MSFC HISTORY PROJECT
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12/1/88

1. DUNAR To start, would you please give us some background about your personal involvement with the Rocket Team? How you became involved. Your relationship with Wernher Von Braun.

2. DANNENBERG I was basically interested in rocketry since my high school years and I started in my hometown where I was brought up, Hanover. We had a rocket society, GEFRA, and one of our team members, somewhat our most senior member, finally joined the Von Braun team at Peenemunde. So here I heard what was going on in Peenemunde. Of course in those days you couldn't talk about it so he couldn't tell me he was building rockets. But he indicated that the work they were doing would be really of interest to me. Then I tried to get to Peenemunde . First my company that I already worked for already during the war. At that time I was already in the US [#13] army and the company for whom I worked PDO who built these tachometers [#4] for automobiles. If you are driving a BMW, Mercedes or Audi, they all have these tachometers. Of course during the war they did wartime things, mostly communication equipment. So they could get me out of the army. Once I was at that company it was not too difficult to get from there to Peenemunde. Of course it was there that I met Von Braun. I had heard about him. He had quite a number of amateur rocket societies in Germany and all over Europe. Austria was very active. France was somewhat active.

British had already formed at that time the Planetary Society, which is one of the leading societies today. But the British, the law prohibits them from doing any kind of experimentation. So they could only work in writing things down. In doing theoretical studies. They were really leading in that field but they had not done any real experimentation. In the rest of Europe experimentation was really the primary goal. We did some experimentation in Hanover and Von Braun had of course experimented in the Berlin area.

3. DUNAR Were there contacts between those two?

4. DANNENBERG Not direct contacts. Of course we didn't travel around as much as you do today in the States. But we had written contacts. We wrote letters to each other. All the groups were a little bit secretive so they all thought they had the answer to the problem. And they didn't want to give the answer away to the others. It was always difficult to find out this information but we did know about Von Braun. I did know about Gorman [#34] in this country. Gorman had published in the early and middle 20's, the book and I had his book. But I did not call him up, my English was very poor in those days. But in Europe we called upon different people. Maybe not very regular, once or twice a a year. We knew basically what was going on. Of course Von Braun had particularly the capability to convince other people to support his work. That's why he finally got involved with the USS army. For that reason the Berlin group made the most, I

would even say astounding, progress. Then he was hired for by the army to be send to Peenemunde and start the military work which finally led to the V-2. Of course before, the V-2 was called the A-4 and I might use both terms to be interchangeable. There was of course an A-1, A-2,, A-3 and even an A-5. The jump between the A-3 and the A-4 was too great and left many problems to be solved and so the people came up with an intermediate step, the A-5. One of the people that know quite a bit about these things was Wenerd Ronsinski [#49]. He worked with Von Braun in Commistoff [#50] before he went to Peenemunde. He was one of the very first ones to join Von Braun in Peenemunde. He was known to be quite open minded and likes to talk about it. He's in town. Werner Ronsinski.

5. DUNAR We have seen several references that describe the organization of the rocket team here in the states as very similar to that of Peenemunde. Would you explain a little bit about how things were set up at Peenemunde and in terms of the carry-over in terms of the organization structure.

6. DANNENBERG In Peenemunde of course we had to really split the whole rocket problem into its major components. I was mostly working in Peenemunde on the rocket propulsion system. That is why I am mostly still interested in those areas. We had one group that built mainly the structures. The [#64] tanks, the outer shell. We too, had separate tanks and a separate outer shell. They handled in two somewhat different design groups. We

had strong guidance and control [#67] section. Guidance and control was the second major problem after the propulsion problem. I got to Peenemunde in 1940 we still had tremendous propulsion problems. When we pushed the button for test, the thing would blow up. It was different from the space shuttle. We had one good one then twenty-four bad ones. That is why I wasn't too much surprised about the shuttle, it was somehow coming. That was the first big problem. Then the rocket engine and then guidance and control. Finally, in Peenemunde the guidance and control section was stronger than the propulsion section. Guidance and control was also handled because it was the same technology. They shared all the measurements on the test stand and particularly measurements during flight. these people came up with the first radio transmitter which transmitted measurements during the flight. This was a big step ahead because up to that time you didn't even know what was going on. We said of course that first one was very primitive. We had seven measurements that could be taken during the flight and transmitted down. But seven measurements you could find out quite a bit more than if you had no section. To build all the underground equipment. You may have read in the underground shelters. They were building in France, underground shelters. The British had apparently heard about that and they came and made a bomb raid at the time the concrete was still soft. These bunkers are still pretty much in the same condition as they were after the war. The military had to give up the idea. They fought for it for some time and tried very hard to do it that way. Then some people in Peenemunde

