MSFC History Project
~~James B.~~ Lee B. James
Conducted by Stephen P. Waring
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WARING: Could you briefly describe your early career and how you ended up in Huntsville?

LEE: I've had to make some talks lately and that is how I start them off. Of course people are always curious about how in the world I got involved in all this. I graduated from West Point during the war years and served in Europe. After the war, I served in Nuremberg wartime trials which has nothing to do with the subject, but I did have the occasion to sit down and talk with Goring and Hess and everyone down there in themselves, which was an interesting sideline. From that European war duty, I had occasion to be in London when V-2's were landing in London. That made sort of an impression! Then when I was in Germany, the V-1's would go over so low you could read the chalk markings written on them by the soldiers. Guided missiles were something I had been introduced to. When I got back from Europe, I went to the Pentagon to see what I should do next. They said how would you like to get into the guided missile field? I said great. So that resulted in the following assignment. I was sent to Fort Bliss for the one year Army guided missile course and after that I went to the University of Southern California for the two years Master's Degree course in guided missiles. Thus got pretty well grounded in the field. Then I became a project officer for some of the missiles being flown at Patrick Air Force

Base in Florida for two years. Then I did three years at the Pentagon in the Guided Missile Department of the Research and Development Division. Then I was given command of a Nike battalion in the Washington-Baltimore Defenses. After that I got a letter saying you have been assigned to West Point. I thought that was just wonderful. What a nice break from all of this. Then I got a telegram that said somebody named General John Bruce Medaris has gotten your orders changed to Redstone Arsenal. Being an artillery officer and me being an Ordnance Missile Officer said who in the world is General John Bruce Medaris in the Artillery Branch? Don't know, but he seems to have quite a bit of clout down there. Then I said where is Redstone Arsenal? Don't know but somewhere in Alabama. And that was our introduction. We took off for Huntsville and we have essentially been here ever since.[032] My wife has been here ever since. I did a tour of NASA Headquarters as a Deputy Director of Apollo and I did a Army tour in Korea. But she has been here all the time and I kept coming back. So when I came down here I was assigned to the Army Ballistic Missile Agency under General Medaris in the Project Office. After my Korean tour I came back down here just before NASA was broken off with the von Braun group. I had a house of the mountain at that time and I remember one day Dr. Eberhard Rees, whom I guess you know, I was down cutting trees over the buff and all of a sudden I realized that he was standing by my side. I didn't even see him come down. He said have you ever considered that you might like to get out of the Army and join us? After some consideration that's what I

did. I retired from the Army with 21 years as Colonel and joined the civilian agency. Then I had the following assignments. I was the Centaur Program Manager, Saturn I Program Manager, Saturn 1B Program Manager, Saturn V Program Manager and Deputy Director of Apollo in Washington. I guess I would have been a program manager all my life if I had stayed in any longer.

WARING: Could you describe the relationships between Americans like yourself and the German Engineers?

LEE: It is kind of hard to do. Certainly when we started, we figured we had some features of management better than they did. But its pretty hard to fault their engineering. They were meticulous, detailed, careful and I think we all learned something from them when it came to engineering. We eventually garnered so much faith in their technical ability that if somebody said it won't work and they said it would, we were pretty safe in saying it will. I can tell you a little story along that line if you are interested in a story. While I was manager of the Saturn IB we were firing a Saturn IB that wasn't manned, it was a sloshing [?] experiment. We had found in previous missiles that this large quantities of nitrogen and oxygen sloshing in that thing gave it instability. So baffles were being put and we were seeing if we could stabilize the sloshing. Anyway, we had a fault come into the propulsion system during the countdown and the window was getting close and it just looked like no solution to the darn thing. Finally, I told them

