679

MFSC HISTORY PROJECT
ERNST STUHLINGER
CONDUCTED BY A. DUNAR AND S. WARING
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WARING: First of all, could you describe your career at Marshall? Talk about some of the jobs you held and some of the projects you worked on. We will start there and probably go back farther in the past, and fill in details of some other things.

STUHLINGER: I became a member of the von Braun team in April of 1943 in Peenemuende. Before that I was with the German army. I was then, so to speak, redrafted from the army into the Peenemuende work force. I remained a member of the army, a PFC and later on I made ~~Colonel~~ Corporal. It was in April of '43. From that time on until 1976. Peenemuende came to an end at the end of the war in 1945. After that time all of us members of the von Braun team were more or less floating free in space. I personally first worked for the mayor of a little town that needed a translator for the English and French troop allies that had occupied this little place. Later on I tried my old university in Twickenham (?) ..[018], where I had started physics under hans Gieger. I joined the university in June or July of 1945. In October 1945, I was contacted by an officer from the United States, who asked me if I would like to accept a contract to come over to this country and continue work on rockets. I asked him first

with whom I would work and he said, "Well, your boss Werner von Braun is just about to go over there." Then I asked him what we would be doing. He had a very short answer. He said "you will be doing what the United States of America thinks is best." But he was quite reassuring. He said, "I bet you will have an interesting life." In a way I said I would like to think it over. He said "Sure, think it over I will be back in a week from now." Then a week from that day, he came back and said, "How about it?" I said, "Yes, I would like to sign up and accept your offer." He said, "Very well, I will be here in January with a jeep. I will load you on the jeep and then you will begin your trip to the United States." In January 1946, he did come with a jeep, an open jeep, a snow storm and very low temperatures. In the back seat of the jeep I rode to Munich from Trippinham..[033], which is not very far. About 100 miles. In Munich there was a staging area for this program (later called the Paperclip Program). It was a program ready to take about a 127 of these Peenemuende people to this country. It was a staging area near Munich where we were held for a couple of weeks and then we traveled. The whole group that was to come over traveled in five shipments where groups of people ~~of people~~ on military ships. My shipment came over here in January and February 1946. The ship landed in New York, and ~~then~~ We came by train to El Paso. We were stationed at Ft. Bliss which is on the outskirts of El Paso. We remained in Ft. Bliss until 1950. In 1950 von Braun and

his co-workers, 127, and a number of civilians and military people (from General Electric mainly) about 400 altogether, came to Huntsville and settled at the (what is today) the Marshall Center. At first we were part of the Army. The Army Guided Missile Development Division. We remained so until August 8, 1960. At that time the von Braun group in Huntsville was transferred into the NASA ~~ballcamp~~ program. This was a civilian program, we left the army. We did not change our place of work, our laboratory and offices. But we changed our "cover" so to speak. We became civilians under the Civil Service and worked under Civil Service for NASA.

My ~~old~~ own work began very early in Germany. As a physicist I was in nuclear physics and energy under Geiger. Then when I joined Peenemuende, I became a member of a group called Guidance and Control Department. (You understand what that means?) I remained with that group after we had come to this country and even during the first years in Huntsville. In about 1954 or 55 I was split off and formed a little laboratory within the overall science and engineering department. My group was called the Space Research Laboratory. It was a small group, about 20 or 30 people. Consisted mainly of physics, chemistry or math background. We were suppose to do some scientific and some research work as opposed to engineering work. But the work that we were doing and suppose to do had some relationship with our main projects. Our main projects were: the Redstone Missile, the Jupiter Missile and then the Saturn,

that went to the moon eventually. I was then the head of this Space Science Laboratory until about 1968. Then von Braun established a position of Chief Scientist which was also called the Associate Director of Science in the Directorate. I became the man for that office and remained so until 1976 when I left NASA. I left NASA and first became a member of the University, at UAH. In 1984 I switched over to Teledyne Brown. I have been a member of Brown for 5 years now. My work at Teledyne Brown is still in space related subjects. Satellites, plans for satellites, instrumentation for satellites, materials processing in space. Measuring the environment of the laboratory in space. That's about it.

WARING That is a good overview. Do you have some questions, Andy about the earlier period.

DUNAR: Yes, let me take you back to the period you know as the Project Paperclip was getting underway. You mentioned at that point that you had contact with an American officer. Do you remember what his name was? What I was wondering about that, is ~~the~~ conception that von Braun had gathered his team.