came up with the idea to really have a transportable, a flexible system. All the ground support system has to be built for that. The milo [? tc 94] which transported the V-2, the launching table, the fuel and reduction [#96] supply, vehicles. It was a very major activity and I think that was the largest move towards the end of the war to get all this equipment together. Peenemunde was involved in doing the training of the troops, to write the handbooks. One of the key people there was Ehricka. He was also an enlisted military man, a lieutenant in the corp [#101]. He was wounded during the battle in Russia and released and spent the last years of the war in Peenemunde. Since he was a military man, he wrote all of the handbooks. Ehricka. He died about four years ago. He was generally pretty well known, a lead promoter for space. He came over with the rocket team to Ft. Bliss then came shortly here to Huntsville. But he thought Von Braun was too conservative and he still wanted to do pretty much the same things that we did in Peenemunde. Ehricka thought we should now really get ready for spaceflight and use liquid hydrogen, really use advance systems. He left and joined the military command under Dawnberger, who was at that time in aircraft. So he built aircraft for two years. Even that was too conservative so he went to General Dynamics in charge of the Centaur [#117] System. You may have heard of Centaur second stage on top of an Atlas launch vehicle. He was the one who came up with the vehicle for a relatively large satellite sent for planetary missions. He got his way after he left the group.

on submarines. They later called this the Polaris. Von Braun could not sell it. I think for good reasons and I go along with the Navy decision. I think Von Braun finally admitted that their approach to use solid propellants was a better approach [#150] for submarines.

10. DUNAR They were similar then because of those contracts ?

11. DANNENBERG Right. I had very close contacts with them. We met practically once a week. He talked about his problems. We talked about our problems here. Their guidance system is quite different, but the engine is basically the same. Both were developed by North American hardware.

12. DUNAR There are a lot of descriptions of the Arsenal concept of during things in-house. Yet, even in the 50's you did have considerable contact with contractors.

13. DANNENBERG Right, and the engines were strictly built by North American we did some testing here after the engine had been developed and put on the test stand here. We even made a number of recommendations for improvements and things like that. But the engine development was really a private industry development. The tanks and basic structures were really made here at Marshall. The final assembly and final testing were done here.

14. DUNAR Did the work with the contractors from the very beginning then?

15. DANNENBERG Right. Actually, North American had the Redstone engine more or less ready. I think that is one of the reasons Von Braun decided not to start our own development, but to buy the somewhat modified Redstone engine. It was really initially the engine for the Navaho Project, one of the very early Air Force projects similar finally to the shuttle. It was more flying vehicle than an orbiting vehicle. For some reason that project was finally canceled. North American was left with an engine on their hands, having no job for the engine. Then Medaris and Von Braun decided to use that engine after some modifications, for the Redstone launch vehicle. That's why the Redstone Rocket could be developed relatively quickly. Normally the engine development is one of the longest lead time items. You normally have to start ten years before if you really want to have your missile ready to go. But that engine had been developed. It was available so the Redstone could be developed in a matter of about 4 years.

16. DUNAR How did the generation of ideas of this sort and with using the equipment that had already been developed work? Give us some idea of the relationship between the Army and the rocket team, between Medaris and Von Braun. How did that all work? Did the ideas often come from Von Braun or were they suggestions from the Army of what they wanted?