that we would have to scrub. That meant you had to scrub for three days with this problem, because you had to defuel, fix it, fuel up again. It was a three day scrub. I remember being always impressed that Walter Cronkrite came on the little TV screen telling them that we had scrubbed it for three days before I had gotten it out of my mouth. I never did know what his channel was, but it was pretty good. Well, in this block house in the center, this was not the Saturn V block house, there was a little glass room built. Glass on the four sides, glass on top, and this was where the brass stayed, George Mueller, General Phillips, von Braun. They looked up and they had kind of expected this, had heard me say scrub for three days, and they fell to talking. We have a telephone arrangement down there where if we have a problem come up we call the conference room out at Marshall and everybody at Marshall that knew about that problem reported to that room. So we had a hundred or so pretty good experts in there, largely German, who were working that problem all the time. After a while they came up with something and so we got to talking. We went over it and over it and over it. It looked pretty good to me and they were solidly behind it. I started the count, we still had little window left and I started the count. I started to go out on my consul area there to go down and tell George Mueller that we had started the count, when he looked up on the screen and Conkrite's clock had started. So he came storming out of his glass room and said Lee what's going on here? George is a good technical man. I said George we did this and this and this and I started the countdown. George

(then said something) I will never forget, says tell me again what you did. I said we did this and this and this, he stood there a minute and said, "Lee I wouldn't have done that if I were you." He turned and went back into the room. Now you know how the shuttle accident happened when that thing failed they had a hard time finding who was responsible. It always occurs to me that they wouldn't have too much trouble that day if it had failed! But the German group and our American group were solid back there and we let her ride. I always said that it was the slowest liftoff I ever saw in my life! But it went.

WARING: You said you thought the Americans were more advanced in the area of management than the Germans? What do you mean by that?

LEE: I don't as I know what I mean, but take von Braun's management. How would describe it? He doesn't manage like anything we had ever seen. I will give you an example and maybe that will explain it to you, maybe it won't. Von Braun led his, you know everyone wanted to report to him directly, he let this happen until he had 30 some odd people reporting directly to him. Finally some of us convinced him that the thing had gotten out of hand and that he really needed to cut down the number of people reporting directly to him. It was kind of a prestige factor. So he called a Board Meeting with the idea of taking a step which would be to have all of the laboratories report to one man. It turned out to be Herman Wagner, if you remember the name, and

that man would report to him. Well of course, the laboratory chiefs would be crushed by such a decision, since they had always reported directly to von Braun and here they would have to report through somebody. And the through somebody was a Deputy Lab Chief at the time, so he was even less powerful then they. The way von Braun approached this thing, he went into that board room and sat down and says some people have been telling me that my organization has gotten too big. What do you think about letting the labs report to somebody? Well, a storm broke loose. I sat there in that board meeting for three hours I know, and he sat there and every lab chief just ranted and railed and gave reasons why that shouldn't happen and this went on and on and he didn't say anything. He just sat there and smile and nodded once in a while. After a while after some system of I don't know how it worked, he said well it looks like we have about beaten this to death, lets take a vote. Everybody in favor of having the labs report to one man, raise your hand. Would your believe all those lab chiefs raised there hands? He just wore them out I guess! I don't know about Americans, but my management would not have gone on like that! We might have listened to the arguments for 10 or 15 minutes, but then we would have to say, this is how it is going to be. But they had it different. That thing took all day. That is not what we think of as a good system. That sort of thing. I don't know that is just one type of example. But they had loose management and von Braun was fairly quick to put in American managers in these things. German lab chiefs, but American managers.

WARING: Industrial operations was primarily led by Americans.

LEE: If you stop and look back at various program managers that have had the job after Rudolph, I replace Rudolph, they were pretty much American all the way down the line. The labs stayed German as long as the Germans stayed active. Now they are all American, there are no Germans out there as far as I know.

WARING: In the early years of Marshall when Marshall had just become a NASA installation, do you think there was a lot of pressure from NASA headquarters for Marshall to adapt to a NASA system rather than going its own direction? Particularly in regards to the Arsenal System?

