named Gordon Griffith, and he had accepted a job at Tullahoma, Tennessee, where the Air Force was taking their Unitary Plan money and spending it on a completely new testing center, using, as far as they could, some equipment they had picked up from the Germans after World War II, which was a mistake, incidentally, but that's another story. But he had gone to work down there with the Army Corps of Engineers, who was serving as the construction agency for the Air Force, and he came through on vacation. He lived in Vermont then, so he came from Tennessee going to Vermont on vacation,

stopped at Langley, came up to the office, and hired me. He said he could pay my moving expenses, which was something brand new, and he said he would guarantee me—well, he would give me a raise if I came to work, and then he'd guarantee another raise within a year. Well, I couldn't turn that down.

So we left there and went to work for the Army Corps of Engineers in Tullahoma. I spent the bulk of my time as a Corps of Engineers project engineer. There were lots of project engineers. Everybody had project engineers, and I was the Corps'. The Air Force had a project engineer for this thing, the operating contractor had a project engineer. Well, I was the Army Corps of Engineers' project engineer for the Propulsion Wind Tunnel facility, which is a very unique facility, one-of-a-kind thing.

I developed a taste for working on one-of-a-kind things in conjunction with that. It seemed like everything that came up on that project was something new. If it wasn't new, it was applying something in a different way, and it was thoroughly enjoyable work, and at last I was making enough money to at least pay the grocery bills. So things were going pretty good until we finished the project.

As it wound down, the Army Corps of Engineers went out of business there, and I was looking for something else to do. Well, the Air Force was attempting to start a big new facility called the Mark II Aerospace Chamber, and that was going to be the world's largest space environment simulation chamber. I had just transferred over to the Air Force, moved one floor up, carried all my stuff up one day, and I was in business the next. I was a section head in that. I had a few people reporting to me. That's my first supervisory job. No, that isn't right. My first supervisory job was the Corps of Engineers. I was a section head there. But I was also a section head in this Mark II facility. That was a real interesting time. That

was something absolutely brand new. Everybody sort of viewed the space simulation chambers as something equivalent to the wind tunnels in aeronautical business. So, it was all new and very exciting time.

We had an office there headed by an Air Force colonel with a civilian deputy, and then we had mixed military and civilians in the organization as it went down from there. I had a couple of military people working for me, military officers, in addition to some civilians. We dreamed up and then administered research contracts in all of the areas that were pertinent to space environment simulation testing: vacuum technology, cryogenics, large structures, several others. We had a budget of about $3 million a year to do that. So we had a lot of work just tending to those.

In addition, at the same time, we were developing the design criteria for this great big 200-foot-diameter space simulation chamber, and we were selling that to the Air Force Headquarters to try to get it in the budget. At the time, it was by far the largest, the most costly single research facility that had ever been proposed. We were carrying a budget of—this was like in the late fifties, and we were carrying a budget of $218 million for it. It was going to do everything. We were going to put nuclear-powered spacecraft in it to test, which is a big problem area. We had a lot of research in conjunction with that.

But we finally got the design criteria for the facility finished, and we went up to [Air Force] Headquarters. General [Bernard A.] Shriever was the Air Force general who was in charge of all the research stuff. When we finally presented it to the Air Force as a budget item, Shriever had a list that year, as well as I recall, of some ten or twelve projects. He had issued an ultimatum. He says, “If I don’t get these projects, I quit.” I don’t know if you’ve ever heard that before, but he did.

Let me think what some of the other things were on his list. The Titan III, I believe, was one of them. I forget. There was a range of research and development kinds of things and advanced weapons kinds of things. One of those things was our Mark II facility. So it got into the budget. But then came the job of figuring out what the Air Force's mission in space was. Nobody could do that. So it began to bog down. We set up an AE, architect engineer, selection board and started the process, interviewing potential contractors and so forth.

I remember I lost all my end-of-the-year annual leave just waiting around for a meeting of that board one year. Finally, the Air Force says, "We just can't justify it right now, so we're not going to put it to the Congress." And I think maybe that was one of the few things that Shriever lost in his proposed budget.

So as that thing began to bog down, I began to look at what was going on at NASA again. The Johnson Space Center had just been authorized. So in the summer of 1962, a friend and I drove to Houston to interview with the Center to see if there was anything here for us. I guess we interviewed primarily with Aleck [C.] Bond for the Engineering and Development. I'm trying to think what the name of it was at that time. It changed names a couple of times. I believe it was Engineering and Development something or other. That wasn't it, but it was something close to that. SEDD. What would that be? Systems Engineering and Development Division. So we were both offered jobs eventually, and I was offered a raise in the process, but then they tried to get me to come and said the raise would come along later. I said, "No, just, you know, whenever the raise is there, let me know and I'll move down." [Laughter] We waited around for a couple months. I think the Center was under some—the Center was being accused of stealing people from other agencies, I've been

told. That delayed my approval for a raise. I guess a unilateral transfer would not have been any problem at all, but they had some explaining to do when they were offering raises to people from other agencies.

So, I came here. They finally made me a firm offer in December of '62, and I came here on the first of January '63.

RUSNAK: Before we get into your work that you started at JSC, I guess there were a couple points I was wondering about from some of the earlier stuff, if you don't mind.

MCLANE: Sure.

RUSNAK: You had mentioned the Unitary Plan and what was going on with the NACA and Tullahoma with that. Could you elaborate on what that was exactly?

MCLANE: The Unitary Plan was the result of a study made by a committee appointed by I forget which President, but it included General "Hap" [Henry H.] Arnold and the famous German aerodynamicist, von Karman, Theodore von Karman, and some others of similar statue. We had ended World War II with a vast superiority, we thought, in aviation. I think if you look back on it now, you'd find out the Germans were a bit ahead of us, but they were restrained in some other ways.

So the question was, what can we do to maintain this superiority? And that's what the committee was charged with defining. They recommended the establishment of one state-of-the-art facility, aeronautical research facility. Space was still not in the picture. The

people in several NASA centers had supported them in this study. I know that that was before I got there.

I know Gordon Griffith and some of the people working for him had done work on defining some of the wind tunnels, for example. It would be in such a thing. They had a thing called a 40-by-40 wind tunnel. I forget whether it was transonic or supersonic. But, anyhow, it was a gigantic thing compared to others. They had come up with feasibility studies and a very broad design criteria and cost estimates. So this plan became known. This thing was submitted to the Congress preliminarily, I think, and they very soon found out that the Congress wasn't going to approve a project like this that would be located in one place.

So they began looking at how they could split it up, maybe, and put little political spoils into various places around the country. Incidentally, the first siting study for that thing showed that it should be located in Flagstaff, Arizona, of all places. Somebody liked Flagstaff, I guess.

But they did split it up where they divided this thing into three parts. One, they gave a third of it to the Air Force, and the Air Force could do whatever they wanted to do with it in the way of building new facilities. They gave a third of it, approximately, to NACA. They gave another third of it to the universities. This thing was collectively known, came to be known then, as the Unitary Plan.

NASA's share was split between the Centers. They built a number of wind tunnels that were called Unitary wind tunnels. Those still exist today in Ames [Research Center, Moffett Field, California] and Langley and, I think, Lewis [(now Glenn) Research Center, Cleveland, Ohio], has got something out of that also. The Air Force took theirs and decided that—well, they had captured a big engine test facility in Bavaria, and it was very near

completion. It hadn't been completed yet, but a lot of the equipment was there. They decided they would dismantle that thing and bring it back to the U.S. and assemble it, and they'd have a good way to quickly get into the business of doing engine tests. These are tests where you controlled the environment of the engine, the temperature and altitude and so forth.

So they took all of their unitary plan money and put it into Arnold Engineering and Development Center [AEDC], which was located, strangely enough, on government property in the state of Tennessee, which had as its big senator Senator [Kenneth D.] McKellar, who was head of the Senate Appropriations Committee, I believe. So that's where the Air Force went. They hung their hat on Senator McKellar in Tullahoma, Tennessee. They put it on the site of the old Camp Forrest area, which is a gigantic World War II camp. They were only on a small part of it, of course, but they took the whole thing.

They built a beautiful lake to be used for cooling water in the wind tunnels. They really didn't need that, but they did it. What else did they do? They built three major facilities, which exist to this day. A couple of others have been built since then. But the Propulsion Wind Tunnel, the Von Karman Gas Dynamics Facility, and the Engine Test Facility. The Engine Test Facility was built around this bunch of German scrap. It was in trouble from day one, because, for instance, the electrical switchgear on it was built to German standards which permits what they call air blast switchgear. The switchgear, the switches when they open a circuit, they blast air to blow out the arc that comes in between the things. That air blast switchgear is just outlawed in this country. We break circuits under oil and quench the flame that way. The arc, I should say.

So there was a number of problems that arose on that account. Can we really use this

stuff, even though it doesn't come up to American standards? And a lot of the equipment had been sabotaged. These very large and very expensive compressors used to blow air through the facility, and those things had been sabotaged. It was right at the end of the war. So they had to be completely rebuilt. So they probably wound up spending more money on this facility that it would have taken to start from scratch. I know they certainly took as much time as it would have taken starting from scratch. So the Air Force had its Unitary Plan there at Tullahoma.

The universities built wind tunnels for the students to use, and one of those at Texas A&M [University, College Station, Texas], for example, was used on the Shuttle Program for some aerodynamics test [of] landing characteristics of the Shuttle and many other things. It's still going there at Texas A&M, as are a number of these unitary tunnels at other schools around the country that offer degrees in aerospace.

So that's about it for the Unitary Plan.

RUSNAK: A couple times you've mentioned the Propulsion Wind Tunnel and, before, you mentioned what a unique set of problems that created for you and how there were certain things that came up that you had to deal with. What were some of those?

MCLANE: Well, the Propulsion Wind Tunnel was designed by an outfit in St. Louis [Missouri] who got the contract through connections with General [Douglas] MacArthur at the end of the war. He thought he was serving a great humanitarian service by volunteering his firm to do the design. [The firm was Sverdrup & Parcel, founded by MacArthur's Chief of Construction in the Pacific Theater during World War II. A wholly-owned subsidiary,

ARO Inc., was founded to operate the Center when the time came to begin operation.] But as it turned out a little bit later, Senator [Albert A.] Gore [Sr.] ran for Congress. This was his initial tour in Congress, in the Senate. He ran on a ticket of the operating contract at Arnold Engineering and Development Center was nothing more than a pipeline to the Treasury, and these were the headlines every day on the paper, you know. "Gore again accuses the government of providing a pipeline to the Treasury for this contractor." And he was elected.

After he was elected, I had need for a transcription machine, and we didn't have any in the Corps. We borrowed one [a dictaphone] from the Air Force. That was the only one that was available back in those days. Anyhow, it made little records.

We borrowed that thing, and I was using it. When I was teaching myself to run it, it came with a cabinet. When I opened the cabinet, and here were a bunch of records in there. There were some blanks, and there was some that had been used. Just out of curiosity, I put one of these used ones on to see what was on it. And son of a gun, what had happened is the general in charge of AEDC had left a very short time before that, and he had transcribed an exit memo to his successor, listing all of the problems that the Commanding General there at the AEDC had. I read that thing and I listened to it, and it scared me. I said, "Good gracious, if he knew I had this, no telling what would happen to me. So what should I do with it?"

I talked it over with my boss. I wouldn't let it go any further that that. And we decided that the thing to do with it was to just leave it right where I'd found it and return the machine. Whether anybody else would find it or not, we didn't know.

But on this record there was such things as there was one very prominent fellow in the operating contractor's staff, which was ARO Incorporated, a subsidiary of Sverdrup & Parcel [Inc.], who was the design AE firm for that. There was one guy there who headed one

of the major elements of their organization. It turned out they were having a lot of trouble with him because they found out he'd falsified his employment application. I guess we've heard a little about some people who have been doing that recently. But it got him in trouble, and the question was whether they should let it be known to the press. They were going to fire him, but just how spectacularly, I guess, depended.

But one of the other things on this was he made mention of the problems with Senator Gore, who had been elected on this platform. His main plank in his platform was "We're going to get rid of this pipeline to the Treasury that ARO has." And he said that what had happened on that was that he had nurtured a friendship with Senator Gore, and they had found out that they shared a common interest in black angus cows. They swapped cows and visited, talking black angus cows, and apparently the business of the pipeline to the Treasury just faded into the background after that. [Laughter] So that sort of brings us in touch with current reality, doesn't it? Anyhow, I thought that was a pretty fascinating, unique experience.

Let me see. On the Propulsion Wind Tunnel, the special problems that came up. Well, first of all, it was a gigantic structure. It was a vacuum structure, primarily, and the design procedures for such a structure were ill defined. The best thing that we could find had been done at Langley in defining criteria for the design of this 40-by-40-foot tunnel going into the unitary plan, which never came about, incidentally, but it had a lot of good, good stuff about proposed methods of designing, for example, the big corner rings. If you look at a wind tunnel when it takes a turn, you look around, it has a big ring around the corner. That's a special structural problem. You look around the doors on it and you'll see that there's some big girders around, circular rings around the doors and some special framing in

between that. So, somebody had developed some rational design criteria and methods for that. Sverdrup & Parcel used those procedures on the tunnel, and we, incidentally, looked into them again down here when we had our big structure [Chamber A of the Space Environment Simulation Laboratory] fail.