17. DANNENBERG I really think it was a mixture. Of course Von Braun was always overflowing with ideas. He liked to talk about his ideas and he often could convince people to buy his ideas. I think he really was the one to finally convince the Army that there was really some use for rockets after he had spent five years in Ft. Bliss. I think at that time our activities, initially launching Redstones. But also working on proposals for advanced launch vehicles, that finally convinced the Army that they should move out and that they should get started in getting their own ballistic missile project on the way. That finally wound up in the Redstone. It first had other names, Oofsfah [#193] in order to show that we wanted to fight against the Russians, the Russian Bear. I think it had another name at some time. I don't recall it. Then it finally was named the Redstone after the team had been relocated to Redstone Arsenal. Von Braun had the basic idea to build a vehicle like that. He also had much more ambitious ideas about building much larger vehicles. We did quite a bit of work because we liquid hydrogen was very limited in availability. It was very difficult to make it. So we worked with relatively large systems. I would say probably of five size to use hydrogen peroxide. To make high concentration use that as an oxidizer and then of course we looked at all kinds of fuel problems. Fuel fossils and gasoline I believe was the proposed to put a ramjet [#212] on top of a V-2. Later it was even planned to put such a ramjet on top of a Redstone. But by

the time the next one was ready for use the project had been canceled. The DOD decided everything with wings would go to the Air Force. Some people said the ramjet wings, which was really the ramjet propulsion unit, but it looked like wings, was what decided that project would go to the Air Force. The Air Force didn't invent it so they finally let it die. Ehricka was working on the Ramjet System. He was a real good solid dynamic and good at solving the problems. That's where he decided that was not his cup of tea and he wanted to lead spaceflight into the universe. He didn't want to have to stay in the atmosphere. You could go high up about 100 miles, but you are still in the atmosphere.

18. WARING Did you continue this liaison work between Marshall and private industry.

19. DANNENBERG Well later on continued by other people. At the [time] Marshall had been established I decided to stay here because for some reason or another in the early days in the army, the liaison work did not pay too well. If you wanted to advance in the GS grades you had to have a job here in Huntsville. So I finally declined the job. You might want to talk to some of these other people Jim Bamlett, even Ballew. He works now for United Technology. He is still here in Huntsville and he was one of the early followers and lives in Guntersville in Guntersville. There are some others, but these are the two key people. Bellew was later on in charge of the Skylab project.

20. WARING What was your assignment during the Saturn period?

21. DANNENBERG Well, the Saturn was very long and some people thought we should have been bigger launch vehicles[#244] Sometimes I was working on the Nova Project. I spent sometime on the Nova. It was finally decided that the time for the Nova was not right. I then went back and was Deputy Manger on the Saturn for a number of years, thirty years. Then Arthur Rudolph [#250] took over. You probably know that Arthur Rudolph was a Saturn project manager when it was launched.

22. WARING Could you describe Rudolf office and the management systems in that office. Could you describe how Rudolf kept track of that the construction of the Saturn?

23. DANNENBERG Rudolf was a very painstaking fellow. He wants to have everything just right. For that reason we had very long meetings. The meetings didn't stop until all the problems had been worked out or at least assigned to somebody. In order to do that, I think he was the founder of that type of management system, to have a lot of charts, where all the milestones are shown, where you, as manager of the subsystem had to put down when you thought you would be ready with the system, when you would do the testing, when you would do assembly work, and finally ship it to the Cape. He followed these charts very religiously. The people had to update the charts. They had to show where

the delays were. They had to have good reasons for the delays. He did a very thorough job. Von Braun had initially appointed him minister. He was very early involved in rocketry. He was a little bit older, a few years older than Von Braun. In a way he was always a daddy of the group, an old man, the wise man of the group. He also had some industry experience when he started to work on rockets, he had worked for a private company before. Von Braun always assigned him the kind of production activities, all during Peenemunde. He was finally sent to Mulerberg [tc 286] where he got into trouble with the concentration camp labor. He had to use and had no way out of it. They would have shot him or made him one of the concentration camp inmates. Then he would have had to continue anyway. He was a little bit more senior man. One of the very first rocket engines was designed and built by Rudolph [# 292] . We also worked with Max Buyah [tc 293] one of the old European early rocketeers, he was basically an Austrian although his name sounds French. He built the first liquid rocket engines and Rudolph supported him quite a bit. When he was killed in the first liquid propellant rocket engine explosion, I know of, liquid engines had not been built much at that time. It might have been Rudolph's design, I never had the nerve to ask him! That was at Peenemunde.

24. DUNAR Would you discuss Von Brauns' management style in contrast with his subornates?

25. DANNENBERG Von Braun was quite a bit the more advanced senior. He liked to worry about future projects and once he had very defined the project, he knew what was going on, he was ready to turn it over to his subordinates and ready to forget about it. One of these people was Rudolph. [Von Braun] He knew that he didn't have to worry about it anymore. Then Von Braun could go on and worry about flights to the moon and building bigger rockets and doing other things.