LEE: You mean to become more civilian oriented than the Army oriented thing had been? I don't know that I can answer that. In my opinion, NASA headquarters never suffered from the von Braun group being military oriented, because von Braun was about unmilitary when he worked with the Army as anyone could be. I would say that NASA headquarters worried about Marshall Space Flight Center in many respects, but that probably wasn't one of them. What they worried about was von Braun announcing to the Associated Press, the United Press and everybody else, something that they hadn't yet decided! And get the public aroused up for it before they felt they could fund it or whatever. He was a

great promoted and sometimes he would promote before they got ready for it to be promoted.

WARING: So it wasn't what Marshall did that was the problem. It was what von Braun would say.

LEE: Well, I think von Braun worried them more than Marshall. Marshall was pretty good to conform to headquarters needs. For instance in the Saturn V when we laid this whole thing out and decided how much payload we had to give the Houston spacecraft, we had to increase that thing 50% as time went on, because they kept growing safety and comfort needs for the astronauts. They called it safety, I called it comfort. We increased the payroll, we increased the thrust of the engines, we cut out weight of the Saturn. We kept giving them more and more payload and that was what NASA headquarters were pushing us to do. I think they were pretty happy with us. During Rudolph's time, he exceeded the budget given to him a good deal. But, that probably was necessary. I don't really know. That was during some growing stages. In my time, we lived within our budget. Houston never did. I think we were in some sense very [good boys? 166]. On the other hand, NASA headquarters were made up of people from Houston, George Lowe and so on. So we were never solid with them like Houston was.

WARING: Do you think Marshall suffered because of that?

LEE: I think Marshall suffered for a lot of reasons. One is, we didn't have any astronauts. Everybody like astronauts. the public liked astronauts, NASA headquarters liked astronauts. So the astronauts could do no wrong and I guess this has always griped me that so much publicity went to Houston because of the astronauts and so little to Marshall out here and we did so much to get those people up there. If you read most of those history books that people have written, you are lucky to see von Braun's name in it. They are just totally Houston.

WARING: Well, they talk about von Braun, but not about Marshall.

LEE: Yes, and not too much about him. It's a Houston story. They talk about astronauts, most every book I have seen. I won't buy them because I know they don't have anything to do with us.

WARING: Could we turn to talking about the actual management of the Saturn System? How would you describe Marshall's methods of managing contractors. What was unique about the Marshall method of dealing with contractors?

LEE: Its been a long time since I spoke along these lines. In the first place I guess we all looked at management as finding the delicate balance between the money you had, the schedule you had, and the technical ex[? 190] of the problem. Those three things had to somehow balance out. One of the main instruments (not the only) for controlling this was any number of meetings

where you reviewed at some stage where everything was at that stage with the contractor. That sometimes was done at the contractor's plant, sometimes done at Marshall. But that was one of the main ways of controlling. There were all sorts of reviews and checkpoints to see that everything was on schedule. Those were very difficult to run because if in fact a contractor was in trouble, he's not going to come right out and say hey I'm in trouble! So you have to ferret it out and that isn't easy. So what these amounted to was an awful lot of questions. If you are kind of stupid about all the parts that make up the Saturn like I was, then you have to ask an awful lot of questions and look at a lot of faces and see who flinches. Keep on asking and so on. It's a tough job. Another way of controlling all of this was a thing we called "change boards". We had five levels of change boards. They started at the contractor plant. Many of the changes started down there. Some started higher. But suppose a contractor was making a gyro and the guy making the gyro decided really that thing wasn't reliable enough and needed to be changed. He proposed a change. It would take up through the contractor plant and our resident boss who was out there. Then it would come up to our laboratories. If they agreed that a change was necessary then they would send it to my stage managers. Lets say this was Rockwell and the S-2 stage and my S-2 stage manager was Max Skinum[?217]. Since these things costs money, most of them would finally come to me at the next level. If they thought it was the thing to do and didn't have the money and couldn't handle the schedule, then they would have to shove