STUHLINGER: Yes, I can tell you more about that. That is an interesting and partly dramatic story. The allies knew who we were by the time they came in. How they knew I don't

know. Somehow during war these nations have a way of knowing. They have contacts. They knew who we were and what we were doing. They knew about von Braun and Dornberger. Dornberger was the military commander of Peenemuende. Von Braun was the technical director. General Dornberger was the military commander. The allies knew who the men were and what they were doing. They came over and had the order, this was General Toftoy, who had the order from General Leslie Simon. To look after the ~~Sarcut~~ circuit? [12] people and catch as many of them as possible and see if possibly some of them may be simply be simply brought over to continue their work. People who did the footwork over there, Toftoy and possible ~~Hamby~~ (?) Hammill [124], (He was a major that became a colonel later) and a few others, Major Stabler [123]. They first made contact with a larger portion of the von Braun group in the Frankfurt area. You should know by the end of the war, even before the end of the war, the von Braun people at Peenemeunde had been dispersed all over the country, because Peenemeunde was bombarded. The first ones who were contacted by the Americans were in the Frankfurt area. That was a major part of the former von Braun group. The other portion was near Isreager [136]. The allies also got there all the ....[138], and so, names lists of the people and organizations they knew all of us. There were about 35 people (all together there was about a 1,000 people)...They knew about me and I had been working ~~in this place~~ and displaced (so to speak) or moved into a little place in the central part of Germany. That particular point was among the latest that we were

contacted by the allies. I was still uncaptured by the time the others were already contacted. But the allies knew who I was and where I was. The little place where I was in the middle of Germany, named Sylvania [148], ~~was~~ the first tanks that came into that little place with the fighting troops were civilians that came out of the tanks. ....It was a small place and they asked where I was, the people said he is standing right there. They said, "Are you Mr. Stuhlinger?" They were nice. They were of course the victors. ...I wouldn't say we had personal contact, but it was fair consideration. I was a civilian, unarmed. They said, "Are you this man?" I said, "Yes." They said, "Have you been working on this?" I said, "Oh, yes." They said, "OK we want you to stay in this town. You are free to move around and do what you want to, but don't leave the town. I am going to keep an eye on you and we will come back and talk to you again. I said, "Very well." They left. After some weeks, the American troops left and the French troops came in. The French troops were in for sometime and then the Americans came back in. In June 15 or 18, there came an officer and he asked where this fellow ~~student~~ was. He contacted me, and said, "Sir, I have to ask you to leave the town. You must leave before midnight tonight. You must go west. I am not allowed to tell you why, but you probably know why." I said, "Yes." He was about as sad about it as I was. He said, "I awfully sorry, but you have to leave." Most of my colleagues had left and gone home to look after

their families. But there was one fellow, Dr. Ruler ..[184], one of my co-workers. He and I were there and he said, "Well you should be that you need to take the instruments with you. Take all of it with you." ....How can we go all the way to .. and carry all of that heavy stuff. He said, "Well, I will get you cars." Sure enough he got us 2 cars and a truck. We said, "We are not Americans, we are Germans, how can we take these cars?" He said, "I am the allies. I give them to you. I requisitioned them. Don't worry, the Germans will have no use for them after tomorrow, so go ahead and take them." So we loaded our instruments on them and drove west. Before midnight we were (I don't know how much you know of Germany, but it is thick in forest....) My friend went to his family that lived in Rhineland, next to Cologne. Mine lived in .....[210]. Then he (the officer that told me to leave) said, "Give me your address in Twickenham[212] and stay there. Don't leave. You can go around, but I want to be able to contact you there later." He did come in October then.

DUNAR: While you were at Fort Bliss, what were your responsibilities there?

STUHLINGER: Supply distribution, I am sorry to say. It was a little strange. We were surprised and in retrospect I am even more surprised. You may not recall those times, it was a long time ago, now about 43 years ago, you may not recall

how the attitude and mood was. At that time people did not believe there would be another war. They thought peace has come now, we will have peace here. We don't need weapons, we don't need rockets, defense. So they left us alone. Von Braun was an exceedingly active man, and he wanted to be active in a productive way. He suffered from the effect that we had no assignment to do. He said every once in a while, he told our commanding officer who was Hemming and Toftoy, to please lets do something. We have that experience and we want to do something with rockets. You brought us over here because of that knowledge that we have. ...We had two fields of activity. The first was the following: the Allies had brought a number of half completed ...[242] with them from over there. About 100 of them. Part, engines, guidance systems, ...[246]. We ~~vested~~ to put these parts together and make them ready for launching and launch them. Also we were suppose to do this together with the General Electric people so they could learn how to put rockets together. There were military people and people from a company in California that was ~~Rockadyne~~ (the most active rocket people today). At that time, they were very much interested in our work and they came to us to look at what we were doing. We launched them. It was not easy work because these parts that had been brought over had been found and located by military troops and soldiers. They did not necessarily know how to handle such delicate machinery. They shipped them over here. They