26. WARING So he preferred to have the technical people who were very interested in the details as subornates?

27. DANNENBERG Yes, Von Braun had a really a knack for picking the right people for the job. I certainly have to give him full credit for that ability.

28. WARING Von Braun often spoke of the importance of teamwork in constructing rockets. What were some of the things he did to help encourage this teamwork and what did he mean by it?

29. DANNENBERG He fully realized that he as a senior person could not do all the things that are really necessary to set up such a complicated system as the guided missile system or like flying to the moon. So he realized he needed the help of all the many specialists. He was a good engineer in many areas. Sometimes he was really amazing in how much he knew, for example, about rocket propulsion. He was on the other hand still willing

and ready to assign other people to other team members and then let them go on their own. He reviewed what they were doing and made any final critical decisions that were to be made. In that sense he was quite different than Bueler. Bueler much rather like to take an existing project and then really make it to be put into reality. To build the hardware for him, to get all the pieces together, to ship them to the Cape and then launch them. Sometimes people called them the nuts and bolts.

30. WARING Von Braun put all the pieces and all the people together?

31. DANNENBERG Of course he also fully realized that he could not do on the one side advanced planning and on the other hand, complete a project which had been started years ago and which was near completion and also to worry about the projects that were actually in use. Like the Jupiter, the Redstone. Then he looked to his team members and gave them their assignments. He told them what he expected them to do and then left them alone and let them do their job. I think in that sense he was a very successful team member. He established the team. He picked the right people for the right job. He was a good technical man himself. Of course he was also a good convincer, so he could talk to his bosses. He could convince his bosses of what he thought was right. Even over and above his budget he went to the United States Congress and addressed the Congress with what he thought should be done in space. He talked to the Alabama

legislature and had the Space and Rocket Center built. He went all the way up and said his peace. The only thing he couldn't sell was the Mars Mission [#361]. He was working on it and would have appreciated it if at least something could have been started doing it in his lifetime. He was quite a bit disappointed I am sure didn't come about. Also at that time he had the good support of Tom Payne, the NASA Administrator at that time. But even these two could not get it going.

32. DUNAR You had mentioned earlier about some of the limitations that the bureaucrats decisions put on him, such as the idea of the Air Force having to have wings on it. Were there any other bureaucratic restrains during the ABMA years that limited what you could do?

33. DANNENBERG Of course we were part of the big bureaucracy of the Army so there were many, many things that were difficult. But again, Von Braun picked some real good people, he was quite active in community affairs and he was what we called an organizer. He could find ways and means to get around all the red tape. At one time, we used pencils and we needed pencil sharpeners and he described in the request for pencil sharpeners as a machine which rotated and which sharpened wooden rods for use in the project. So he always had means of getting around the red tape and not having to wait for the next fiscal year when you get a new allocation and then you can finally buy your pencil sharpener. So he made it technical project and as a technical

project it went through easily, it was no problem. The other time that he almost ran into a little problem was on our neutral buoyancy facility, a big water tank. Congress had to approve all facilities so he could not call it a facility, that is why we called it an underwater test fixture. By doing it that way he could get permission to build it without going through Congress. Congress learned about it later and of course made a big fuss. Von Braun had to go to Washington and justify what he had been doing. Of course by then there was not too much the people could do by then. A similar activity was at North American where I was the liaison engineer. We also needed, again a facility, in order to test when the Jupiter rocket came into being. We needed a [?tc 394] test stand, a Redstone test stand and particular the start of procedure was a very difficult process. There was a lot of problems in engine blow ups. So North American wanted to have it at our facility and in order to get it, and we did that without Medaris knowledge and he complained about it in later and bawled me and Von Braun out. But we built a transition test stand. We named it for the purpose we had with it, but we didn't use facility and for that reason we could buy some structural steel some various and other things we needed to in the long run build a facility. But we could get it done. Once again Von Braun on the one side, dared to stick his neck out when many other people just wouldn't have wanted to do it. But when he saw a problem he dared to stick his neck out and he gave the go ahead and people moved. That way he got many things done that otherwise wouldn't have gotten done at all.