So there were other special problems on it. One was a big compressor, the main fan, if you want to call it that. The tunnel was really two separate wind tunnels, separated by an electric drive unit. I think it was about 183,000-horsepower on one shaft. That caused a lot of concern. There was something that happened on another large amount of power connected on one shaft, and I can't remember where that was. But there was some fear there would be a very slow resonance that would built up, not in five or ten minutes, or even an hour or two, but over several days perhaps, that would suddenly cause this shaft to really be overloaded, and gosh knows what would happen then. So that thing was studied ad infinitum. I didn't really work on that, but I kept a close eye on it.

We had other things. The tunnel had to run at a fairly high temperature, and it built up this temperature through the heat of compression in the drive unit, but the structure was so very, very heavy and had so much mass that after a short while it would take it forever to heat up and it might not ever heat up, to tell you the truth, because the structure was just so big. So they decided we'd better insulate it on the inside.

Well, some areas in that tunnel had something like 200 decibels, just an unreal noise level. How can you insulate the inside of a big structure like this with the wind load and the noise? And another criteria slapped on it, you cannot release any particulates into the air because it would erode the model on the test. So, Sverdrup-Parcel really looked into it and decided that they couldn't find anything that would work.

So when they gave us the specs for letting that part of the contract structure, they put in the specs just the performance requirement for this insulation. They said the noise level will be this, can't release any more particles than this, and it must have this insulating value. So they put it out on sort of a performance basis. We really couldn't dream up anything better, too, so it went out that way, and the insulation was a relatively small part of the overall contract.

The contract went to an outfit that had done a lot of wind tunnel work there at AEDC and other places. At that time it was called Pittsburgh-Des Moines. They've changed their name since, I think, to Pitt-Des Moines or something like that. They build water tanks all over the country, but they also specialize in wind tunnels and space chambers now.

So they got this contract, and the first thing they did was send the chief engineer down and say, "Well, we've looked into it, and that part of the contract is void because it can't be done. We've gone to all these insulation people and everybody assures us that it cannot be done. So, please, just take that out of our contract. And, incidentally, we spent this much money looking into it, so you need to give us that much money." [Laughter]

So we said, "Well, wait a minute. We don't think you've really given it a real try, and we have some ideas about something that might work and we have some ideas about how you might test it and demonstrate that it works okay." So we sort of went into a partnership with Pittsburgh-Des Moines in developing this stuff. That was an interesting thing. Everything from—well, the design that we lit on, finally, was a series of pans about three feet square with the corners chopped off, stainless steel pans. These were drawn like kitchen sinks. So we went around and visited with the people who made kitchen sinks and found out how that was done so we could get a good handle on whether it was feasible and

how much it might cost.

Then the insulation inside it was fiberglass, but we learned real quickly that all fiberglass was manufactured with a lubricant in it, usually some starch, and that stuff would just go to pot in no time under any real temperature difference. The people in the aircraft industry knew that already because they had a need for it around afterburners in airplanes. So we went to them and found out what they did about that. There weren't too many people in the country making that stuff, and it required a quartz, a very pure quartz, that was lubricated with a silicone, high-temperature-resistant silicone stuff, instead of starch. We agreed with the contractor on a little test setup that would vibrate it and heat it and everything to demonstrate that it really worked, and that was very successful. I think the contractor actually wound up making some money on it. I'm not sure. He certainly didn't lose any.

We had something else. The facility required an enormous amount of dry air. The design that Sverdrup & Parcel came up with was a whole separate building about 150 feet by 150 feet, and I forget how high, full of beds of a desiccate material, a drying material, which we would circulate the air through that and dry it. Then, of course, it would load up with moisture, and we would then reverse the cycle with heated air and dry it out. That was going very well. We put it under contract and everything.

We got a letter suddenly from a fellow in Pennsylvania, I believe, who said that he noticed that we were using his methods for desiccating air, and he was very happy to see that but he called out attention to patent number so and so. [Laughter] So we apparently were in violation of that, and he'd appreciate getting together with him real soon to negotiate a settlement. So we had to contend with that.

What else happened? This is really where I got a real career boost out of this. We

built what was called a auxiliary compressor plant. This is a system to take a good bit of air out of the area that surrounded the test section. The test section in the facility had holes in it. They weren't ordinary holes. They were bored at an angle, and they were very spaced and sized according to a lot of research that had gone on ahead of time.

We had had somebody at Langley [John Stack] win the [Robert J.] Collier Trophy, I believe, one of the big awards, for his design and his inventing the slotted test section in wind tunnels. They were using it at Langley in the 16-foot tunnel up there. This was something that would minimize the shockwaves generated at the walls of the test section that would come back and hit the model at transonic speeds. Supersonic speeds didn't make much difference. The shockwaves would go over and it was slanted so far back that when it came back, it would miss the model. But at the transonic speeds, it just went straight out and would come back and really disrupt the test conditions. So he invented this slotted test section where they put slots along the side along the length of the test section and, I guess, on all the sides, sides and top and bottom. This somehow permitted them to test at transonic speeds without the interference of these reflected shocks.

Well, AEDC took it a step further, and they actually built a whole facility to optimize this phenomenon. For a couple of years they developed the optimum design for it as far as what area the slots would occupy. That turned out to be not slots at all but holes, and not just holes, but slanted holes. Also the holes had to be proportioned according to the area that they were in.

Let's see. There was one other criterion, too. I'm trying to think about what that was. The amount of air to be drawn through the holes to make it work. So you surround the test section with what we call a plenum, a big area, big volume. The test section comes

through it, and it has these slotted holes in it. Then you exhaust the air out of the test section with some auxiliary compressors. You reintroduce that air downstream of the next thing past the test section, is called a diffuser. There the air is decelerated from transonic or supersonic speed back down to its static conditions, and you reintroduce it right past that standing shock in the wind tunnel.

In the case of the Propulsion Wind Tunnel on the transonic side, we had to exhaust 40,000 cubic feet per minute, which is a very large flow rate, and get that across a pressure ratio of something like, well, one to three, or something like that, for the transonic conditions.

So the question was, how do you do that? Another of the political aspects of that tunnel that a lot of people really frowned about and were disgruntled about, especially the Corps, the Air Force had gone out and bought, separately from the Corps—the Corps wasn't involved in it—the main compressor for this thing, and that involved the furnishing of several million dollars' worth of government tooling to make the blades, the great big blades. There were all kinds of design and fabrication problems associated with that, and the Corps was a little bit unhappy that they never were involved in it.

So when it came time to come up with this auxiliary compressor to do function on the transonic with the slotted holes in the test section and everything, Sverdrup & Parcel sent us to buy a set of performance specification for one compressor that would do this, and it was essentially a smaller version of the big compressors over here.

Well, I was talking to a friend of mine who worked for Aero, the contractor, and I said, "That doesn't make any sense to me, going to a big R&D-type structure again that may or may not work right and certainly would require a lot of government tooling and everything. It seems to me like you could take some compressors that have already been

designed and built and put them together in a way that they would give you this big capacity."

This guy said—his name was Bruce Estabrooks. Bruce said, "Well, it seems to me like it would, too." Well, a very prominent aerodynamicist from Germany had come to Wright Field [Dayton, Ohio] under this project called Project Paper Clip. He was in charge of the wind tunnels at Wright Field. His contract expired at Wright Field, and ARO made him an offer to come to Tullahoma and be in charge of the Propulsion Wind Tunnel, which was not too far away from being ready to do something.

So he came to Tullahoma. We had a pretty good German community there already from this Paper Clip Project. They were all Lutherans, and we had started a little Lutheran mission congregation there. I was active in that, my wife and I, and so were all the other Germans, most of them. So, one of these fellows, Alfred Windmueller, who had accepted a contract extension with the Air Force and was still working for the Air Force there, says to me, he says, "You really ought to meet Bernard Goethert." He says, "He's coming to work on the Propulsion Wind Tunnel, and you've been working on the Propulsion Wind Tunnel, so you ought to meet him."

Well, he came down. He left his family in Dayton and came down to get started. Alfred brought him around to the house one night just to meet Dot and I. We offered him coffee, and we sat there talking about various things. He's the kind of guy that just couldn't stay away from business, so we started talking about the Propulsion Wind Tunnel. I mentioned this thing, the work in progress, you know, about this compressor and how I really felt that we could probably get the thing a lot cheaper and maybe it had a lot of advantages to having it in little multiple units that you could reconfigure in different ways.

He says, “Boy, that makes sense to me, too.” He says, “Why don’t we go ahead and look into the feasibility of this in a little more formal way, and then we’ll let the Air Force know about it and maybe we can change the direction of this thing.” He says, “I’ll assign somebody to work with you,” and the fellow he assigned was Bruce Estabrooks. He said, “Bruce will do all the aerodynamic calculations and so forth if you can get the data from the compressor manufacturers. Then you guys can do all the bricks and mortar and the ducting and everything.” I said okay, so we went to work on that.

In about four weeks, we issued a report which became far and wide known as "the Blue Hornet," because it was between blue covers. [Laughter] It was signed off by the Corps of Engineers, the District Engineer, and Dr. Goethert for ARO.

Well, the Air Force literally blew their stack. I mean, you know, we had all exceeded our authority and our mandate and everything, and we had no business getting into this. Goethert nearly got fired, but he survived it, I might say, and went on to much better things. But, anyhow, you couldn’t deny what was in the report. So we wound up, instead of sole-sourcing it to the Westinghouse Corporation, which is what had been done by the Air Force directly with no involvement of the Corps of Engineers, we wound up competing it on a performance basis.

The things that were very interesting about that was that one of the bidders was Brown Bavari Corporation, previously from Germany but now Switzerland, you know. They had built all kinds of big compressors for industry everywhere, and they really wanted the job. Our boss, the colonel who was District Engineer, didn’t really look with disfavor on having a job in Switzerland that he’d have to go attend to every now and then. [Laughter]

Anyhow, we advertised this thing and we got about four bidders on it and wound up

using some [smaller, off-the-shelf] compressors. The Allis-Chalmers [Corp.] and U.S. Steel Company had a joint venture that they were successful in, using compressors that they had designed for the Atomic Energy Commission for their uranium hexafluoride separation plants, only the ones in the separation plants were aluminum and ours were steel. But the characteristics were very well known. They were set up to crank them out like crackerjack, you know.

That system was a rip-roaring success. Since it's been installed, they've found all kinds of other uses for it. For instance, they put the system in tandem with the main compressor over on the supersonic circuit and gained a lot of additional capability for the supersonic circuit of that tunnel. That's been done since I left. So I was very proud of that, and that got me the first outstanding performance rating that the Corps of Engineers had ever given there. [Laughter] My boss said to me one day, he says, "Mac, you know, you really have done a good job on this thing." He says, "As a matter of fact, I would recommend you for an outstanding performance rating, but it's so doggone much trouble to write those things."

I said, "No problem. I'll write it for you." [Laughter] I did, and it was approved. I guess I shouldn't talk about things like that.

RUSNAK: So, from this experience I guess you learned a thing or two about working with contractors on special projects and stuff that probably served you well once you went to the Manned Spacecraft Center [MSC, Houston, Texas].

MCLANE: Yes, it did. It really did. When the Corps folded, I went to work for the Air Force

in an office they set up to promote the Mark II facility. I learned a lot there, too. That was my introduction to space simulation. We traveled all over the country. We talked to every aerospace firm about what they thought the requirements for such a facility might be in the future. We refined all that into a document that essentially described what the performance parameters and the nature of the Air Force future spacecraft might look like. We could get that out and look at it today and you'd say, "Why that's the Space Shuttle," because it looked just like it.

RUSNAK: Things like Dyna-Soar?

MCLANE: Dyna-Soar was much smaller than what we were looking at.

RUSNAK: Oh, really. What were some of the specific projects, do you remember?

MCLANE: No. I'm not sure they had names. It was just what's the trend. We tried to define all the characteristics of it, the nature of the power system that would be on it, electric power system, the coatings that might be on it so we could have some idea about what we would have to provide in the chamber to pump the effluent, the outgassing, this sort of thing.

It really did, it looked very much like the Shuttle, about the same size. That was the model that we used to design the facility for, you know. "The facility will test this. It will have this capability to test." Of course, the most difficult thing was handling the nuclear powerplants. We designed it to be able to accommodate a SNAP-III, I believe it was, a Small Nuclear Auxiliary Powerplant. That led us to making the structure out of aluminum

and everything else in there we could out of aluminum, because most other things would become activated in a nuclear sense and would take a very long time to decay. So we picked aluminum for the structure.