it on up. If it comes up to us, we have to decide if the change is necessary. Now, that is darn tough with the budget things that you are not an expert in. Again, an awful lot of questions. I don't like to say this, I hope your recorder forgets it, put yourself in the position of the guy who is designing this gyro out there, who has finished designing and he is now out of a job. Its quite possible that this gyro needed to be changed and its quite possible that he needed the job. So you certainly have to find out which one it is. That was one of the problems. If he is just furthering his career out there, then that changes out. If the thing is absolutely unreliable that's another story. I would say we turned down more changes than we approved. But you get awfully nervous down on a flight-line with three astronauts on board, if you have a hold for something where you have turned down a change. But that's the name of it. That's how you age in this thing. But those were two of the main ways of controlling contractors.

WARING: Do you think the Saturn program was as successful as it was because Marshall kept so many people in resident offices in the contractor's [plant]?

LEE: I think that was one thing. They were good people. Jack Lee, who is now the Center Director, used to be Fairchilds resident manager. They had good people up there. I think one of the main things is, the laboratories we had here. When that change comes up to those laboratories and the guy working on the

gyro in the laboratory is not adverse to improving it. So that is another little problem. However, if he doesn't even come to your meeting, somebody else comes, right away you might suspect that even though they endorsed the change, that it might not be necessary. If he comes to the meeting and we say, well we aren't going to do that and he says well, ok. But if he comes to the meeting and we say we are not going to do it and then we schedule another meeting a couple of weeks later and we get a whole bunch of new arguments, then you better stop and listen a little bit. If the labs are getting that concerned, sometimes there is some smoke involved in this. You learn how to work with the laboratories and trust them. They were awfully good. There is no doubt in my mind if a change came up from a gyro that the guy in the laboratory knew full well whether it was needed or not. The problem is to find out what he is thinking and why. The labs were a real oasis. We had the best laboratories the world have seen before or since at Marshall.

WARING: Was there ever problems with conflicts or different interests of the labs or program offices?

LEE: Yes, money and schedules. The labs had no real care about money restrictions. I told you the three things to balance and they were only interested in one of them. So there is conflict. But they understand also that we had to run on schedules. I would say some of the best friends I have today were old lab chiefs. They are still around here. We got along real well. We

had different points of view. The day I took over Saturn V, I met von Braun in the hall and he said, "Lee I think maybe I ought to tell you how we are going to work." I took my eyes and said, "Yeah I think maybe you should." Well, I will back up just a little bit. Back in those days NASA headquarters got the bright idea that if they put a line on the chart directly to the program manager, me, and sent the money that way by-passing the Center Director, they would have a little more control over up at headquarters. So von Braun said, "You have an advantage because you have all the money. I don't have any, it comes directly to you. So when you have an argument with the laboratories, I want you to know that I am on their side." And that's the way we worked. In a big meeting, he would generally argue for the technical side knowing full well that it had to be defended with the schedule and money before we would argue that way. We got along pretty well.

WARING: Do you think that changed later? The Center Directors were less willing to...?

LEE: Well, I wasn't there. By the time Bill Lucas took over I took off. He was very much a technical man. Dr. Rees was a technical man. I doubt if it changed too much. Program managers remained very Americanized. Program managers with backgrounds a lot like mine. So I don't think it probably changed too much. Even today Jack Lee is probably more like a program manager than we had before. J.R. Thompson came right out of the labs. He

certainly was a technical man. Jack has had a little more broad experience, he may be a little bit more. He was a resident manager at Fairchild. He was my resident manager at ~~KFC~~ KSC when I was with Saturn V. I was the one that brought Jack back up here. Now he's the Center Director!

WARING: I have read a lot about Arthur Rudolph's program office and the management systems he had there.