34. DUNAR How did Medaris function in terms of his relationship between Von Braun?

35. DANNENBERG Medaris was mainly the contact part to the Pentagon, the Defense Department in general. He was the one to get the money, to justify the money, to make the budget. For that reason he had a strong group of mostly Army officers, who did that kind of thing for him. He got the basic technical requirements from Von Braun and Medaris also got quite a bit of direction from a smaller group of lab directors around Von Braun that gave a lot of input for these projects. He had to submit for time-lines, for promises concerning future army projects. I think again it was an ideal team between Von Braun and Medaris.

36. DUNAR So he was sympathetic towards what you were trying to do rather than towards holding to army regulations.

37. DANNENBERG Yes, he also tried to get around army regulations. In the one case (mentioned above) he helped us to get around regulations in the other case we didn't mention it to him because we were afraid he might not go along with it.

38. DUNAR What are the feelings of the members of the Rocket team at the time that Marshall was established and there was the separation then from the army?

39. DANNENBERG You have probably heard that Von Braun declined for about two years to join the new NASA team because he said that he gave an obligation to the army work and he was happy to do this kind of army work. After all he had used army vehicles to launch the Explorer satellite and to launch a manned flight. In a way he had been able to do the things he saw as a long-term goal working for the army. When the army was finally told and of course he was assigned to the army, you can only build guided missiles up to a range of 400 miles, that did it. Then Von Braun said that is not really my cup of tea I want to do a little bit more than building short ranged missiles. Then he, after consulting with his staff, decided that he should be ready and join NASA. Then we officially became a part of NASA in summer of 1960, two years after NASA had been established.

40. DUNAR Who of the people you have mentioned on Von Braun's staff that he most relied on?

41. DANNENBERG Basically, the lab directors. He met every Monday morning in a staff meeting. That included the lab directors, his assistant who worked directly with him, Eberhard Rees, and the few administrative people and the public affairs officer, Art Slatterly [#467], who died a little while ago. I was really always quite impressed with Von Braun's all-around capabilities. His on the oneside, his knowledge as a scientist, a technical man. His capability to really be a team leader, to establish a good team. To work with other people above him and

only very few people have that kind of capability. I think that is one of our problems with the Space Program now we don't have that kind of person.

42. WARING Do you think Eberhard Rees was as successful a center director as Von Braun was?

43. DANNENBERG I hate to say bad thoughts about Eberhard, but he was certainly not Von Braun's personality. Many people have said so. On the other hand I think while he [Rees] was director of the center it was still in better shape than what happened later on.

44. WARING With a difficult funding problem as time went on.

45. DANNENBERG Eberhard was the much more careful person. He's not looking as far ahead as Von Braun. He listens to what Von Braun tells him and then he starts his own planning, but he is not the first one to come up with the idea. He's a little bit more like Rudolph [#495] in many respects. He was a really good man to do the detail planning, to find out what facilities do we need, what people do we need. He is the one that saw the effect after the Apollo lunar landing we would have to dismiss a lot of people. He was the one who said lets not hire a lot of civil service people. We have no way of getting rid of them eventually. He then brought in the tremendous support of private industry in this area. That's where he and Teledyne Brown were

support contractor and after the lunar landing the whole team had to be reduced quite a bit in size, it was relatively easy to dismiss some of your people. We still had to dismiss several thousand civil service people. That of course was a tough time and Eberhard Rees was in charge at that time. He hated it, but he saw it coming and in a way he was prepared for it. He of course was not the dynamic personality that Von Braun was.

46. WARING Do you think at this time of the RIF's, the reductions in force, the NASA administrators wanted to disband the rocket team?

47. DANNENBERG There were certainly some efforts on the way in headquarters. Not only the rocket team but basically they were not too much in favor of Marshall. Marshall is today quite a bit smaller than we used to be in the heydays of Apollo. We were by far the biggest center. Today I think even Houston is bigger.

48. WARING So you think during this time of reductions, they were primarily concerned about the size of Marshall and not so much about the influence of the rocket team?

49. DANNENBERG Well, I think you are right. They were concerned about both.

50. WARING There are some descriptions, for instance the Levine [# 537] book about managing NASA. He talks about the Marshall

Problem in the late 60's and describes it as a problem of having senior people with a great deal of technological expertise concentrated at Marshall, whereas some of the other centers had younger people and were not as top heavy. In other words, the people with a great deal of experience. Was that a true feeling here at that time that maybe there was pressure to split up the rocket team?