We had some unique features in that, as far as I know, have never been used in a space environment simulation chamber since then. We had a big double wall. It was two shells, really, three feet apart and separated by the stiffeners [which] were on the inside, separated by compartments which we used to leak-check the thing. It had a lot of neat little features in it that some were real good, some have not turned out, some have been untried. That's one. The structure like that.

But it had a nuclear hot shop, big nuclear hot shop, to take care of things all remotely. We had some of the very early work on manipulators. Because of the nuclear problem, we had to handle a lot of things with the mechanical manipulators. We even looked forward to leaving the chamber pumped down between tests and removing the test article through a big airlock remotely with manipulators. You can imagine connecting this thing up for a test with all that's involved in that, and then being able to get it out of the chamber without ever raising the chamber pressure, because pumping the chamber down was an expensive and lengthy thing.

So it's a shame they never built that. They kept putting it in the budget for years after that. Never could get it built. I think they maybe [have] defined their space mission by now, but too late for the big chamber anyhow.

RUSNAK: When did it become clear that the future of manned space flight would be with the civilian NASA instead of with the military?

MCLANE: I don't know anything about that, except that that Mark II facility was going to be manned. We had men going into the chamber and coming out of the chamber during the tests to do maintenance work, for example, not just as a part of the astronauts like we do out here, having the astronauts part of the tests. These were actually just maintenance people that would go in and do certain tasks that had to be done.

Well, this division, I read about that. As a matter of fact, I think there's something in the current issue of *Air Force* magazine, either this one or the issue before, that bears on the Air Force manned capability. I don't know when they—you're telling me that the Air Force doesn't have their sights on manned capability. I'll tell you that they probably do, and that's one of the reasons I didn't enjoy working for the Air Force. Everything is secret, and they get away with all kinds of things under the guise of classified information. It was like taking a yoke from around my neck when I came to Houston and with NASA and we could talk openly about everything. What a great thing that was. That's one reason I would not, even though I'm a retired Air Force officer, I would really not like to work in the research and development end of the Air Force anymore. Very glad to get out of that.

RUSNAK: That's understandable. When you came to NASA, what specifically had they hired you to do? What kind of things were you looking at?

MCLANE: Aleck [C.] Bond hired me for engineering. He was working directly for Max [Maxime A.] Faget. I was hired as a member of the staff, and Aleck said, "I'm not sure what you're going to do, but when you see something that you want to do, let me know," or words

to that effect. [Laughter]

So what I did was, I started out sitting in on design reviews. We had had a big contract with Bechtel [Corp.] at AEDC for design of this Mark II, helping to design the design criteria for it, although we junked most of that because we really didn't agree with much of it and wrote our own document. But they [NASA] had Bechtel as the principal designer here on SESL [Space Environment Simulation Laboratory], for example. That was a big project, and so I would go to design reviews and participate in those just like the other guys. That came back to haunt me later on when the structure failed the first time they pumped it down. I wasn't part of SESL then, but having been in on the design, I became a witness for the court case that resulted from that.

I did other odd jobs. I designed a space chamber that is now—it was very early, about one of the first things to go into thermal—what do you call it? Our thermal test facility, TTA?

RUSNAK: Thermochemical Test Area?

MCLANE: Yes. And it's still out there. It's a fifteen-foot, little small chamber. But I developed the design criteria for that and sort of participated in its design and construction. An outfit here in Houston got it. Very lucky. They were very good. A fellow named Larry Megow was the project engineer. They'd designed the *Alvin* submarine, so this sort of thing really wasn't completely foreign to them, although they really hadn't designed any vacuum facilities to amount to anything. But that was a very, very interesting little project. That facility is still running, as far as I know.

What else did I do? Must have been something. Well, I just did a variety of things. They had some unsolicited proposals that came in, for example, and I evaluated a number of these. Eventually—you know, that's a period that I'm having difficulty remembering. Maybe I'd better refresh my memory a little bit here. Perhaps this will help. [Referring to documentation.]

I went to all the facility design reviews and took an active part in them. One that I spent quite a bit of time on was the centrifuge. The vibration and acoustic facilities for E&D [Engineering and Development], I followed that activity pretty closely and contributed something to that.

White Sands [Test Facility, Las Cruces, New Mexico] was getting started back then, and I was sent out to White Sands for some design reviews. Eventually, a very major operation was when they thought they were ready to go on line, we conducted an operational readiness inspection out there. Charlie Yodzis was the chairman of the committee, but I was the secretary, which meant that I had to do all the work. We went out there. I went out ahead of time to try to get them set up for that, and they were not real enthusiastic about it. When we went out for the actual inspection, they just did not respond like they were supposed to, so we walked out on them. We said, "Look, do your homework. We'll maybe come back."

We had guys coming from all over. For instance, Doug [Black] from the Cape, and Kenny [Kenneth S.] Kleinknecht, I believe, was on one of them. So they did their homework and cleaned things up. We came back about three weeks later and conducted that inspection, came up with a whole long list of things they still had to correct, but at least it made them visible.

I went out to White Sands several other times for other things. White Sands had a problem with a director out there.[*] What was that guy's name? Wesley [E. Messing] somebody. They were changing—they were scheming to get rid of him, is what it was. I happened to be out there on some other business, I forget what it was, on the day that some—along with that job went occupancy of a nice house over on White Sands Army side, very nice house. I was out there one day when this lady had shown up at—Wes Messing is his name—at his house over on the White Sands side, and she said, "Hello, I'm Mrs. So-and-so." Says, "My husband is going to take over the [NASA] White Sands [operation] here, and I just wondered if you'd let me look at the house. I understand that goes with it." [Laughter] Nobody'd bothered telling, or was brave enough to tell Wes about that yet. So he got the word under some adverse circumstances. They did change the director. He went down to Florida, I think.

What else did I do in that interval there? I guess it was about this time that I got started with the criteria for the Lunar Receiving Laboratory. Well, first of all, I might say that I was given the job. Let's see. Max Faget directed that sort of a flight readiness review be made on a Propulsion Power [Division] facility out at Ellington that they'd temporarily set up. I wasn't a party to that, but after it was over, he and Aleck Bond decided that, hey, that was a pretty good thing, running some—we ought to do something as we're bringing all

[*] [Note from Mr. McLane: The White Sands Facility had been originally built by North American Aviation, Inc., to provide a static test stand for the Apollo Service Module engine. Altitude test chambers were added later to test the Grumman Lunar Module ascent and descent engines. At this point in time, many problems were arising because of fuzzy or redundant lines of management responsibility. Mr. Messing was caught in the middle of this. This situation was widely referred to as "the 3-headed monster," taking its name from the Apollo Spacecraft Program Office, which provided direction to North American; the JSC Administrative Directorate, which was interfacing with the US Army at White Sands Missile Range and which was responsible for site development; and the JSC Engineering Directorate, which was overseeing the technical aspects of the tests. Paul Purser, the special assistant to the Center Director, Dr. Gilruth, was sent to White Sands upon the departure of Mr. Messing, to implement a successful realignment of Management responsibilities under one strong Manager.]

these big major facilities on line to make sure that everything is all right before we really go operational.

So we decided to have—no, I know what happened in the meantime that drove that: the [Apollo 1] fire came along. The spacecraft fire came along, and everything was shut down as far as manned testing was concerned. So we desperately needed to come up with some new rules to make sure that we didn't get in bad trouble with our manned testing in particular.

So we came up with this idea as a part of bringing a facility on line, we would run an operational readiness inspection, and we would call in outside experts and they'd review every facet of the operation and certify that the facility was ready to start. Or the way it really worked is they would write a number of chits on deficiencies, and these chits had to be disposed of before the facility would go on line.

I guess I wrote that procedure. I can't for the life of me remember why I got that job, but I did. I wrote that procedure and coordinated it with everybody else, and that became our bible. We also, at that time, wrote a procedure for requirements for manned testing, and that procedure is still in existence and still forms the basis of what you have to do to run a manned test.

So we started running these operational readiness inspections, and the first one was out at White Sands, as I've already described. Then we ran them on other facilities, and I wound up being on every—either chairing—I chaired the one, for example, on the thermochemical test area. I was on one for the facilities over in Crew Systems Division. SESL had one, but I guess I was already in charge over there before that one was run.

But that turned out to be a big area of activity, and I think they still do that. I don't

know. I can't imagine that they would have stopped doing it. You probably just haven't had too many new facilities to make that a big area of activity.

RUSNAK: This is a good time for us to stop and change out our tape. [Tape change.]

We took our break. We've been talking about some of the other facilities that you helped with at the Manned Spacecraft Center. I was wondering how design and construction, building these kinds of facilities, differed there than it had from Tullahoma.

MCLANE: Tullahoma had, as we had here, had the Army Corps of Engineers as their construction agent. There wasn't all that much difference between them, except that I think here there was a sense of urgency. The Apollo Program provided a sense of urgency that wasn't quite as intense… at Tullahoma. So that was one big difference.

Another difference was that at Tullahoma there was no established operating agency. ARO, which got the first contract, and still has it as far as I know—no, wait a minute. Yes. They have part of it now, but for years they had the whole thing. They had just begun staffing, and they would sit in on some design reviews, but they had a minimum input to them, not very much.

Here the operating people were pretty well established, and they'd come down with a lot of experience from Langley and other places. So they felt that they had a big input to make to each one of the projects. The guys in Structures and Mechanics [Division], for example, would have—at that time SESL was under Structures and Mechanics. They felt that what they had to say about the design of the thing ought to be the final word, you know, because, after all, it was theirs. They were going to use it. They were the ones that was

going to have to live with it. So that was missing up at Tullahoma. The only people that really made inputs into the design were Sverdrup & Parcel and the Corps and the Air Force. But the Air Force was not really staffed with a lot of people who could do that too well.

You know, that's the trouble with the Air Force system. They had these guys who were there with punch cards. They've got to spend six months doing this, a year doing this, get the card punched so they get that next promotion, and that's a great big difference, a great big difference.

Of course, fortunately, in most of those operations they alternate the military with the civilians in the chain of command or supervision or whatever. But that breeds a little ill will between the civilians and the military, and I'll have to confess to having had some thoughts along that line. Sometimes it was very good; sometimes it wasn't so good.

I had one military guy, a captain, a West Point man, who was one of the stupidest fellows I ever met in my life. He was working for me, and the office had just been established a little bit before. So it came time for his performance rating, and I know how important those performance ratings are to military people. I mean, that's on the top of the list. So the boss, who was a bird colonel, told me, he says, "You know, he's working for you. You should fill out his performance rating."

I said, "I really don't want to do that."

"Oh, yeah, you can do it."

So I tried. I stretched everything I could to avoid saying anything really bad about that fellow. And he was bad, you know. Like he would read at his desk with the magazine in the drawer. And everybody knew that's how he spent most of his day. [Laughter] I went in there one day, and he was a little bit late getting the drawer shut, and he shut it against his

fingers. It must have just killed him. I can see him sitting there just grimacing, and he couldn't say anything. [Laughter]

Well, anyhow, I gave him the best rating I could, you know, and all the detail. It went in to Colonel Reifsteck to be approved, and he came in to me. He says, "What are you trying to do, kill this guy?" He says, "With a performance rating like that, he'll be out in a month."

I said, "I stretched everything I could on it, Colonel, and I just could not live with myself if I went a bit further than that.

He says, "Well, okay." He says, "I'll rate him."

I said, "Fine. Take it away." [Laughter]

That guy got transferred to some remote radar location in Hawaii, I think, on top of a mountain. I heard from him later on, and he had apparently gotten out of the service, and he said he was applying for an engineer registration in California and wondered if he could put me down as a reference. Boy, that really—I forget what I said. I guess I had to agree, but, anyhow, it turned out that he really didn't need me. He had some other references. Boy, I was so glad of that. [Laughter]

Well, now, where were we?

RUSNAK: You were comparing Tullahoma and working for NASA.

MCLANE: Oh, yes. The biggest deal was the secrecy around the thing. That was always a big impediment to really getting things done, that and the fact that the operating people here were experienced and established, where they weren't up there. So they made a big input to

the design.

RUSNAK: You began to speak to your involvement with the Lunar Receiving Lab earlier. You told us a little about that. Could you elaborate on exactly how you became involved with that and what your role in that process of getting that facility designed and built?

MCLANE: Sure. Well, I was on the E&D staff at that time, doing odd jobs, operation readiness inspection, writing a spec for manned testing, whatever, and one day, two young men who were assigned to the Bill [William E.] Stoney's [Jr.] division, which was called Experiments or something like that—I didn't have much to do with them—came in to see Aleck Bond, and he called me in to listen to them. It was a chemist named Don [Donald A.] Flory and a geologist, Elbert [A.] King [Jr.]. These guys were both Ph.D.s and were working for Jack [John M.] Eggleston over in Bill Stoney's division.