LEE: We both had these management systems, but we weren't alike. Rudolph was a typical German. Great detail man. He had some odd, he was probably best suited to be a program manager than most anybody in the original group. Just his own nature. He was a technical man. Back in Peenemunde, he invented an engine called the Rudolph engine for a while over there. He was a propulsion man. But, we both had this big control room and used it quite differently. He would have ten times as many charts as I would. With his little bit of problem with English and with the English-American people making these charts, he would (in my opinion) pretend not to understand anything about the chart and ask the people to go over it in great detail. I have to admit you would be surprised the things that fall out of the cracks. I will give you an example of what he always did that always intrigued me, although I never did adopt it. When he got all through and we said well we have agreed to change the gyro so that its connected directly to this and this. When I would do that, say that, I understood what that meant and that was

probably it. But Rudolph would always have the habit of saying, "OK, lets write on the blackboard up there exactly what it is we agreed to." Well, you would be surprised, even thought everybody thought they understood it, how often it was difficult to write exactly what you had agreed to. The other thing that he did that was interesting. He and von Braun had the same motto I think, well, not quite. They had the same first part of it which was "Late to bed and late to rise". The rest of it is von Braun's, "to advertise", but Rudolph's was late to bed and late to rise. His meetings would go on to midnight out there. I didn't do much of that. I got to work before 7 o'clock. He would get there about 9. Then he would run his meetings till everyone was worn out. I didn't. I would say he was a harder worker than I was. He spent a lot more hours on his job than I did on my job. I would be satisfied with ten or twelve (hours) not sixteen. He was a good man. His management method was detailed, meticulousness. He would nitpick the charts, he would nitpick the decision he made. He would play with all those things until everyone fully understood them. I can't fault him because it came out pretty good.

WARING: Many commentators have also described Marshall's use of the Perk Charts?

LEE: Some of the charts that we would all understand.

WARING: Were those charts in that system particularly useful do you think?

LEE: Yes. You know charts depend upon part of your staff that makes them, depends on how accurate they are. Perk charts did things like this piece has to be ready at this point and this piece comes up here so you draw two points. These have to be ready at this point. Its one thing to sit in a meeting and say, then why isn't this piece ready like it suppose to be for this one. But the main thing for me was who makes that chart up. If he isn't awfully, awfully good the whole thing is kind of useless. I found out that what we generally end up doing is remaking the foot chart every time we had meeting on those things because you couldn't expect the GS-12 down there who was doing that thing to know enough to do it right. They are good, but if you are going to do it you are going to remake it every time you use them, you are going to spend a lot of time on it. I may not have gone as far down into them. You know who did the perk-type charts for John Bruce Medaris? The chairman and CEO of Brown Engineering, Teledyne/Brown, Joe Moquin. That was his job, doing the charts.[379] You have somebody like that doing the charts its ok! I think Rudolph used that type of thing more than I did. I can't fault it. If you have the time to spend there and remake them, you will sure find out what is wrong with the system.

WARING: It seems that the decision to go for "All-up" testing was a very important decision.

LEE: Made by one man.

WARING: Mad by one man. Could you describe that decision and Marshall's reaction to it and how it changed Marshall?

LEE: I was in the meeting. We were describing to a new guy up at the headquarters named George Mueller how we proposed to do the Saturn Program. To fly first the S-IC Stage with a shroud on top. Then the S-IC with the S-2 stage and finally with the S-4V stage. George got up at the end of all that and said, "No, No, No. We stack them all up the first time and fly them." The place came apart. Von Braun took the floor and everybody explained how complicated, how big this was, how the valves had never been used, how the engines had never been used. They had never used the J-2 engines up on top. How could you expect the F-1 engines to work. On and on. George stuck by his guns and we flew on up. Marshall didn't believe it. I don't think anybody at Marshall believed it would work. I don't think anybody believed we would never have a failure in the Saturn Program. We had a failure in the Jupiter Program once, but we never had a failure in the Saturn Program. Its really kind of fantastic. Everybody pitched in after that. The Germans, more than anyone else I know, pitch after the decision made and really go to work. But they did and it worked. But nobody believed that it would.