51. DANNENBERG That was probably one of the reasons behind the attempt. So I think that it was not only bad will to disband the team. But that was certainly one of the problems. Of course it also led to the fact that practically all those people, these older people retired almost at the same time. That was not so much the form at the other centers. But it was a big problem here.

52. DUNAR Was there a feeling of a lot of center rivalry as well between the different centers?

53. DANNENBERG Yes, I think that it was there all the time from the beginning. Again, Von Braun was known as a good politician. He could smooth over these things. So while Von Braun was still center director the rivalry was not as pronounced and recognize as later.

54. DUNAR To what degree did Von Braun stay involved in Marshall affairs after he went to Washington?

55. DANNENBERG Not really too much. He turned it over to Rees for the early years and Rees knew his thinking quite well. Von Braun came back fairly frequently. I am sure they discussed these problems all the time. But he really had no direct influence. Only through telling Rees his story.

56. DUNAR Another criticism that had been leveled, not so much at Marshall, but at NASA itself, during the late 60's as Apollo was winding down, was a lack of long-range planning, which in effect contradicts Von Braun's philosophy. Do you think that is a fair criticism?

57. DANNENBERG Von Braun had a long-range plan to go to Mars and that would have been implemented the plan would have been there. Since it was decided not to do it, then even Von Braun couldn't see what could be done instead. Since Von Braun was really anxious to get started on the trip to Mars, not necessarily right away a manned trip, but he realized that we had too do many other things before that. He did not for example, push another lunar landing in establishing a lunar base. That was not one of his priorities. Some people feel that maybe that was a mistake, maybe we should have. It was not as costly as a Mars mission.

58. DUNAR There was a question in the early sixties about a lunar base with Project Horizon. At that point Von Braun supported that. Did he change his perception about it.

59. DANNENBERG I think at that point it was too ambitious to really plan for a Mars mission. So he saw the Mars mission as a next step after a lunar base. After he then had caught on to propose a launch mission, he could not split his resources too far. I think for that reason he de-emphasized that mission. He really didn't talk about a lunar base anymore.

60. DUNAR During this difficult transition period as well as at the end of the Apollo project, were there problems imposed from the outside or were there problems from inside Marshall itself?

61. DANNENBERG The whole structure was somehow hurt by the reduction of technical people. You start first to reduce the lower people and then you wind up with a very top heavy organization. Many of these people might become very unhappy because they don't have the big test anymore. Not only was the center reduced, but there were no test. The people could have probably kept themselves busy doing research on their own. But that is not the same as three working on a team and having a joint goal. If everyone does his own study that is a completely different thing. That was missing, besides the top heavy structure and the dire need to fire some of the people.

62. WARING How did some of your own responsibilities change in the 60's and 70's?

63. DANNENBERG I also retired relatively early for some of these leaders.

64. WARING What did you work on during these periods?

65. DANNENBERG The assignment I had was in connection with the Space Station. Again, people say that NASA had no plan, but Von Braun proposed very heavily space stations. He really wanted to use space stations to use as a starting point for Mars missions. That was an intermediate step. He proposed to use similar, like what we did with the Skylab. To use a much larger second stage of Saturn V. It has two stages, a Skylab type workshop and that project was dumped for financial reasons. It would have cost a billion dollars. That was not approved and for that reason there was not common goal. The team had a tendency to fall apart. We did the propulsion systems for the shuttle, but the main shuttle was Johnson's responsibility. The astronaut training was Johnson's responsibility. Fortunately, Von Braun had seen that problem and had started to get Marshall much more into scientific projects. He was the one to build up the science lab. Most of the labs had been reduced whereas the science lab was being built up. This was the scientific lab to support Skylab. To monitor, to devise and design all the experiments that were to be for political reasons, not to build the space lab here. Our people had established a good basis and they did quite a bit of the science and the space lab that were flown were basically Marshall's. Marshall is now in pretty good shape. They can do a

lot of scientific work. Von Braun was the one to start the change from fuel propulsion management into more scientific activities.