The deal was that they had been going to science reviews and they had been given money to have designed a box to return the lunar samples in. But they came in and they said, "You know, nobody has paid any attention to this, but it seems like it just doesn't seem right, just opening a box when they get back, because it seems to us that the atmosphere might ruin these samples in some way. And we were wondering if E&D has a vacuum chamber somewhere that we could use to open these things."

Well, the answer to that is no, you know. If you think about it a little, what they need to do would require a very, very special facility. So we tossed that around a while, and we learned as much as we could from Don and Elbert about what they had in mind. [J.] Gordon Griffith came over. He had, in the meantime, transferred down here and was over in the

Engineering Division. He came over and sat in, and we decided we'd crank up a study, an in-house study, to come up with a concept for a vacuum chamber that would really treat these things the way they were supposed to be treated.

So we did. When we wound up, it was pretty expensive. I can't tell you without checking in the file exactly how expensive, but it was pretty expensive, you know, a few million dollars. It hadn't been put in the budget, and it was late in the program. So we said, well, obviously what we need to do is we need to refine this thing. The word's going to get out that we're working on a big new facility, and we'd better get it defined and we'd better get the Congress in on it as quickly as we can. So we had a big meeting with the Center Director and a bunch of other people to decide what to do, and we decided that we would let a contract to an AE firm to assist us in coming up with preliminary design criteria. And with the headquarters people, we established a committee to try to determine what the requirements were going to be. Boy, that was interesting.

I'm just an ordinary poor old B.S. engineer, you know, and this activity was all very high-level science stuff with, I guess, the level of experience of the people that were on the committee were—I always said they were one level below Nobel Prize winners because several of them worked directly for Nobel Prize winners. For instance, Jim Arnold was one from USC, worked for [Harold] Urey. I forget what Urey's first name is. He's a Nobel Prize winner. And some of the others were about the same way.

So I was a little out of my element, but on the other hand, I had a definite interest in it and I knew exactly where my place was, so I really didn't have any trouble getting along with those guys. It was interesting having a peep into that community, which is different from everything else, just completely different. Those guys are very, very honorable, but

their code of honor is their own. I mean, it's one they've developed over the years for themselves. It's not like the codes that we have, you know.

One thing in the way they approach things, it was really frustrating in that activity, was they would agree to something, and then the next meeting you'd have, they'd completely turn over. You'd say, "Well, you can't do that. We agreed last week that we were going to move along on this. If we did this, we'd never get this thing done."

They would say, "But I was wrong last week," or last month or whatever, "and obviously this way I'm saying now is the way it should be done." So that's the way—and they were all like that. It wasn't an isolated case.

The other thing that was very interesting, every meeting we had, every one, would end up with everybody saying, "Well, we've got a lot of action items here, and this job has got to be done. You know, we really don't have any time to do it. It's got to be done. So now let's set up the next meeting." They'd all get their little books out, and they'd say, "Well, how about so-and-so?" And a couple of them would say, "Well, I'm sorry, I just can't come on that date." And they go through that setting up a date for the next meeting, when all of them were really saying, "This has got to be done now." They would invariably set the meeting up six weeks downstream somewhere, and it was somewhat problematic as to whether we'd really be meeting then or not with all of them with their action items. Oh me, what a group.

We got in trouble with those people when we first started meeting with them. First of all, headquarters thought they were running the thing, and I guess they were. And we didn't object to that. They had a mole in [NASA] Headquarters from [Eugene] Shoemaker's USGS [United States Geological Survey] office. His name was Ed Chao, and he was there to

represent in this program the interests of the US Geological Survey. His boss, Gene Shoemaker, had this grand plan that the way to run the lunar mission was—first of all, the main reason for the lunar mission was to get samples and do geology, and the way that should be done is that NASA should build for them a big control center out at Flagstaff [Arizona], and Shoemaker and his buddies would gather around the control consoles and whenever the guy says, you know, "The Eagle has landed," they said, "Thank you, we'll take over now." Then they would go about directing the geological work to be done on the lunar surface. I mean, that sounds absurd, but that is really just about the way they summed it up.

This guy, Ed Chao, was up in headquarters as the fellow to maintain that viewpoint. Of course, they really couldn't—it was a little hard to get it through, but still they tried. Well, the first chance they really had to make inroads there was with [this] committee to establish the requirements for a facility to handle the samples when they came back.

And so Ed Chao established the committee. Dr. Chao was educated in China at Shanghai University. I have a lot of Chinese friends now. I've been to China many times. As a matter of fact, I've been to Shanghai University. I never fail to think about that guy when I'm there. He was different from most of the other Chinese I've met. I guess Shoemaker viewed him with a great deal of approval, because he stood up to Shoemaker very well.

But he set up this committee and he got some darned good people on it from Harvard [Unversity, Cambridge, Massachusetts], from USC [University of Southern California, Los Angeles, California], from Oak Ridge [Tennessee]. The guy who ultimately became the laboratory director, P.R. Bell, was on it. He [Chao] brought in some people from the Public Health business. I guess they had maybe been a little active in some of the programs that

JPL [Jet Propulsion Laboratory, Pasadena, California] had had for landing things on the Moon as far as quarantine was concerned. We had never met anybody like that before. But they came in and the first thing they announced was, "Well, what are you doing about quarantining the samples and the astronauts?" What we were doing was nothing. I guess we and the other people at JSC weren't all that enthusiastic about it. Matter of fact, the first time, sometime later, the first time Deke [Donald K.] Slayton heard about it, he really blew his stack. He said, "Look, it's hard enough getting up there without all this crap thrown in on top of it." [Laughter] Oh, he was really upset, but I think he finally realized they just had to swallow it.

So we had this first meeting up there [at NASA Headquarters], and came home. Ed Chao wrote the minutes of the meeting. That guy wrote all kinds of things into the minutes that had never transpired there, all promoting Dr. Shoemaker's desires. I wrote him back. After we reviewed the thing, I wrote him back and said, "Look, these minutes are no good. They just aren't right, and I object to them being published," and counted down chapter and verse exactly what was wrong with them.

Well, the next time we went up there, he had hired the most expensive court stenographer in Washington, one person who was versed in all these various scientific terms. That makes the rent on him really go up. I've forgotten. I did know for a while how much they paid him. It was awful. But the guy was really sharp, and the fact that it cut across scientific disciplines made it more difficult. But he kept good notes, and we didn't have to take exception to the minutes anymore after that.

The business of quarantine against lunar pathogens was gradually gelled up, and the big job was being able to get people back at the Center here and elsewhere to agree that that's

something we had to accept. The Surgeon General was called in on it, and he came here to JSC once to consult with them. When he got through, the attitude was, "Well, you know, we can't argue with those people. Let him justify it to the Congress and to whoever else." So that's what they did. It added a tremendous amount of cost to the program, not just to the laboratory, just the program in general.

Now, let's see if I can tell you a few little anecdotes that came along in that time period that you'd be interested in. Well, I'll tell you one. One day George [M.] Low—George Low, I guess, he was the Deputy Center Director, I think, not the Center Director. He was Deputy Center, because I remember he was in the office on the front of Building—do they still call it Building 2?

RUSNAK: It's 1 now.

MCLANE: Oh, it is. Okay. Well, on the ninth floor, he was on the southwest corner. Now, doesn't the Center Director, does he occupy that office, or does he occupy the one on the northwest corner looking over the campus?

RUSNAK: Northwest.

MCLANE: Okay, well, he was in the other one that looked out the window toward the front of the building, so he must have been the Deputy Director at that time.

Anyhow, he called me and said that he was having a visit from Congressman [George E.] Brown [Jr.]. This is the father of the Congressman Brown that's in office now from

California, who was—I forget which committee he was heading. It might have been the Space Committee, or subcommittee or whatever. But, anyhow, the one that had control over the NASA money. He was coming down, and he wanted to know what in the world was going on here with this new laboratory that we put in the budget for several million bucks.

So he was going to be briefing him, and he wanted to make sure he didn't give him any bum information. So he wanted me to come up there and sit with him so that I could answer questions or straighten him out if he said something wrong. So I went up there, and we were sitting at his conference table. It was me and Brown and an aide of his, and George Low.

George starting briefing this guy. Well, about ten minutes into the briefing, I looked over and Congressman Brown was sound asleep. I don't mean he—he wasn't just dozing; he was sound asleep. Low quit talking, and he looked at the aide and sort of motioned toward him. The aide says [whispers], "Go ahead." [Laughter] Well, about fifteen minutes, and a ludicrous situation, here George Low was giving a personal briefing to a guy who was absolutely sound asleep.

But after a while he woke up, and he told a story of his own. He said, "Well, you know, this thing sounds like something I've run into before." He said, "The Atomic Energy people had a bunch of plutonium that had been dumped in one of the ocean trenches, some tremendous depth. There were some people who were worried that this was going to poison the whole world, and they wanted a lot of money to somehow do something about it." He says, "We just decided that they weren't all that sure that it was really going to poison the whole world, so we didn't give them any money." He says, "Nothing's happened. That plutonium's still down there, as far as we know." He said, "I think these lunar pathogens sort

of fall into that same category." But he says, "You're right. With all these people like the Surgeon General and everything lined up against you, you've probably got to do something about it, so we'll give you the money."

But I'll never forget sitting at that table with the guy sound asleep. That was something else. I've seen people sleeping in meetings, but when it's a one-on-one, you know, I've never seen that before or since.

What else about the Lunar Receiving Lab? Well, we finally got money and got authorization to go ahead, and we established the program office for it. Joe [Joseph V.] Piland was heading the program office. It basically had three elements. On the facilities side, he had a design branch or a section or something. Gordon Griffith headed that. And had a construction branch that was going to look after the construction when they got it going. It had a requirements branch, and I headed that. Maybe it was section, I don't know. Branch, section, something.

So we went into business, and the first thing we did was we hired an architect engineer firm, Smith, Hinchman and Grylls [Associate, Inc.] from Cleveland [actually, Detroit, Michigan], I believe it is, an old established outfit, and gave them the job of coming up with some design criteria for the requirements that we had and were still in the process of getting. That went fairly well for a while.

Finally, I wasn't getting along too well with Joe Piland, to tell you the truth. He's a difficult man to deal with. Suddenly, they assigned his brother, Bob [Robert O.] Piland. You know about him. He was a presidential intern or something at one time, a very bright guy, very smart, and I think he'd been Acting Chief of the Apollo Program Office at one time. But he was definitely a fair-haired boy. They brought him into the organization, and I said,

well, I knew I wasn't destined to stay with it, because it was obviously a scientific thing. It was just a matter of how long would I stay with it. We were really busy. There had been nothing happening that would provide a good juncture for me to say, "Hey, I want to get out of this," until Bob Piland came over. I said, "You know, that's a good enough reason," because then Joe, instead of coming to ask me about what we should be doing about this and that, he'd ask Bob and Bob would give him his opinion and that was it. So we were just sort of cut out of the deal.

One of the things that we had been planning to do was the staffing, the organization and the staffing. We had built up the staffing a bit. We'd hired maybe a dozen people to be part of the operating staff. We really hadn't fleshed it out, and in particular, we didn't have a laboratory director designated yet. So when they brought Bob Piland over, I just quit. I went up to Aleck and I said, "I'm sorry. That's it for me."

He said, "I understand," and he said, "Come on back over here."

So I went back over to his office, and I don't know what I did for a while, maybe a couple of ORIs [Operational Readiness Inspections] or something. They called me in one day and said, "We've got two jobs open, and you can have your pick, either one." Says, "The White Sands facility needs a director," and they had—what was that guy's name [Jesse C. Jones]? A good friend of mine. I can see his face just as well, and I can't drag up his name. But he had been off on a [MIT] Sloan fellowship and was coming back from that, so they needed to put him somewhere. Of course, I was without a challenging job, and they needed to put me somewhere.

So they had White Sands directorship open, and they had the SESL open. The SESL at that time was a part of Joe Kotanchik's division, Structures and Mechanics. Max [Faget]

essentially said, "You can take your pick, whichever one you want." Well, I didn't want to move my family out in that desert. I'd been out there enough to know I really didn't like that.

So I took the SESL. SESL was in bad trouble then. They had run one test on a command and service module called a—what was that, Spacecraft 8 [Block I spacecraft 008]? Something. LTA-8 [Lunar Test Article-8], not LTA-8, but CSM-8 [Command and Service Module-8] or something. That had been running just immediately before the fire at the Cape, and, boy, were they ever lucky to get through that thing without anything happening, because they had the same sort of conditions they had down at the Cape. It's just the grace of God that that fire happened at the Cape and didn't happen inside SESL.

But they had gotten through it all right, and now they were gearing up to do the real testing, which was on a spacecraft called 2TV-1 [Block II Test Vehicle 1]. The Grumman people had their lunar module LTA-8 that was the first man-rated lunar module down the production line because it was needed for manned thermal vacuum testing. It cost more probably than any other lunar module because it had all this special equipment to make it usable for thermal vacuum testing. It had a system of heaters that was covering the whole outside, for example, that simulated the thermal input to it from the sun and Earth and Moon albedo.