had a long trip over the ocean. They were then in New Orleans and reloaded and hauled on freight cars and unloaded to trucks and brought up to White Sands. They were then put in the open on the desert. A couple of months later, (the parts came over in the summer of 1945 and we began in early 46 putting them together). It was a surprise that those things still worked. We assembled about 74 out of all those parts. We thought it was a good accomplished. Of course there are a lot of our colleagues in this country who said, "This one failed and this one failed!" That was one of our activities. The other one: Von Braun with his active mind said, "Lets build a project." So he proposed a project for the army to accept and to let us build. The project was a little bit similar to what we would call today, a cruise missile. (This is a missile that flies at a level altitude for a long distance.) It must be put on its track and up to its velocity and then it will cruise. That was a project that von Braun proposed. ~~There were two rockets~~ that still works, lets put a ....supersonic wings and kept its propulsion from a ram-jet (it is like a turbo-jet). The air comes in by the high velocity ~~of the~~ ....[301]. That's what we decided, and began to build. We made a number of wind tunnel tests and burning test on our way to build this rocket. Then began the Korean War in 1949-50, and with the Korean War, the attitude of the American army changed. We needed a rocket. The request was for a rocket that was ....[311] and about 8,000 pounds more. That became the

Redstone. We began to design the rocket in 1949 and build it here in 1950. The first one flew in 1953. It was launched by troops.

DUNAR: While you were at Fort Bliss, did von Braun set up an organizational scheme that would carry over to Huntsville? Along with that, to what extent did von Braun have responsibility for setting that up and to what extent was it imposed on you by military authority?

STUHLINGER: We were organized. At first we were not much organized. There was not much reason to organized us. In Peenemuende we were very organized. There were departments ~~as well as...~~ by a scheme [327] that von Braun used for his organization. It is an interesting one. He had it at Peenemuende and here. A very simple managerial scheme or organizational scheme. It looked a lot like this : Von Braun said that we need some departments that are organized for vertical and others which are horizontal. The vertical ones are our projects. For instance the Redstone, Jupiter, Saturn, Perishing projects. The program manager, under him the project engineers, the stock..[338] managers, so they had a ???? here that covered all the requirements of the project. To take care of every detail of the project. Then, superimposed on this organization, you had this direction, the technical laboratories. One laboratory was for electrical needs, one for electronics, one for guidance and control was one of

them, etc.... For the ...laboratories, this person and his co-workers were responsible to build the test stands, to equip them, to operate them, to make sure that they worked. They were ready when needed. So these tasks were permanently assigned to the test stands. When one of these people needed to test, like Jupiter or Redstone, they would go to this man and say, "I need to test this rocket on your test stand." So they could organize it together. This very simply scheme fulfilled many requirements. Everybody had access to everybody and everything. Every project manager had access to all the technical services and capabilities. Second, the technical people are not dependent on the ups and downs of ....[364] project. Whether the project begins or ends they are still in business. They remain there, same people, same vicinity, same equipment. They are very stable. These change with the project, but these remain the same. The whole system had a lot of stability. When we came over from Germany, von Braun made sure the 127 people were kind of a cross-section through his whole organization. So with the people he brought over, he could set up again a skeleton organization like that. We were very ....[375] We had our guidance people, our design people. Everyone who needed design knew to whom to go. We had our air-dynamitist, our propulsion people. At first, we did not need project managers. Only after we began this cruise missile system did we begin to need this project person and project people. They were nominated, very informally, but

to the extent that he knew what he was suppose to do and others knew it to. That was then the organization that was both flexible and it could cover almost any kind of function that would be given to use. So that when the Redstone came upon us, we were prepared. We could go right to work.

WARING Were Americans receptive to that management system? Did they think that was irrational at first?