WARING: Did it cause Marshall to change its quality control methods at all do you think?

LEE: No, I don't think so. I believe that quality control dieter valves [sounds like 415] shop felt that they were as tight as they knew how to make them to start with. You get more concerned and put more people into it because you [have] got more things to look at. But I think the method didn't change. Not that I know of. Quality control was always a concern. But I think the biggest concern was simply so many big pieces flying at one time. These things were big. If you ever go out to the Space Center, look inside the F-1 engine. When you have never flown engines like this before it really gets to you.

WARING: In what ways did Marshall's efforts in constructing the Saturns cause Marshall to change through the 1960's? What do you think were some of the major changes at Marshall as a result of the Marshall program?

LEE: The way we started off to build it, we were going to built the first S-IC and then turn it over to Boeing later, which is almost what happened. We were going to fly the S-IC before we flew anything else. Here was a laboratory effort. We were going to do like we had the Jupiter. We were going to build it and fly it. So with George's decision the thing became too big for us. So, we were forced into a management structure.

WARING: You were forced to use contractors?

LEE: Forced to use him and forced to oversee him differently. One of Germans was the Saturn V program manager ahead of Rudolph for a short time. (I wouldn't want you to say this, but not of the same capabilities as Rudolph) One of the things that this caused was to change that right quickly to a man like Rudolph who would pull all of this together because it had suddenly become huge. At that time the stage offices were set up with American managers under Rudolph, because of the different viewpoint that we have, maybe in how we work with contractors. In other words, we were kind of afraid that a German stage manager would say our men in the lab changed this when really it was North American's job at that point to change it. So North American people worked that. But American people had to learn to work those labs. I guess we learned that quicker than they would have learned how to use the contractors.

WARING: Do you think the labs experienced this as a loss?

LEE: Yes, it was a loss. They would have much preferred to build that S-IC stage in quiet. I got a cut little cartoon upstairs in the attic dating back to the S-IB stage. If you remember, Marshall built the first 7 or 8 S-IB stages and then turned it over to Chrysler at Michoud. So Chrysler came up this little cartoon (which I have framed) that shows a little, tiny six-year old girl doing a strip tease out on the stage. She goes

off "S-IB-I, S-IB-2," until she gets down to S-IB-8 she still has on something. The Chrysler guy in the wings with a violin says "What an act to follow!"

[Starts showing Dr. Waring pictures]

WARING: You were talking about the Saturn I and the Saturn IB. Did you find it substantially different to move from being manager of those vehicles moving into Rudolph's job heading the Saturn V?

LEE: Yes. We flew some astronauts, but primarily most of those flights down there were unmanned. That's one big difference. The second thing is some of those engines had been used if not the same, in the near configuration on the Jupiter program. So when we got into hydrogen and huge engines like the F-1, oh boy, very, very scary. Countdown at the Cape could take a couple of years off a manager's life. Everything that happens is something that you had a hand in and did you do it right? You can't help but sweat that thing out. When its all over, when the flight is gone, it is such a feeling of "whew" that you would never believe. I will tell you another story. The night of the first moon landing that Neil Armstrong was on, LIFE Magazine and TIME magazine threw a great big party down there. Of course my wife and I, my wife would like to go! So even though the countdown started about one o'clock in the morning and took off at eight, we went to the party. I remember we sat at a table with Norman Mailer. It was a great party and the time to go home, it was

time for me to go to the countdown. So, I went down to countdown, sat down after a long night of "do we hold, do we go". Talking to Marshall all that time. The next morning about eight o'clock we flew. The S-IC stage dropped off. The S-2 stage dropped off. The S-4V stage dropped off and Marshall was through. I tired anyway and as I stand up here at the back of this thing, the windows down towards the back here, I was leaning on my desk like this. Frank Borman who had flown the mission before was escorting Spiro Agnew (and I hadn't seen him), they were coming down this aisle (back here in back of this thing). Frank got right up next to me, he slapped me real hard in the small of the back. If you know that spot back there and as tired as I was, I spun around, I was going to tell somebody something, and my face was about that far from Agnew. He smiled and said "Nice flight" and went on. I swallowed whatever it was that I was going to say. You are sure dropped down at that point and time. There is sure not much left in you. Luckily I didn't say something.