The 2TV-1 was to be done with the solar simulators, instead of the heaters, completely different technique. We were also doing some suit testing. I don't have the schedule here, I forget exactly the sequence of things, but we did some suit test, astronaut training test, really, in Chamber A, the big one. Probably not more than three or four of the astronauts went through that before we moved that over to the smaller Chamber B. So that

activity was going on. Let me take each one of these things one at a time, although they were sort of all concurrent. The 2TV-1 had some interesting little things in connection with that. We had a branch chief who was the one who was supposed to interface primarily with the spacecraft contractors that were bringing in their thing. We had a lot of people from the contractors. North American had probably about 200 or a little over most of the time. The Grumman people, boy, they didn't know a way to do anything except to throw more people at it. They had something like over 400 here at one time. They weren't sure how many were here, but it ran about 400.

Well, we had a branch chief who was supposed to interface with these people, and he was so biased toward the North American people and so biased against the Grumman people. I don't know what in the world had forced him into this sort of an attitude. But he got drunk one night over in a bar, maybe it was the Holiday Inn. He started mouthing off about these terrible Grumman people and these great Rockwell people, and, unfortunately, he wasn't the only one in the bar. [Laughter] So the word got back to everybody right off the bat.

Well, when I first talked to him, I said, "Well, we have no choice but to take you off of working with the Grumman people. You obviously can't do it." I said, "I'm not too keen on you working with the Rockwell people because I think you're leaning too far over and then we have problems coming up toward them."

He said, "Well, I quit." So he did. That was interesting.

Let's see if I can think of a couple more things that happened, sort of peripheral things that went on. We had one test on the way up there. I don't even remember whether it was a lunar module or the command and service module, but it was a manned test, and a big problem came up. I think this was in conjunction with—I could be wrong about what the

problem was, but I think the problem was the time that the transformers serving the facility blew up from a gas line running under them, and we were caught with a crew on board and just a relatively small amount of emergency power.

So the question was, how in the world do we get out of this test without hurting the spacecraft or hurting the people or something, because the walls were cooled down with liquid nitrogen. Anyhow, I believe it was during that thing, I'm not absolutely sure, it could have been another emergency of some sort, but whatever, we had a public relations input. Doug Ward had become the expert on thermal vacuum testing, and he had come up and herded some newspeople into the activity.

Well, I recall that we were sitting in a meeting with most of the interested parties concerned trying to figure out what we ought to do about this or that. Somebody looked over in the corner and said, "Who's that guy?" It turned out it was somebody from UPI or someplace like that. "He doesn't belong in here." [Laughter] I guess Ward talked to him a little bit or something, and he didn't bother reporting on the proceedings in our meeting. I'm not sure any of them would be so accommodating nowadays.

Also in connection with the command and service module testing, Joe—Dr. whatever his name is, that you interviewed—

RUSNAK: [Joseph P.] Kerwin.

MCLANE: Yes, Kerwin. He got pretty excited. We had a jury-rigged thing that they were going to be up there a couple weeks, I guess, at least ten days. I forget exactly how long. They jury-rigged a system to take the urine since they couldn't dump it out into the chamber.

That was no good. We didn't like that idea. We ran a pipe down to a 55-gallon drum that we pumped with a little vacuum pump, and it would let it go down to this barrel. And that thing got stopped up one time. [Laughter] I don't know if Kerwin told you about this or not. He's too nice a guy to talk about these kinds of things. I don't know who was at fault for that, but it got stopped up, and, in essence, the vapors all came back into the spacecraft. Well, it was a pretty bad situation. They put on their oxygen masks and started cussing. We finally got it fixed, but they sure didn't like that.

Some other little things that may have happened along the line. I'm sort of scratching my head now.

We had, in conjunction with the—oh, I guess we did have one serious thing take place on that command and service module testing. We had to simulate the oxygen. We loaded oxygen on board the spacecraft, but we didn't load any hydrogen. We loaded nitrogen in place of the hydrogen. As a matter of fact, I take that back. I believe we loaded nitrogen in place of the oxygen also. We just didn't see any need to run the risk of an explosion in the chamber. When we did that, the Rockwell people, who were responsible for that system, they'd put in some special piping for that, they could not get the stuff to load properly, and they kept troubleshooting it and troubleshooting it and troubleshooting it, and they couldn't find the cause. Finally, the test was coming up. Max Faget chaired the test Readiness Review Board, and that was an outstanding item for test readiness.

The Rockwell people—what was the story they came up with? Well, they said, "This is special GSE [ground support equipment] piping, and it isn't a safety problem, because if we lose nitrogen into the chamber, it wouldn't explode or catch on fire or anything. It's probably just some quirk in the piping that we just haven't found yet. So we recommend you

just go ahead with the test like it is." And Max approved that.

Well, it wasn't long before Apollo 13 came along, and we reviewed the data on that spacecraft, and they had the same problem on that that they did on Apollo 13. I guess the problem being that there was a buildup of tolerances on a vent pipe in there that permitted you to overpressurize the thing. We had the same thing on this spacecraft 2TV-1. I don't know who had been wise enough to say, "Okay, stop this big expensive test—it's costing us $500,000 a day or something like that—and go in and tear into this spacecraft and see what's wrong with it." I don't know. That would have been a pretty bold step. I don't fault anybody for not doing it, but had we done that, we would certainly have avoided the Apollo 13 thing. So there's a case where a real expensive ground test that's intended to catch things that would cause trouble in flight, and we actually ran across one and didn't follow up on it.

Now, another little interesting personnel problem over there. Had a mechanical engineer. Grumman had a requirement for some ultra-pure alcohol, and so we had a big drum of it that had very tight security on it. But this mechanical engineer who was also in charge of the security on it, it turns out he owned a bar over in Kemah [Texas]. We didn't know anything about this until one day somebody from the Texas—the security people brought in this guy from the Texas Alcoholic Beverages Commission or whatever it is that rides herd on Texas taxes for alcohol and giving the licenses out, and they had caught this guy selling this alcohol over there at his bar in Kemah.

They asked him where he got the alcohol, and he told them; it was our alcohol from the lunar module. [Laughter] They didn't know what to do about that. They weren't going to file any charges against him, because while he admitted it, they didn't really have any proof of that having been stolen. I think they were going to lift the license for his bar. But

other than that, I don't think they were going to do anything.

It turned out he had a bad back, and when those guys came in, he was in the hospital with his back. So I had made up my mind that even though they weren't going to bring any criminal charges against him, I didn't want him working in my organization. So I talked that over with folks, and we decided we'd just get rid of him. So I kept trying to call him, and he was in the hospital. Finally, one day we called, and he was home from the hospital. We said, "We need to talk to you pretty badly. Come on out to the office."

So he did, and we sat down. We said, "Well, you know, we've had all this stuff brought to our attention about alcohol missing out here and everything." And I said, "I understand that they're not going to prosecute you because they don't have the real proof but," I said, "I don't think that's a very good thing to be happening here in the lab, and you've sort of lost of confidence and everything. So I was wondering if you'd thought about retiring." [Laughter]

He says, "As a matter of fact, I had." He says, "I'll get the forms from personnel or somebody."

I said, "You don't have to do that. I've got them right here."

He said, "Well, I'll fill them out when I get home."

I said, "You don't have to do that. You can fill them out right here." [Laughter] I was afraid he'd change his mind. So we were one less person then.

Let me see what else happened out there that was interesting. We had cats in our lab. You know the utility tunnels? They were in the utility tunnels, and they would come up out of the utility tunnels and go all kinds of places inside the space chambers and everything. They were a real nuisance. We found out that some of the technicians were feeding them.

So that was our cat problem. I don't think it ever was really resolved satisfactorily, but always we were having something going on with cats getting loose. By the time I left that place, we didn't have a cat problem. To tell you the truth, I don't how it was ultimately resolved. It wasn't resolved all at once, I know that.

We had a big emergency one night when we brought the lunar module in for test. Big deal, you know, bringing the lunar module. First time anybody'd seen the lunar module. We were getting it rigged up to put in the chamber, and it was all wrapped up in plastic and everything. So the way it was being handled was very carefully, and that meant that we had a device on the crane which was called a—I think old age caught up with me right there. But anyhow, it was a little hydraulic device that had a handle on it that you worked like this, and it would pump and raise the cylinder, and you could tell how much weight was on the hook by the pressure in this hydraulic cylinder that you were raising it with. What was that thing called? [A hydrotel.]

Well, anyhow, so the lunar module came in. They hooked this thing up to it and lifted it up off of its support, whatever was in the bottom of the crate. They started pumping on it, and all of a sudden, somebody noticed that the thing weighed about 10,000 pounds or so more than it should, so they stopped pumping on it. [Laughter] We called a meeting. It was in the middle of the night. Everybody came to the meeting, big meeting. What are we going to do now? We don't want to stretch this thing, we don't want to break anything, we don't want to stretch it out of shape or anything, or have we already done that?

Well, we finally decided, after really carefully looking at it, that what had happened is they had failed to release the bolts that were holding it to the bottom. So the hydrotel—that's the name of the device. The hydrotel. So when it was pumping, it was trying to lift the

whole case. After, I guess, a ten-or fifteen-thousand-dollar study, they concluded that it hadn't hurt the lunar module at all.

We did a lot of suit testing, that whole suit development program. I think one of the most valuable contributions that SESL made to the whole Apollo Program were the tests on the spacesuits. There we had something you could clearly identify, and that was that as a result of a manned tests on the spacesuits in Chamber B, they were able to, in more than one test—it went on over a whole period of time, and by the time that they ended the test, they were able to extend very confidently the time of EVA [extravehicular activity] on the Moon by several hours. I think that's pretty doggone valuable and probably worth the price of the whole facility and all the tests that were done over there.

We found other things wrong. For example, there's a water line connecting the ascent module and the descent module on the lunar module, and we discovered that there was a line of sight for the thermal nodes on it that had been overlooked, and that waterline would have frozen after about a very short time on the lunar surface, and they would have had to abort the surface operations and come home. So that was pretty important.

There was another rather interesting thing. I'm probably putting you all to sleep, and this is a very, very appropriate time to tell you this. The lunar module was tested with a system of heaters, skin heaters, we call them. Grumman had used these on another test on a big unmanned spacecraft that they ran up at Goddard in one of their chambers. They were pretty confident of the technique, as opposed to shining a solar simulator on them. They had these heaters, but it depended a lot on the correctness of the analytical stuff.

But what they did was they controlled the temperature of each one of these heaters such that it simulated the thermal load into the spacecraft skin, and they varied that according

to various attitudes, whether it had sun shining on it and what angle the sun was coming at, and whether it was just facing cold space or whatever. So they had to have it programmed so that these heaters could be adjusted to suit whatever condition the spacecraft was supposed to be in at that time.

Well, these heaters, they ran out of money, so they weren't able to automate them. I'm not sure that would have been a good idea anyhow, because state of the art back then in controlling something like that through computers was not all that good. But in any case, they did not have an automated system, and these things had to be controlled manually.

They had a bank of power supplies down on the floor there in front of Chamber B, quite a number of them, for controlling the temperature on these heaters. They had a guy sitting at each one of these consoles. Must have been about fifteen to twenty people from Grumman sitting there, twiddling the knob in response to an occasional command from the Grumman test director. That was without a doubt the most boring job, you know. Some of those things didn't need tweaking once every ten hours. Some of them had to be tweaked maybe a couple of times an hour. But that was a boring job.

So one night, one of these Grumman guys got up from his station and told the guy next to him, he says, "I'm going to the bathroom." He was never seen again. [Laughter] He'd just had enough of it. And everybody understood. I don't think he even showed up to get his paycheck. I'm not sure.

Let's see. There was another story along that line. We had another system that was a pretty boring duty station. We had a guy manning the manual system of valves that supplied the oxygen and regulated the pressure and everything in the system of umbilicals into the Chamber B for manned tests. This guy would sit at this big array of valves, each one of them

with a handle on it like this. He would sit there sort of under the steps on the Chamber B end of Building 32, and he would sit there. We had to have him there all the time in case something came up. It was strictly an emergency thing, except when they were going in and out of the chamber, which was, you know, not very often. But they still had to be manned in case of emergency, so the guy had to sit there all the time. Well, that was a pretty boring duty station.

So one night George Low came over to see how things were going, and I went with him. We looked down the steps at that panel, and the guy was down there reading *Playboy*. George says, "You let your guys do that all the time?"

I said, "Look, we let them do anything when they're on a duty station like that to stay awake." He just smiled and said okay. [Laughter]

What else might I say about those tests?

RUSNAK: You mentioned before that when you took over the SESL, that it was in pretty bad shape. Could you give us something of the history of that facility? For instance, you mentioned the door failing on that when they pumped it down for the first time.