STUHLINGER: That is a very good question. There was not much criticism at first because those who contacted us, were together with us had no experience themselves and didn't know what the problems are, what one should and should not do. Or they were company people, such as the people from General Electric, Rockadyne, and they just wanted to learn from us. They were not competitors at that time. Later it was different. They (at this time) just wanted to learn and join forces with us. Then, later on when we went into the real project, Redstone, Jupiter, Saturn, things were a little different. It was not so much von Braun's organization, but what was called the "Arsenal concept". The Arsenal Concept, which was not our invention or von Braun's invention, it was a system well known in this country under this name. The Arsenal Concept means that one has a government agency that has in-house capability, shops and laboratories and expert mechanics, design engineers (later computer people) who could really do a project in-

house. That could complete partially, small or large portion, could do much of the work in-house if needed. That is a concept that was brought here before von Braun. It was developed in Peenemuende for the particular reason that nobody could build rockets at that time in Germany. Nobody and no place knew how to build rocket motors. We had to develop it and von Braun had gotten the team together. We did it in our Peenemuende laboratories and became the experts before anybody else was an expert. Then when we moved here, von Braun kept doing this, applying the same principles. He looked and saw that it had a strong capability. It was at first necessary, because we just had no other choice. We could not have built the Redstone Rocket different because we were a close group, a lot of capability, but not much else. The other missile system, the "Air force System". The Air Force began in 1953 with their missile work. The opened with the Minute Man, the Polaris. That Air Force principle was different. The Air Force did not do anything in-house, they contracted everything. They had only paper people in-house. The industry was split on it. There were people around who could criticize us very heavily. It was the not the way to do it. It is not the way we do it in this country, we give it all to industry. There is excellent industry that do much better. You just tell them what to do and they will build it. We said, first of all, it is very difficult to tell them just exactly what to build, because we don't know

ourselves before we have begun with some experiments or something. Second, we know far too little about industry to know what to do. Third, we would never get the money to do. We are a small group. So we build our Redstone. We build ten of them ourselves. Altogether ten were built here before mass production began and after ten the first eight were built right here in Huntsville at the Marshall Center in our own shops by Von Braun's people. Of course not the 127, of course by that time there were many more. In from the big Saturn V, the first two were built in our own shops and that had been the particular reason why we did it at that time. The Saturn V was larger than any kind that had been built before. The normal methods of production and manufacture production did not work because of its size. ...33 feet in diameter and 60 feet long. So we had to develop welding methods. We developed the welding [technique] right here in Huntsville and then it was spread out into industry and from the third Saturn on, was built by industry. Rockadyne, McDonell-Douglas and Boeing. The first Redstone was built by Chrysler. They worked with us on the first eight and learned how to do it. We were really close together and then they took over and did it. There were people that criticized us for doing so much in-house. But very strangely, none of the real industry people, the higher ups, the responsible ones, criticized us for it. They said "We learned much from you, we took it over and we

will do it now. So, the criticism that was raised was typically raised by people who didn't know better.

DUNAR: The Army had to make some compromises in ... was General ~~McDar~~Medaris largely responsible for this?

STUHLINGER: From 1956, but before him it was Toftoy and Simon in Washington.

DUNAR: Both of them kept the bureaucracy from interfering with this thing?

STUHLINGER: Yes, they gave us a lot of protection. Then, later on even before we had reached the height of rocket building of the Saturn V, about 95% of the money which the von Braun crew received for rocket building went to industry. So they got their share. It was from about the mid-1960's on. We began to shove over much to industry in 1953.

DUNAR: (Just to shift gears a little) during the 1950's, could you give us some of your personal reaction to when you first arrived in Huntsville?

STUHLINGER: That has different aspects. First of all for the German's to immigrate to the United States, has been a process over many many years. You may know that among all

the European countries when you count them individually, Germany has provided the highest number of immigrants to the United States. If you take England and Ireland together, they had more than Germany. If you take England by itself and Ireland by itself, then Germany is on top (7 million more) ~~has about~~....[548] This is not an unusual thing for Germans. At a certain point almost every young German, before the war, had a dream to go to America. To be here for some time or for good. Going to America was something that immediately stirred you up and excited you. Then of course, we came over under war conditions and when we came over here under war conditions it was very different. First of all those years that were behind us was very unpleasant in many respects. There was war and it was deprivation and the hunger that was very persistent, misery was great. There was always the thought among us Germans, that we were Germans and had started the war. The reasons were many fold and perhaps it was not right. It was understandable that some explosion had to come, Germany started the war and we were defeated. The question was can ~~you re....into the~~ we and will we find our way back into the Family of Nations[582]. This thought was not always in the front line of our thinking, talking and living, but it was there. So we came over to this country we were on the one hand very happy and envied by many people that we would have something to eat again and would be in houses that were not bombed out, could buy clothes again and could have a normal life and sleep at night. The other one was: we hoped that we