WARING: Do you think that is another reason why Marshall has not gotten the credit that it perhaps deserves because within the first half-hour of flight Marshall's role is over?

LEE: I think the main reason is that we don't have astronauts. Somehow they became the love of America. I don't want to degrade them. They have done great things. Somehow Houston rode that and I don't think that Houston did anymore than we did. Houston

got much more publicity and glory and all that than our engineers did here. I have always resented that.

WARING: I think that is true of a lot of people. Could you describe the relationship and the relationships between the Centers and the ways the Centers coordinated their roles during the Apollo and Saturn programs?

LEE: The interface wasn't too hard to coordinate. You draw up the interface. This wire goes through here, this bolt goes through there and they work their side and we work our side. The parts that are difficult are schedule and money and payload and all that sort of thing. That sort of thing was done in these monthly meetings we had at headquarters. We certainly were not unfriendly, but the way I suspect that it happened would be George Lowe before he went to headquarters would call George Mueller, with whom he is on close basis with and say we have to have 10,000 more pounds and when we have the next monthly meeting help us beat it out of Marshall. Because, when we got up there headquarters and Houston were always lined up. We were always can you do it and we would go back and see. I think Houston headquarters were a lot closer than Marshall headquarters. It probably has gotten better over the years. I did a tour up there and any number of people that have now done tours up there are from Marshall. I think its probably "Marshallized" more than in those days. But in those days about the only people who came up there from the labs and Centers came from Houston. But besides

that Houston was made up of this old NACA crowd and so was headquarters. So they knew each other before. Marshall was made up of Redstone Arsenal and Germans and had no interface with those people. So we were always a little behind the gun.

WARING: So you say then that Marshall's relationship was...

LEE: Careful.

WARING: Careful, yes. But Marshall's relationship with the Cape was far more friendly?

LEE: Easier, because of Davis being one of the German group. Not necessarily because of Rocco. It certainly was better at the Cape. An awfully lot of the people down there had close relationships with our people. I think about the only stumblingblock and I wouldn't you to write it, was Rocco. He was his own case. But the rest of the people were pretty close. A lot of the German group was down there.

WARING: What was the role of Marshall during check-out and launch? Could you give an overview of that?

LEE: Check out was largely done by the Cape. Launch, we were the goal for the launch vehicle at every step. So the Program Manager was the focus of that goal. We worked that by keeping in touch with groups in Huntsville by telephone. We really didn't

have Marshall people come down and man things. We had to man some things, but the communications with the program manager was generally by phones. No step or no hold or no release on the vehicle was done except by Marshall on the launch. The check out, the Cape did.

WARING: Were there problems in check out then required.

LEE: We kept people down there so if they had a problem in check out we begin to work the problem. But if there were any problems, they would be surprises to us.

WARING: By the later 60's the Saturn program began to phase down. Could you describe that process and it effects on Marshall?

LEE: Well, this was the time when we were scrambling to do other bigger and better things. There was the [sounds like 683] Big Dell Booster program that they were talking about. Which was an unmanned very heavy pay, something like the Russians do. That was on the drawing board. There was the Orbiter Taxi. We had another name for it. We found it was going to be necessary in space. All these things were being pushed and so there was an awful lot of preliminary design work. The laboratories, of course, kept busy with Saturn, as long as Saturn was flown. But you worried about the moment that the Saturn quit. Other things were just on paper. So we began to put together projects that