MCLANE: Want to talk about the door for a minute? Okay. The contract for construction, first of all, there was a design contract by Bechtel Corporation. They had as a subcontractor to them for doing the studies on the shell, the structure itself, of both of those Chambers A and B, Chicago Bridge and Iron, very capable firm that we all had a lot of confidence in. There were really only two people in the country that worked on those kinds of things. One was Pittsburgh-Des Moines, and the other was Chicago Bridge and Iron.

I recall the design review I went to in San Francisco. The big door opening was being designed using a design technique that I was completely unfamiliar with. It was some sort of indeterminate thing that I had never been involved with before. I, therefore, in my comments at that review, put down that I was unfamiliar with this design technique and just couldn't comment on whether it was adequate or not. Where I came from up at Tullahoma, when we had a big opening in a large structure like that, a pressure or vacuum structure, we did a very simple thing: we through a ring on each side of the opening and then a beam, two beams, that encompassed the opening, and that was fairly determinate. We could design both the beams and the rings with the loadings from the beam with great degree of confidence.

We had some tremendous openings in the Propulsion Wind Tunnel up at Tullahoma, for example. We had a 55-foot-diameter plenum around the test section, and there was a door that opened up on that maybe forty feet long and at least a third of the diameter of the thing we were opening into. We never had any trouble with that. But that was using a technique that I was familiar with.

I don't think anybody else that was in the design reviews really understood the technique that they were using. I'm not saying that it was invalid, but I'm just saying we just didn't know anything about it. Well, when the job was advertised for construction after Bechtel had finished the design and their subcontractor had finished the design on the structure, they [the Corps of Engineers] wrote some words into the contract that held the chamber fabricator responsible for the design, and we had a big flip over that. We objected to it. If the AE does not have that much confidence that they can say that this is the design, the way it should be, you should only leave minor details to the fabricator, is what we'd all been brought up with. But they were sort of dumping the whole design over on the

contractor.

Well, we bounced that around with the Corps, and I don't know, somehow or other it stayed in there like that. There was some wording that had to do with the contractor checking the design or something. We changed the wording a little bit, but in essence we still required the construction contractor to sort of be responsible for the design.

Well, everything proceeded okay and the construction contract was let. Chicago Bridge and Iron, who had been the subcontractor for the structural design of the chamber, was the successful bidder. They proceeded to fabricate the thing, which was a pretty good job. I think they did a good job, really. They had a gantry crane out there and they erected everything from that one gantry crane in both chambers. They brought in and built a fifty-foot boring mill. Do you know a boring mill is? I'd never only seen one other fifty-foot boring mill, and that was up at Allis-Chalmers in Milwaukee one time. I thought that was really something special. They set one up on site out here, put a tent over it, and proceeded to—they brought the subassemblies down in as large of pieces as they could on a barge and rail. They would then weld them together out there and put them on that boring mill and machine the flanges and everything right there.

So they did a good job, but when they went to pump the chamber down for the acceptance test, they had to pump it down. Of course, we didn't have the pumping systems in there then. We did have any cryogenic systems in then. But they went to put a little vacuum pump on it and pump it out, and that they did. It turned out as a little pump, it took a pretty good while to get it down.

And in the middle of the night, somebody heard it. They didn't have any lights on in there, either. In the middle of the night, somebody heard this creaking and groaning going

on. So there was an inspector out there. There was about two or three people, including, incidentally, a guard that I talked to last week. He's in the hearing-aid business now. His name is Andy Anderson, and he told me he was a guard out there the night that that chamber failed.

So they were smart enough to stop the pump, anyhow, and get on the phone and start alerting people. In a nutshell, what had happened is that all the reinforcing around the big door opening was distorted, and the chamber was about to implode right there where the big door was. The door itself was an unusual design, and it didn't fail. I don't think it did. They may have beefed up little minor details around the flange, but it wasn't the problem. It was flexible. It was a unique design. It was designed so it was dished toward the inside of the chamber. The vacuum then stressed that fifty-foot piece of plate like a balloon. It was all tension and it was very determinate and it couldn't buckle or anything.

All that load went into the flange, which was another thing you could design very readily. So that was a good design. But all the reinforcing around the door had failed. Well, needless to say, that was a pretty big thing, and all of a sudden, they called in all the consultants and everybody that they possibly could to figure out what had happened and what should be done to repair it.

They finally came up with a repair plan. They looked at Chamber B, and it had some things about it that weren't right either, around the big lift-off top, from their having used the same design techniques around the top. Anyhow, they came up with a repair plan and did it, and it cost them several months and a good bit of money. The government decided that they would lodge a suit against Bechtel and Chicago Bridge and Iron, as a subcontractor, to recover the cost of that, the direct cost, anyhow.

I think everybody was afraid the government might win that, because nowhere—it's a tenet of design that the architect engineer is not responsible for damages, in case the design fails. That's just the way it's been all these years. That's basic law. What would happen is, if we were suing them because of negligence in the design, that would have made everybody who ever had a design contract with an engineering firm in this country, that would be precedent then if it stood up. That would make them put extra money in to cover that contingency, into the contract.

So nobody was really too happy about the suit, but we went ahead with it anyhow, and it drug on and on and on. I had a deposition in it that took all day and wound up with a book about that thick that I've got in here. Eventually, they had to go to trial on it. They kept postponing the trial and postponing it, and eventually they had to go to trial. I guess the statute of limitations was running out on it somehow or other, so they finally scheduled it one last time. It looked like it really was going to go to trial in San Francisco, federal court in San Francisco, and I was going to have to go out there to be one of the witnesses. The week before it was going to go to trial, they settled out of court. I think everybody breathed a great sigh of relief, especially me. I didn't much want to deal with testifying. So the government got some money back on it, but I don't know how much. The settlement was not publicized very much.

RUSNAK: Do you remember when that was?

MCLANE: Well, it was after I was over there running SESL. I'd have to somehow refresh my memory on that. I don't know if there's anything here that would help me do that or not.

I don't think so. I can't tell you, without going and looking.

RUSNAK: Okay.

MCLANE: I thought about maybe bringing—I've still got my reading files from way back. I've got my calendars, too, my office calendars. I thought about bringing those out and having them handy while we were going through this, but I said, "Well, I don't know if they want to fool with all that."

RUSNAK: Actually, that may be nice, yes.

MCLANE: Well, they're back there, but it would take me a few minutes to—

RUSNAK: We can do that later if we need to.

MCLANE: All right.

RUSNAK: We were talking about some of the specific testing going on there before. You mentioned the suits and testing the command module and the lunar module. What other sorts of maybe unusual testing was going on, sort of one-off items or things that were out of the ordinary in terms of things you had to test?

MCLANE: Well, I'll tell you a little bit about one program, not very much, but a little bit.

One day, I was called, along with Alec—Alec had been made Assistant Deputy Chief of the E&D somehow. He had four divisions under him, four or five divisions, mine, Crew Systems, Propulsion Power, and I forget the other one. I was called up to the director's office, along with Aleck. What had happened is some guy had shown up with an inquiry about supporting DoD, or somebody, in a test, a major test, and it had a security clearance on it that was higher than—nobody on the Center had a security clearance that high. So they couldn't talk to anybody about it. [Laughter]

So, eventually they granted that security clearance to a few of us and we got to undertake that program. That was pretty interesting, because we had a whole bunch of people here with it. They didn't even want people to know who they worked for. The test was very successful, I might say. We made a little money on it.

RUSNAK: Can you tell us what it was, or is it still classified?

MCLANE: Still classified, as far as I know, but I'll tell you a little bit about it. It had some arrays on it that were covered with gold. Of course, we took the security business very seriously. A couple of our guys almost got in trouble. They had recognized some of these people from the visiting things, people that they knew, so they said, "Hey, Joe, what are you doing here?" That was a little awkward to get out of, this sort of thing.

But, by and large, it went good. We didn't have any big security breaches or anything until after they had gone. One of the man locks that was used as pedestrian entry, as a matter of fact, we had it rigged up as a clean room passage, they were working in there and they took up some of the floor plates, and what in the world did they find but a couple of

film canisters down under the floor. This guy shouldn't have done it, this Brown & Root employee, but he took them down to the drugstore and got them developed. He was curious as to what it was. He didn't know that they'd come from that test. He brought them immediately to me after he'd had them developed. He says, "It's all gold. I didn't even want to look at them, and didn't look at them." But he says, to my amazement, "They're all gold." So, of course, we immediately had to tell our customer about this. I don't know. We didn't get in too much trouble. Actually, I'm pretty sure they came from the contractor, not from any of our people. That was a very successful test, though, and kept us busy for quite a while.

Some other little test that we had. You know the Mariner, the Mars Mariner? We tested some equipment for those folks. I forget whether it was a contractor or whether it whether it was a program office. But there was a spectrometer they brought it that was gold-plated for thermal purposes. They ran a test on it, and when we got through, lo and behold, it was silver-colored. That was sort of a surprise, but good to find out. What had happened, the gold had sublimated off of it somehow or other, under the conditions it had in it, or from the treatment it had or something.

We tested just an infinite variety of small equipment like that from outside, some from JPL, some from JPL's contractors. We tested a really neat antenna that was a parabolic antenna about thirty feet in diameter that was to be deployed in space on the ATS-6 spacecraft. This was a Goddard spacecraft that started out, I think, delivering television to the Indians on the Indian subcontinent. Then it was moved to various places and did all kinds of just—ATS stood for Applications Technology Satellite, and it did a lot of different things through its life.

Well, it had this antenna that was a crucial element. It was built by Lockheed. They asked if they could bring it in and deploy the antenna under thermal vacuum conditions in Chamber A. It was thirty or thirty-three feet in diameter, and Chamber A is fifty feet in diameter, so it was just the right size for that. Well, that thing was an umbrella-looking kind of device that had this metal mesh on it. I may be wrong on that. It may have been a—no, I think it was metal mesh. But in any case, the mesh was coated with some nonmetallic stuff and it had been cured the way Lockheed thought it should be before it was assembled. They had gone through many, many deployments of the thing, static deployments of atmospheric conditions, brought it in here. Our guys loved it because when they'd go to fold it back up, we'd have to get everybody around and get one on each one of the ribs of the umbrella and all together they would walk in and fold it up. It was like a square dance.

So they brought it in, we pumped the chamber down, and it turned out, by coincidence, that the pump-down time we had and everything just by accident corresponded fairly well to the vacuum and thermal history that this thing would see on launch and shortly after launch and before the antenna was deployed. Well, the antenna was deployed and it split, and a couple of these gores of the umbrella, the cloth on it, split. It turned out what had happened is that they had not taken into account that this material that they had sprayed or painted on the surface had not really vacuum-cured completely. So it went through a curing process after it was pumped down in the chamber, and it stuck together.

They went home and focused their attention on that and brought it back, and we did a couple more tests. We did another one just like that, nothing but just straight deployment. Then they brought the whole spacecraft in, and we hung it up and deployed the antenna and measured the reactive forces because there was some concern that the little RCS [reaction

control system] engines that were required to stabilize it after it opened up, that they might not be strong enough to bring it back if it was taut, if the spacecraft was rotated too much, you know, during that deployment. It was marginal, but it went okay.

Let's see. What are some other tests we did? We tested a bunch of balloon payloads for—these were, by and large, university people. You know, they had a big balloon-launching facility up at Palestine, Texas. "Palesteen." "Palestyne." They don't pronounce it the same way as the people overseas do. Anyhow, they have these balloon payloads and a big program up there, one right after another. That's a national facility for launching balloons, scientific things.

They'd had a number of failures of equipment because of the environmental effects, and somebody got the idea that maybe they could test them in a thermal vacuum chamber. So we eventually worked out plans for doing that and tested quite a number of those payloads in Chamber B, with a good degree of success.

What else we did there? Well, you know the Space Station has an arm that goes out, a truss that deploys in space. I'm not sure. I meant to ask somebody about that, but I think that's just the same design that we tested in Chamber B once. I've got to ask somebody about that. We tested a thing called the Astro Boom that was designed at Langley, and it was a little truss like that, that could squeeze down to almost nothing and then when they deployed it, it would go out and be very rigid.

What we were testing was the effects of sunshine on it, whether it would distort it to more than would be allowable. That involved an intricate little design on its mount and system for measuring the distortions on it. Good successful test, and it sure looks like one of these big trusses that they're putting on the Space Station now. I don't know whether it is or

not.

What else did we test?

RUSNAK: Well, we can give you a minute to think about it while we change out our tape, if that's all right.

MCLANE: Sure, go ahead.

RUSNAK: While you doing this great variety of testing both for NASA and for the outside agencies, did you have time to follow the missions that were going on and to provide any sort of support for them either in real time or when they got back to perhaps investigate any anomalies they might have had?

MCLANE: Well, we were very active in supporting the problems with the Skylab when the solar panels did not unfurl, and we did a number of things in support of that through a wide range of things. One thing, we did some tests in our very small chambers in Building 33 on materials that was aimed at determining degradation of some of the materials that were involved in the fix in that thing over a period of time. We did try to do accelerated testing. I'm not a great advocate of accelerated testing. I'm not sure how legitimate it is in all cases, but we tried.