could continue with our work. From Peenemuende we believed that we could do our rocket building, not for weapons but for educational and civilian uses. We had hoped very much that we could continue this work here under American auspices or at least some good technical work. At that time everything looked bleak in Germany. We didn't know whether it would come back as a state. Here we could, so that was another big plus. Another thought that was not a dominant one but not unimportant one. We knew and hoped and realized that when we came over we would be able to send some gift packages [611] home to our folks. ...We did sent a lot of things back over there. There was also the challenge of a new country. It was a country, particularly in El Paso which was not unknown to us because there was an author in Germany by the name of Karl Maye (he wrote western stories, he was never in America, but wrote it beautifully)...Many of these stories ....so El Paso was a known ~~country~~ place for us. We came to White Sands in El Paso and we knew about the Rio Grand, etc. .....[642].

DUNAR: Was it a big change when you arrived in Huntsville?

STUHLINGER: It was because in El Paso, we lived in a compound. At first we lived behind a fence and gate. Later on we could go in and out as we chose. We lived among ourselves in converted army barracks and houses. We were not encouraged, (not quite forbidden) but by no means

encouraged to contact the civilian population. So we had very little contact with Americans or the outside world. Here in Huntsville it was different with one big step. We could live where we wanted to, we could buy or rent houses, buy property. We could send the children to any school we wanted to. We could go to church. I^became a member of the symphony orchestra association. (I don't play anything myself. My wife does). We were on a committee where we tried to build up the symphony orchestra. So, we could take part in civilian life and we all got along very, very much. Our freedom began for us.

DUNAR: Were you involved in the Future Project Office?

STUHLINGER: No, it was Hammond Quilly [683]. He came over later, I think in 1954 or 55. I had started Research Projects Office in the Space Science Lab.

DUNAR: Then the Space Sciences Lab, you were involved in theoretical research or practical applications or both?

STUHLINGER: Both. We did quite a bit of flight research which was the support of the Saturn Program. Then we began very modestly with some work with in comos...[702] that connected with Saturn. It involved in astronomy and solar physics.

WARING When did you get involved in those latter projects?

STUHLINGER: It began very, very slowly. We began with three science projects in the early and mid 1960's. We couldn't talk too much about it.

DUNAR: How did you preserve any sort of possibility for pure research when there was the pressure ~~from~~ for your applied research [...[730] to get ~~stuff~~ something done.

STUHLINGER: There was not much of an opportunity and for several reasons. Our own management and that includes von Braun, just wanted to concentrate on the Saturn project. They wanted to concentrate on Saturn, that we should do this first and foremost and we should not be distracted by work which was....[003]. My laboratory remained small, 25-50 people and the larger portion of the...work applied to research that somehow supported Saturn or at least rocket engine. We began with our first really good science project dealing with solar physics. This had to do with measuring the magnetic field of the sun by taking a specter (?) of the sun from the clouds with a telescope. We then began with some infrared work, we had to develop some infrared sensors anyway for our Saturn work. We expanded later to ~~an~~ make on Infrared research project out it is (?) ...[016] center to day, twenty years later the infrared work at the Marshall Center is internationally known. People go to ~~classes~~ Congress and present their findings. For example, there

is has been built in the last year, a center that can receive signals from the stars. It is the best one on earth, the most sensitive one.

DUNAR: Did that opportunity for that kind of research come up because of the winding down of the Apollo project and they were looking for new options?

STUHLINGER: To some extent, yes. After this Apollo project was winding down, we ~~at~~ (the Marshall Center) got into two projects which are pure science and which had been prepared over three or four years. They were under very low profile and most people didn't know we worked on these things, we prepared by doing reports and studies and so on. Then after the Saturn had begun to wind down there was a need for new projects. The science project had been very handy. The one was a ...[034] high energy satellites, the other one was a ...[035] telescope. The originator of those projects was Landon Spitzer..[036]. We did a lot of ..work to make the ideas of the astronomers and translate them into technology. That was what we created then around 1971. We accepted it as a project and was assigned it by NASA headquarters. There was a strong competition with the Goddard Center. We won it so it was our project now.

DUNAR: Did you operate a liaison ~~then~~ between the astronomers? Would you describe a little bit about how that

worked? Did you have to work through Goddard? Or was that entirely separate?