The fixture that was used for inserting—what the heck did they do on that thing? They stuck something through a hole up there on the spacecraft, and we installed that thing in the chamber, on the wall of the chamber, and duplicated that operation of sticking whatever it

was through the hole.

RUSNAK: A parasol, I think they called it.

MCLANE: Yes, yes, that was it. That was it. We did that chamber, right. That was a rather exciting time. I used to get phone calls in the middle of the night on that thing. Who was the fellow that was the—I don't think he knew how to call in the daytime. I'm trying to think of who that was. I dreaded getting calls from him. We were really doing everything we could, and he just wanted to do it a little faster, with very little slack to pick up there really.

What else did we do? There were about four tests that we did that supported that Skylab emergency directly, and I can't remember what they all were. Previously we had tested the Skylab control console in one of the man locks on Chamber A under cabin reduced pressure conditions in the cabin. It seems to me that they found out something that was very, very worthwhile to know, and I'm sorry, my memory doesn't serve me. I'd have to go back to the test reports. But it was something they picked up, the astronauts picked up. They were manning the console manually. We had the Skylab in the chamber.

Now, that's another whole program I didn't mention, Skylab Apollo Telescope Mount [ATM], and that was a major activity for a couple of years. This was done in support of the people at Marshall [Space Flight Center, Huntsville, Alabama], and they brought the Apollo Telescope Mount in for tests. We used a solar simulator on it. It has super clean requirements. We had to keep everything really super clean. That had never been done in a chamber as big as ours, and the Marshall people had some serious reservations about whether our chamber could be cleaned up and kept clean enough to support them.

So we had quite a program going just to prove that we could clean it up. We looked into various techniques of how you might clean the residue in a space chamber, finally wound up spraying it with some cold-water detergent that somebody had found, that worked quite well. Anyhow, we did clean it up. In the process, we invented a number of—invented or applied, in a new use, a number of instruments to measure contamination. And there for a while I think we were probably the experts in the country on contamination in large space chambers.

Now, you know, the computer industry has far advanced over anything we've done. Building chips is just a—we were required to work to a standard of a Class 100 clean room. The computer people in the chip business, they work at a Class 1 or less, I guess. I mean, they can't take any contaminate in. Nothing. So they're a lot classier than we are, or were.

We had somebody that had the foresight to build a big clean room to support the chamber operation. That was in Building 36, as part of the initial construction. We never used it, but we kept it maintained, and it cost a little something to keep it. It was a Class 100 clean room. At the time it was built, and for several years thereafter, it was the largest Class 100 clean room in the country. We never used it, except for some insignificant kinds of things.

Finally, the Skylab Program came along, and we and the people at Marshall decided that they would like to assemble the spacecraft and prepare it for test in that clean room and then bundle it up and bring it over and put it in the chamber. So that was the first time we really got any real use out of the clean room. Those tests went very well. What can I say, except it was a major operation, everything worked fine.

We got along real good with the people at Huntsville. They brought their own crew

down. For instance, they wouldn't trust our people to handle a spacecraft, so they brought their own handling crew down under some German up there, a guy named Hans, Hans something or other. [Laughter] I'm not biased against Germans. Some of my best friends are Germans. He was a rough old guy that was, I guess, a good buddy of [Wernher] von Braun's. They weren't going to let anybody else touch that spacecraft except him.

I was disappointed when we didn't get any more work from Marshall. I thought we should have tested the Hubble Telescope, but they were just in too deep with the people of Lockheed to let that program come here, so it underwent thermal vacuum tests at Lockheed.

RUSNAK: With the end of Apollo and the related programs like Skylab, did you face any uncertainty in terms of the future of your facility?

MCLANE: Yes, the uncertainty being that we couldn't convince people that we were going to have more work to do than we ever had before. Spent a lot of effort on that. Presentations to headquarters. Our own people, a guy—he's dead now so I can talk about him—he was the deputy director who took care of the C of F program, construction of facilities budgeting. What was his name? I don't know.

We had gone to a lot of trouble to try to anticipate what tests we might have, but, you know, people normally don't identify the requirement for a test like that until fairly late in the program, so it's got to be speculative in any case. You can successfully speculate, though, because usually the ones that don't come forward are replaced by something that comes forward later. But, boy, try selling that to some people.

This guy who was in charge of our construction of facilities program and operations

budget, which was running a pretty good bit, I think about 3 million a year or something like that, he questioned this thing, and we worked and worked and worked and fixed up all of these briefings and everything. And we go up there, and he goes "Okay, what have you got?"

And I'd say, "Well, we've got this program."

"I know about that program. That program's going to be scrapped for sure. It'll never make it." Then he'd look at the next one, "Well haven't you heard about that? That's been delayed three years." And then we'd go down to the next one. "Well I've never heard of that one." [Laughter]

So he wasn't really too conducive to giving us money, and that's really what promoted my retirement. I said, "Shoot, they don't pay me enough to listen to this sort of crap." So I retired, and they shut that operation down, did a little bit of damage to it [the facility] because they moved in some operations that—model-building, for example, was done down in the high bay, and they left a mess that was real hard to clean up, in, you know, the cleanliness conditions that we need to handle stuff down there.

But finally, they came back in, and now they're doing a pretty good bit of work. Not as much as I thought we would be doing, but I don't think anybody's out promoting it.

Aleck Bond and I went on a program of selling this facility around the country, visited places like JPL, Naval Research Lab, a lot of spacecraft contractors like Hughes, Lockheed, promoting capability of the facility which couldn't be matched anywhere. We got some stuff out of that, and I think we'd have gotten a lot more if we'd kept it up.

RUSNAK: What level of support did you provide to the Space Shuttle Program before you

left?

MCLANE: Well, first of all, you know the thermal control system, that is, the radiators that are mounted on the doors, you probably know that that was an in-house R&D program to begin with that Crew Systems Division undertook, and it depended fairly heavily on some empirical data. It was available only through actual tests. So even before that system was baselined for the Shuttle, we had done a number of tests while this type of system was still considered an R&D item.

They built panels that we put in Chamber A, and we would shine the sun on them or do whatever to fit the conditions that we wanted to duplicate. We had, outside of the chamber, systems that would load the solar panels, solar rejection panels, in a way that the spacecraft would. Well, they finally baselined that for the Shuttle, that type of a system. There were alternatives, you know. We could have had a flash evaporator that operated all the time during the flight instead of just while they were waiting for conditions to suit the deployment of the panels.

There were some other things that could have been done. But they baselined that system, and when they did, then we really did need some data that related directly to the Shuttle instead of just R&D, and we ran a number of tests that duplicated those panels, finding out a lot of things. For instance, the coatings on the panels needed to be verified, and we did that. What else? I think that work was still in progress when I left there. We did some other interesting tests.

RUSNAK: That's okay.

MCLANE: This is a little disjointed, if that doesn't bother you.

RUSNAK: No.

MCLANE: Somewhere along the line in the Apollo Program, somebody noticed that the crew training simulations were requiring in a normal descent lunar module to the lunar surface that the RCS engines were being fired to a different duty cycle than the design had assumed. The significance of this was that some of those RCS engines were firing where the plume impinged on the structure of the lunar module, and the significance of that was that the radiant insulation that was in blankets on the inside of the skins on the lunar module, it was multilayer radiant insulation, and it would melt or degrade if it was heated for longer than had been anticipated.

So they needed two things. There was an immediate solution to it, and that was to put what came to be known as coal chutes under these downward-firing RCS engines on the lunar module. You probably remember seeing those. Those things needed to be qualified. The other thing that needed to be done was that the RCS engine plume needed to be quantified, defined, and verified experimentally. So, by golly, we decided for both of those things that we would fire these RCS engines inside Chamber A. Now, Chamber A wasn't designed for firing engines inside. We'd just gotten through with these critical cleanliness tests on the Apollo Telescope Mount, and we dreaded having to clean that chamber up again, but it was a real program requirement. We had to do it. It couldn't be done anywhere else.

So we did. We fired the engine any number of times. The vacuum would, of course,

instantly be reduced, but you could see the gas patterns inside the chamber when you look in the window. It fired the thing, and you'd see this swirling smoke, you know, from the engine. But you could fire the engine for a reasonable amount of time, long enough to get the temperature data that you needed and pressure data. So we did that.

There was another thing in Chamber A, too, the big chamber. On the Shuttle there was some uncertainties about base recirculation heating. I think that's what it's called. That is, the pattern of gases around the base of the Shuttle where the nozzles are for the OMS, orbital maneuver system, as well as the other engines back there. [aside] Boy, he's late today [referring to mailman]. Anyhow, this is a problem on all rockets, I guess, is what is the heating condition around where the thing is firing, under various conditions.

I forget who sponsored this test, but somebody built a model of the rear end of the Shuttle with all these nozzles on it. It was about 1/20th-scale or so. If you can visualize the back end of the Shuttle, it was all on a plate about this big with these nozzles. We fired them, using some gases that were stored in tubes that were connected to it. The thing that was limiting on how long you could run the tests, you had to have some high-speed response instrumentation because you couldn't run it very long. The limiting factor was, whenever you opened the valve to let the gas flow into the engine to be fired up, a shock would be generated, and that would go down a storage tube, and it would reach the end of the storage tube and return. When it got back to where the valve was, the test was over. The data was no longer valid. So you had to grab the temperatures and pressures pretty fast. We did a lot of that testing over a period of two or three months, and it worked very, very well.

What else?

RUSNAK: One of the unusual pieces for the chamber we came across in our research was using it to help recover after a flood.

MCLANE: Oh, that, yes. I was out at White Sands doing something when we heard there'd been a big flood in Houston. I called—I think the boss was away. I'm not sure who I talked to, and said, "Hey, you know, if all the hospital records and library records or museum pieces are suffering from flood damage, we could probably help them, if you'd like, by drying them out in one of our big chambers."

They said, "Well, that sounds pretty good. Let us get in touch with this disaster agency," whatever it is, "and see if that's appropriate." Of course they said, "Yes, fine."

So by the time I came home, they'd set it up pretty well. We dried things for the hospitals and the Medical Center. I remember Methodist for sure, and St. Luke's and there may have been others. For the Modern Arts Museum, for Rice University, and maybe others. We didn't invent this process. There had been some records that were processed through in the chambers at, I believe it was Goddard who had done some emergency drying. But they really didn't know much about it. We checked with everybody to see what the best—it's essentially a freeze-dry process. You have to heat it, you know, and because when the moisture sublimates or evaporates, it takes the latent heat of evaporation out of the thing and leaves it very cold. It instantly freezes in a vacuum, so you have to keep adding thermal energy to it. The same with freeze-drying. That's the way you do freeze-drying.

So we fiddled around, first of all, verifying techniques in some of our small chambers over a period of a few days, and we advised everybody if they really wanted to save this stuff, to refrigerate it right away. So they were running around town renting refrigerated

trailers, and when their turn came, they would back the trailer up to Building 32, and we'd unload it and put it in the chamber. It was fairly successful.

I guess one of the most interesting things that was dried out at that time, University of Houston had a collection of old Texas newspapers from small towns and things. That thing was flooded in some ridiculous way. They left a door open or something, and it got flooded through a tunnel somehow or other and flooded all those valuable old newspapers. We got them dried out. I don't know how well they've lasted since then. I'd be interested to contact somebody out there and find out. But the Center got a lot of good publicity out of that, I think, good thing to do in the community. The only trouble was, after that, we got phone calls from all kinds of people, you know. Their bathtub had run over and that sort of thing. [Laughter] Of course, we couldn't do that.

RUSNAK: It certainly seems like you've done an interesting collection of things while you're at NASA.

MCLANE: Well, I always thought that the SESL, if you couldn't be an astronaut, which I would have dearly loved to have been, I always thought that we had one of the more interesting places to work, for sure. Never a dull moment. Always dealing with a new bunch of people, new piece of hardware and, most of the time, several groups and pieces of hardware at the same time. I always felt sorry for the poor fellow who got over and he was stuck with one little piece of hardware for the whole program. He does nothing but worry about that. I'd get bored very quickly with that.

RUSNAK: After you retired, did you stay working in interesting kinds of things?

MCLANE: Yes. Had one consulting contract with Lockheed through Eagle Engineering to act as really a part of their organization in bird-dogging the new space chamber that they built to support the Milstar Program. That was pretty interesting, and I'll tell you, that was about the easiest job I ever had. It required a trip out to San Jose [California], or Sunnyvale, it was, about every month. The stuff I reviewed for them, the contractor would send a copy of it to me here at home, I would review it here, and if I had any comments on it, I'd send it out to the Lockheed people. That was very nice. I was sorry when that project ended.

I've been most active in dealing with the Chinese through contacts I made on a People-to-People tour. I went with a People-to-People vacuum technology group to Japan and China in 1980-something. I'm trying to remember the first one of these trips. I've been to China five times. The first one was with this People-to-People group, and I met some people in China who knew the people in AIAA [American Institute of Aeronautics and Astronautics]. I had served on the National Board of Directors of the AIAA.

I met some people over there that had interfaced with people in AIAA that I knew. This gal, who now, incidentally, is the head of the office of the Chinese Astronautical Society, she took me—I was with this bunch of people in the vacuum business, and I was the only one who had anything to do with space simulation facilities. They were all involved in—they were from universities. They were from people in the nuclear business. Some of them were with vacuum equipment manufacturing concerns. Just a wide spectrum.

I happened to be the only one in the space simulation business, so when we got to China, the Chinese have a space simulation facility out in the country in Huairou County, a

place where the National Women's Association met a few years ago, Huairou County. She took me out to visit out there and see the facilities. While we were talking in the van that we were riding in, we talked about the AIAA a little bit and about the Chinese Astronautical Society. She says, "We've been looking for ways that we could strengthen our ties with people in the U.S."

I says, "Hmmm. That's interesting." So I got to thinking about it.

We came home early from the trip. My wife slipped up coming down off the Great Wall and broke her ankle, and so we had to leave the group there and come home a little early. But I thought about that, what she had said, for quite some time. My concern, my real interest in AIAA, is on the working engineer level. I really am interested in doing things for journeyman engineers. And so I got to thinking, and I said, "You know, maybe we could come up with some sort of an alignment between one of the Sections of the Chinese Astronautical Society and our own Houston Section of AIAA here where we could do some cooperative things that would benefit us both and, most importantly, let people in China know how their professional counterparts live and work and let the people in the U.S. know how their Chinese counterparts live and work. I thought, to me, that's just very, very interesting.

So I came home and I attended the next meeting of the officers of the Houston section and proposed that we investigate the establishment of a sister section relationship. They bought it very enthusiastically and said, "Go on and contact the Chinese and see what they think about it." I wrote to them, and the next thing you know, they're sending people over here to talk to us. So we signed this proclamation that we would be sister sections. We're still at that, although it suffered in recent [times].

For a while we swapped delegations and we swapped communications. For instance, I sent them copies of *The Roundup*. I don't know what they thought about the "Swap and Shop" in there. I imagine they read that pretty closely. But they sent some delegations over here, which we entertained pretty nicely. I personally took two delegations from Houston to China, and with their help, they rigged it up so that we could visit a whole bunch of their space-related—of course, we were touristing, too. We took our wives, and they had a special program set up for the wives so they didn't have to go to the labs, but we went to quite a number of their labs. On one of them, we went to their launch site down at wherever it is, in Xichang [Hunan Province], a place like that. Anyhow, this was the launch site that they use the most, and I'm sorry I can't cough the name up for you real quick.

So that's been a very interesting thing in retirement that I had to do, was to fool around with the Chinese. But I found out I've been retired so long that I've lost most of my contacts at the Center. I really don't know the people in AIAA anymore. All the old-timers have stopped coming to meetings, although the guy who is current Section Chairman went to China with us one time, Garland Baugh. I still get from them, about once a month, a mailing of two or three of their publications, and nobody is interested in them over here, unfortunately. I feel real bad about that. It looks like our sister section business has sort of run downhill. Maybe something will come along to rejuvenate it before long.

RUSNAK: I'd like to give Tim and Carol a chance to ask some questions if they have any.

FARRELL: You asked all the ones I had.

BUTLER: I have a couple for you. Going back to talking about the LRL, and you mentioned that the scientists would change their minds from time to time on what was needed. Did you get from the different scientists in the different areas, did you get a lot of opposing views on what was needed, or was it just that they would come up with different realizations?

MCLANE: Yes, we did get a lot of opposing views. Number one, those people had no concept at all, no matter what. They all came out of laboratories in different places, but they really had very little knowledge of what was required to build something. So that was a real handicap to the thing.

I got along with those people real well and I admired them. They were all very intelligent, of course. Some of them had little quirky hobbies. One guy had memorized every dirty limerick that he'd ever heard, and he'd heard a million of them, and I won't say which one. [Laughter]

P.R. Bell finally wound up being the Chief of the LRL, to my amazement. I don't know who in the world picked him for that. But he was an interesting fellow. He would sit in conferences. He had some real thick pull-down glasses in order to read. His eyes were terrible. He couldn't see anything. In order to read, he would have to pull these big thick pull-down things over his glasses. Well, we'd sit in a meeting and he always kept a little screwdriver in his pocket. You could tell when he was getting a little bored with things. He would take those glasses off, and he'd completely disassemble them with his little screwdriver. He'd lay the pieces out on the table in front of him, and then you'd notice when something really got his attention, he'd very quickly reassemble all this stuff and put his glasses on again. [Laughter] He was a real nice fellow, but a little eccentric. He was in

charge of a big fusion machine up at Oak Ridge, and he was operating in the part of the envelope that was completely different from anybody else. Of course, it never worked. I don't know what's happened to that fellow. He's probably dead by now. I hope not. He was a real nice guy. But I couldn't imagine him trying to run something, and that's what he wound up doing, I guess.

BUTLER: How did you reconcile those, all the different objectives for the scientists to make the LRL come together?

MCLANE: Well, frankly, what I did was I bit my tongue a zillion times and I waited for things to happen. Very often these things would resolve themselves, and then every now and then we'd run up against something that was a real hard point. One such thing that comes to mind immediately is how are we going to handle the samples inside these glove boxes. Are you going to do it with a mechanical manipulator system? I forget who proposed it first. I thought it was idiotic. Or are you going to use some spacesuit gloves to reach in and work it? I just thought that was just completely a bummer.

But it turned out that the guys up at—what was the name of that laboratory in Maryland [Ft. Detrick, Frederick, Maryland]? They were the real experts on handling pathogens in glove boxes, and they had been using glove boxes up there. They had standard designs for it. I guess I left before that was resolved, but I guess that's what swayed them to adopt those. But we really had it back and forth a long time on those things. Nobody really knew what to do and so they wound up using the glove boxes.

Bringing that facility into being was pretty interesting. There were a lot of people,

very powerful groups, lined up against it. The people out at Ames thought they had a corner on biological stuff in space. They thought they had that sewed up, and they took great offense in JSC building anything that looked like biological research. They didn't want to be cut out of the market, and they raised a lot of sand about that.

The answer to that was to form a committee, a site selection committee. I didn't serve on it, but I was around when it was all going on. We had people that had been active supporting us in some things serving on the site selection committee. They did all the homework of coming up with all the prospective sites and evaluating why this was a good place or wasn't a good place. Of course, the answer comes out, since you started working with JSC in the first place, it comes out that they really can't put it anywhere but JSC. I think the people at Ames tried to get their congressman to go to work on that, but they didn't have any success.

Let me see. There are bound to be other things about that LRL that I've not mentioned to you.

BUTLER: You had mentioned that there was a lot at first—people didn't see the need at NASA for it.

MCLANE: Right.

BUTLER: How, given the eventual scientists talking, given the presentations to say why it's needed, and then given the costs that went into it and the time that went into it, in your opinion, did it end up being a valuable resource?

MCLANE: Oh, I think it was absolutely essential. Everybody recognized at the time that it probably would be obsolete for use on, say, a Mars mission, but in the meantime, we would learn about how to do it. I think it served its purpose. I think it did very well.

BUTLER: Did you have a chance to go in later, even though you had moved on to the other project, and see any of the samples or see them put to use?

MCLANE: No, I moved on. I never bothered going over there. [Laughter] I once hauled a sample up to headquarters. I was going to up on TDY [temporary duty], and somebody asked me to take it up there. I had fun showing it around in the airplane.

Of course, you see lunar samples everywhere you go now, so nothing. Elbert King gave me a lunar sample, a tektite that he said had come from the Moon, but I'm not sure that it did, really. He's not around. He died here about two years ago, three years ago. I'd like for him to tell me whether he still thinks it came from the Moon.

BUTLER: Thank you. That's all the questions I have.

FARRELL: I did actually have one. Looking, we were talking about your experiences with the SESL, what kind of regrets, if any, do you have that you were not given the chance to build the Mark II facility after being connected with SESL for so long?

MCLANE: Well, all I can say is we would have had a rough time. There's only one other real

big facility in this country and that's up at Plumbrook Station for the Lewis Research Center. It's 100 feet in diameter. They had a rough time. They had some unique things. They were dealing with radioactive materials just as we were planning to. Well, not as much as we were planning to. They built it. It was made out of aluminum, just like ours. The Mark II was going to be made out of aluminum.

But they made some other conceptual decisions that I thought were not the best, and, sure enough, they wound up having a lot of trouble with them. That facility still exists. In AIAA we have something called a Working Group on Space Simulation, which I helped found in 1964, I believe it was. It was patterned after an earlier group called the Supersonic Wind Tunnel Association, which was a group that got together periodically and in all confidence discussed problems that they had. In other words, you could bad-mouth a contractor or anything you wanted to do, trying to really get right to the root of the problem and improve operations. This was strictly operators of the facility, and they swapped notes on operation.

So we established this thing for space chambers just like that. To be a member, we said you had to have a facility that had some minimum capability. And that thing is still going. A few years ago, after I retired, I was made an honorary life member. My wife and I used to go to all the meetings, sort of a vacation. The last one we went to was in Munich [Germany]. We had to pass one up to go to Brazil a year before last. I hated that. But we've been to others in California and Williamsburg [Virginia] and all around the country. Now, I'm afraid I can't travel.

But that thing has done just exactly what we envisioned it doing. They've really avoided a lot of problems in a lot of places by telling people, each other, frankly and where

you don't have to worry about a lawsuit from a contractor or something, telling them about a problem you had and what happened. Other people then are able to take advantage of your experience. I think it's benefitted the industry greatly.

I forgot your question now.

FARRELL: You pretty much answered it.

RUSNAK: I want to give you an opportunity to make any final remarks, so if there's anything else you thought of before we close today.

MCLANE: Well, the only thing I'd like to say is I'm really proud of having had an opportunity to work in the space program. I thought it was great. I can remember when no matter what came along, we used to say to each other, "We've got to get that man on the Moon," and mean it. We really meant it, you know.

Not everybody was that motivated, but I daresay well over 50 percent were really motivated better than I've seen any other team in any other activities, with the possible exception of the fighter group I was attached to in World War II. But it was really an invigorating experience, and, of course, I thank God that I was in a place that touched so many different aspects of the program. We even ran our control room like a mission center. I think they came to us several times about "How did you do this?" and then they'd send somebody over to observe and we'd send somebody over there to observe. But really that's the only thing that I didn't have a chance to get into. Just about everything else going on at the Center was touched on at one time or another.

BUTLER: Do you recall where you were and what you were thinking when Apollo 11 landed on the Moon and you achieved that goal?

MCLANE: Yes, I was up in the VIP viewing room. I used to go out every night and I'd look up at the Moon, and I'd say, "I just can't imagine we're actually going to put a man there." I was obviously just as happy as anybody else that we'd done it. We'd had a press conference after our successful lunar module testing, and I spoke at that. We'd been at it so long and we'd worked so hard on it. I say "we," and I really mean everybody over there at SESL. I was just probably a little overjoyed that we'd passed the test successfully, run the test successfully. So I started out with a statement that, "Well, we're home free." [Laughter] And that was a little headline on a little newspaper article that came out the next day, and I got severely chastised for that. There were a few other things to be done in the program. So I looked a little stupid there, but I really meant it.

RUSNAK: It's been a pleasure to be able to get some of your contributions here on tape today and talk with you for these past few hours.

MCLANE: Well, I'm sorry I didn't prepare a little bit more for that. I'm sure I've left something out that's fairly important, but I won't dwell on that. I appreciate your asking me to participate in this thing, and I look forward to—are you going to give me a tape on it?

RUSNAK: Yes.

MCLANE: Okay, good. I'll give that to my kids. I like to write, and I was hoping to write. I've got a box of stuff from the Lunar Receiving Lab just crammed full of stuff, and I was reluctant to give it up. Jim [JamesM.] Grimwood suggested that the NASA historians would be quite interested in that. What do you guys call the little files that the people keep?

RUSNAK: The archives. What you guys keep?

MCLANE: Yes. You've got a name for it. I can't remember that either. You don't know what it is

BUTLER: Good resources. [Laughter]

MCLANE: No, no, no. I forget. There's another slang name for it. But I was really planning to write a book about that. We've talked a bit about it today, but there's a lot, lot more to it than that. I was reluctant to give up my files. I'll be glad to lend them to anybody, but I was reluctant to give them up completely to somebody else. Nobody wanted them except on the condition that they could keep them, throw away what they want, I guess, and keep what they think is valuable.

RUSNAK: At some point you may want to consider donating them to JSC and to the archives there. Other people have done so, and it would certainly be a valuable place to keep the information.

MCLANE: I've got something here I don't want to take your time up with. I know it's past your quitting time and everything. I went on TDY [temporary duty] once when we were—

[End of interview]