STUHLINGER: We had a number of ...[044]. First of all in NASA headquarters there were different offices. There was an office for Manned Spaceflight (OMS), the OART (Office for Advanced Research and Technology) and OSSA (Office for Space Scientist and ....[049]). Each of them had their directors. At the time the director of the OART was ~~Ted~~...[051] who has died. The OSSA director was Morgel [052]. I was a key-scientist here so I was automatically the liaison man to these groups up there. They invited me for their planning meetings and the management meetings. I was invited there and went and learned what they were doing and could tell them what we were doing. There was very good personal contact. I knew a number of the people in the Goddard Center. From these meetings and from my just going there and talking to them, (we exchanged papers and letters, etc). The position of a true scientist in a group like this kind be described as follows: He should be a two way ambassador. He should go out to the scientist as an ambassador from here and say "Hey, look here you can build this rocket and that rocket and such, would would be interested in having that sort of a satellite? What would be different and what would be a good set-up? " Then he has to be an ambassador from there to his own people. He says "They are the scientist and they would love to have something that looks like this

and that is what they could use for their science." This two-way ambassadorship is a relatively good way of bringing them together. The scientist and the engineer are opposites and they have to be brought together. There must be a bridge builder between them.

DUNAR: The bridge-builder brings up another thing. We have read a good bit about the centers rivalries between Marshall and Johnson. You mentioned Goddard also. Could you mention something about the rivalry and did you share information between them? Stages of Saturn, also a book on Skylab talks about it a good deal. Compton and Benson's [078] book on Skylab.

STUHLINGER: I have an old one on Skylab before it flew. A compendum that tells the details of the experiments and science. It came out about four weeks before Skylab. This is was a very interesting time. The rivalry between Houston and Marshall was there. No doubt about it. A number of people from headquarters were very cold and there were, during the first years, a lot of tension between these two centers. The head in Houston was Bob(?) Kilruth. Later on in about 1986, there was an interview with Kilruth said "Yes, we had some friction. But I tell you if there are two outfits working on a project and there is no tension between them they are no damn good"." I must say, however, that twenty years earlier he didn't have that opinion! Von

Braun's case was a little different, but von Braun was a totally different personality. Entirely different. Von Braun never said any disparaging word or derogatory word about anyone of his colleagues. It was his style of life and he stuck to it from beginning to end. Even during the hardest times, he would never have said a bad word about Kilruth or his people or headquarters management. If some of us in his board meetings came up and said, "That fellow, he really burned me up, he did so and so, and I don't like him" then von Braun would cut him off and say, "Just hold your horses, I don't want to hear that, this man is alright". That was von Braun's style. On the other hand he was very determined to remain on his idea as long as he was convinced that they were the better ones. If a decision was made from higher-ups that this man was to be followed, von Braun would immediately change over. He was a little unusual in that respect. One of the headquarters people, John Shay [114]..was deeply involved in the moon project, he is now the Vice-president of RCA. He said from his headquarters, We had these meetings and there was tension between these people." Von Braun was always the gentleman. After all, von Braun was not the one who had the problem! He was so sweeping with his charisma and clout and capability. His way of formulating things and doing things was so superior that could afford not to go into the bickering and fighting...[126].

DUNAR: Did you find your position working in science, that there was rivalry with Goddard?

STUHLINGER: Yes. The Goddard people simply said we are the science outfit and we should do the telescope. You are rocket people and not telescope scientist. The decision was not made by me or by people in my level but on higher levels ...[132]. My argument was that you did not want to take over the science. We wanted to build a good telescope and work with them as chief scientist for the telescope. We could form a team as a cooperative situation and build the best telescope together. The decision that it should come to us, to Marshall, was finally made by George Miller. George Miller was not a scientist either, but George Mueller (?) realized that the Marshall Center had a much better in-house capability to build a very demanding mechanical system, far more than Goddard would be able to do. If you look at the telescope you realize what that means. The accuracy that is needed out of this huge structure and .....[145] and all of that are exceedingly high and only a group or team that is very, very well-versed in the mechanical work could be expected to do a good job. The Goddard people had enough work to do in their science projects, satellites, etc.

WARING I have several questions I would like to ask. You served under several different Center Directors, during your stay at Marshall.

STUHLINGER: Yes, von Braun, then Eberhard Rees, Rocky Petrone and Bill Lucas.

WARING Could you evaluate their different styles of managing comparing them to von Braun and to one another?

STUHLINGER: There is no comparing to von Braun! Haven't I told you I am biased? Eberhard Rees came after von Braun and he was an old Peenemuende man. He trained von Braun in 1939 or 40. Rees is basically a mechanical engineer. He came to Peenemuende to take over the shop area (the shops that built the new systems). Then he and von Braun had a good way of getting along, I think von Braun took him in more as his deputy. Then when we came over to this continent, von Braun had to name formally a deputy, he named Rees. ....Eberhard Rees took over after von Braun and carried on. I believe it was the right choice at that time, to take him as successor of von Braun. Under von Braun, the whole group was under a lot of momentum, like a fast spinning wheel. Then when Eberhard Rees came, there was still a lot of momentum and we continued as we did. That made things easier for Eberhard Rees and it made it easier for us because he knew us and we knew him and we knew all about what was being done and what was not being done. So that was a very easy transition for both parties. He did his work very well as Center Director. I must admit that he

did it better than I would have anticipated. But what helped him very much was this momentum, this ~~inertia~~, ingrained in all of us and it continued. He introduced the ~~HEEL~~ Project [190] (which I mention earlier) and the telescope project. He also had a lot to do with the Skylab. All his projects worked well. He left, in my opinion, too soon. He should have, could have, done a few things. [Dunar: He left at his own choice? Stuhlinger: If you don't print it, he left at his wife's choice!] I would have loved for him to stay longer. I think it would have done him, the Marshall Center and the program much good. Then came a face that does not live as a good one or a pleasant one in our memories. Petrone came and during his reign, he was there for one year, and during that one year, the von Braun team was more or less dissolved and cut to pieces. That is a sad story.

WARING Do you think that is why he was selected? That he was an outsider who ...?

STUHLINGER: Again, I wish you will not print this or quote me, it is sad and nobody can help it, but when it happened, people could have helped it at that time. But its too late now it is past history. I am sure that Petrone himself did not feel comfortable under the conditions. He was a completely different person from von Braun and Rees. He was a good soldier, very good. When given an assignment he

would just do it, push through to the letter. He built in Florida for example a huge building, an assembly building, the largest building in Florida. He built the launch pads that you might have seen. These are great accomplishments. He did it as a construction manager. He got the order, he knew what to do and he did it. Then he came here and as we realized soon and quickly, at that time and even more in hindsight, he came as an order. The order simply was to give that whole center a new face, a different one.

WARING Do you know who gave the order? Was it the NASA officials?

STUHLINGER: I wouldn't tell you!

DUNAR: Did this come as a surprise to the Rocket Team?

STUHLINGER: Yes. We had hoped that the team would have of course we knew that us old ones could not continue forever. Many of us had our past history and proofs that had worked very well and it was of course understandable that this same team could not continue, however, there could have been a transition that could have been several things smoother, more efficient, without loss of many good traits and features and much fairer from the human standpoint. That is what we were sorry about. We knew, and it was obvious of course that new wind would begin to blow one day. A number

of us, and I personally too, asked von Braun several times to bring new young people in now while everything was going alright. To bring in a few new young people, natives, to take over. This was one thing that we and even my high respected bossman did not call right. We should have thought of this transition and replacement earlier and in a more organized way.

WARING What was the attitude of some of the younger native-born Marshall employees to what had happened to the Rocket Team?

STUHLINGER: They were split about even. Where a number of younger people, some of them are still over there, (you may know some of them, Bill Sneed for example) they felt very comfortable with the older generation. In fact, they would have loved to see the kind of transition as I just mentioned. They would have come up to the high post anyway because they were good people. They were as sad as we were about it. Since some of the people who really had done an excellent job over many years, were not invited to the meetings anymore. They were calling in younger people to discuss, and our group was just forgotten about. That's not a fair way to do it. It could have been done differently. All of us would have understood and cooperated. Then there were young colonel, simply said "We can do as well as they

have done, why don't they go home now and we will take over."

DUNAR: Some have mentioned that George Lowe was one of those involved in bringing that decision to bear. Was his role one in shaping that decision?

STUHLINGER: Since you asked, Yes. Very unfortunate, between Lowe and ..[289] and von Braun, there was an excellent relationship while Lowe was in Houston. We not only respected him as a engineer, human being and colleague, but we knew that because of Lowe, our relationship with Kilruth and the whole Center was much, much better than it would have been without Lowe. He balanced it, smoothed it out and was fair. That was the time before he went to Washington. I would not like to go into that. If you like to go further into that, ask other people. I am sure that if you proceed with the details of your study you will come to that conclusion yourself.

DUNAR: We have gotten some hints of that already. Moving on to the Lucas years.

STUHLINGER: That is your overall plan with the writing? Are you in the middle of it?

DUNAR: We are still pretty early. This is a four year project and we are still in the first year. We have some time to go yet in terms of research. ~~We are going to continue~~. Our first chapter we hope, another ~~may~~be 9 months before we have our first chapter and then hopefully and chapter every three months or so. We are still really very early into the project. Could I ask you too, about your book on von Braun?

STUHLINGER: I am on page 332. I started in about 1985.

DUNAR: Are you shooting for fall then?

STUHLINGER: I am shooting for May 25. When I give a package to the publisher. But I am not complete then, about 90% will be complete. I can begin to give it to the reviewers and they can give me feedback, and say "Well, that is to lengthy and that is too cumbersome." It is good to have these things before I am completely through. Then I will be gone to Germany for a month in June. Our old ...Saint[335] in rocketry is having us over. He will be 95 years old. We will celebrate his birthday.

DUNAR: Will you be back then for the celebration in July?

STUHLINGER: Yes.

DUNAR: We sure do appreciate you coming in and taking your time.

STUHLINGER: You have one question we can take up shortly?

DUNAR: Yes, when we talked about other directors, we had talked about after Lucas took over, how ....

STUHLINGER: Well, I said a number of positive points. ...He's a very intricate, a very hard worker. When he took over he did not take over a very easy job. He was received at the Center which had just gone through this ordeal. This was not only a matter of losing a number of people, but also a matter of some distrust coming up against the whole system. He had to fix that again and get some balance and some sense of working. So he did not have an easy stop. He worked very hard. He was very conscientious in the way how he began and conducted his business. He is very intelligent, a good engineer. On the other hand there were some features that were quite different from von Braun's era. These features came out in this Challenger. You may recall that one the things that was highly criticized, Lucas did not have a very good cross-communication in his system. Cross-communication between him and the other levels. That is something that was just perfect under von Braun. Just working up and down, excellent, no problem of communication whatsoever under von Braun. One of his major management

principles was openness and talking to each other and bringing every problem out into the open and talking about it and discussing it until it was resolved. Lucas was of a different kind in that respect. He liked to work only individuals and not openly. Let me give you a little example that might illustrate what I mean: von Braun introduced the so-called executive luncheon. That means that for lunch everyday, about 20 of his managers and directors would come together for lunch. We sat together with von Braun and talked about things of the day of importance. This was always a very important half-hour for us, because von Braun had a beautiful way of bringing ~~appending~~ impending problems in such a way that, first of all, everybody would realize what was being played and what the problem was and what was being done about it. How it was, who was the boss, who should come in and help. It was a beautiful management tool on von Braun's part. It really brought us together and made us feel that we were all in the same boat. Von Braun would come in and at the beginning say, "Well, we have this meeting yesterday and this man was in from Houston and this man from headquarters and he was in and we talk about this. People thought we should do it this way in Houston ~~and do it this way~~, and we thought we should do it this way. Then we agreed that we should do this, and this, and this. We will have another look tomorrow. I will then tell you day after tomorrow what we have decided." Then everyone knew what was being done. With Lucas, it was

quite different, it was like this: We would be sitting around and he would say, "Did you call this man?" "Yes." "Well, what did he say?" "Well, he said what you anticipated." "See, I told you!" They took up the time they took up everybody's attention, nobody knew what they were talking about. You see the difference? It was very characteristic, the difference.

DUNAR: Did von Braun do that daily?

Yes, Except when he was in Washington, or somewhere else.

STUHLINGER: ....[410]. These meetings were appreciated by all our group. It was a major element of our work. In Lucas' case, I am sorry to say, ....[417]. .... That points to an important feature.

DUNAR: Would von Braun have a certain agenda, or would he toss it open for discussion?

Oh, he had the agenda in his head,

STUHLINGER: ~~Yes,~~ he didn't need a written one!

DUNAR: He would address certain problems and ask people their opinions of it? How would he handle it?

STUHLINGER: He would say, "Say, we talked about this thing or that. How do you feel about it?" Often he said, "Well, we discussed that and then we decided this way, how do you feel? Who would like to comment? Do you agree? Would you

have decided differently? We have to make a decision tomorrow, how would you decide?"