66. DUNAR Von Braun was largely responsible for finding that niche for Marshall as the Apollo program wound down.

67. DANNENBERG Yes, it was clear that there are not that many propulsion systems. You cannot support a large center just by building propulsion systems. After the shuttle nothing new has been started. The shuttle was designed 15 years ago. It was designed when I retired. I didn't see too many possibilities for myself. To answer your question, I was working on a local simulation program and I don't even recall the name of the program anymore. We simulated the activities on the space lab. We continued that even after it was known that space lab would go to the Europeans because our mission would still be to propose experiments to decide what should be done. We had to find out what some of the problems would be if (an astronaut) were alone a whole week, completely on his own, he might not have the right tools, or might not like the food anymore. He might get dissatisfied with the other flight companion on board and are with all the time. We did a lot of simulation with actual people. I was at work at that project. It was really the closest thing to a space station. Initially I was working on space stations to build a huge space station, based on the Saturn V, but after that had been turned down we concentrated on what could be done with

the space shuttle. It was known that the shuttle itself would be built by Johnson. For that reason they did not have too much time to concentrate on the payloads. We picked up the payloads at that time.

68. WARING Your career shifted then from working from propulsion systems to these human systems. Was this a choice that you made?

69. DANNENBERG There was not really much going on in the propulsion systems. I was initially in charge of early space stations. When it had been decided not to build the space stations then we used this knowledge to apply to the space lab. Which is a very small, very primitive space station. .... That is where I had my first contact with Herr Thompson, he was also working on the same thing at that time. Later he continued on orbit propulsion, he was in charge of the main engine of the space shuttle before he left here. ...Our people worked on a conceptual basis so they don't make new designs on new engines.

70. DUNAR Was it a mistake to abandon the arsenal concept to move to the contracting system?

71. DANNENBERG I think it was. But with the American economy, you have to keep the contractors happy. For that reason you could not really do too much on the Arsenal itself.

72. WARING What are some of the problems with having the contractors having such a big role?

73. DANNENBERG They really determine today what we are doing. ...that's not really being decided maybe by some very high level people, like Von Braun or Edmondson, Slater. They make the final decision. Of course they also have to go to Congress with their recommendation and get approval. Many of the things we do are heavily influenced by private industry, like the Space station, [#779] now by Boeing. It is really more or less a Boeing run project.

74. WARING The initiatives come from businesses and not from the.....

75. DANNENBERG This is even more true for the shuttle and even the shuttle systems.

76. DUNAR How about the role of the military in terms of its input into what NASA does? When did you see....

77. DANNENBERG You mean the Air Force, not the army? Yes, the Air Force had quite a role in deciding the final design of the Space Shuttle. ...they would have like to put some jet engines on it like the Russians finally did, but for money reasons again, it was decided against it. But the Air Force had quite a number of things to say about it. The size of the cargo area was

determined by the Air Force. The basic design of the shuttle was inspired by the Air Force. The use of solid rockets, they had been using solid rockets for their Titan launch vehicles and finally convinced NASA to use the same thing. Von Braun initially tried to get a liquid propellant stage [#786] but it would have cost twice as much and taken a couple of more years. So for that reason it was dropped. Purely for money reasons.

78. DUNAR Money and time for development? Was it with the shuttle [tc 793] that the Department of Defense began to have an impact on Marshall and NASA, or did it come earlier?

79. DANNENBERG They had already some influence and the shuttle was done jointly with the Air Force. The key role was NASA, but the Air Force had its input.

80. DUNAR But was there anything earlier than the shuttle, or was the shuttle the first?

81. DANNENBERG The shuttle was really the first joint project. The Air Force was also interested in the Space Stations. When we made the early Space Station studies, the Air Force was always represented on our study teams. The Air Force was never very outspoken. ...today they are more concerned with protecting it. Your other systems to protect it.

82. DUNAR Do you see the role, not only of Marshall, but of NASA, altogether in more recent years as shifting to a more liaison, contact between contractors and Department of Defense on one hand and NASA administration in Washington on the other? Is there less innovation at the Centers at Marshall or the other centers because of that?

83. DANNENBERG Well, I certainly don't want to play NASA down completely there are still some pretty good scientist, with pretty good ideas. They may even often convince private industry to take their ideas and run with it. So they still have a pretty good influence. The actual work [#808] is being done by private industry. They make all the money, they pay all the good salaries. That's of course the reason, and I think in a way its a shame, that many good key NASA people, the top people, very often leave and go to private industry. Even here at Marshall many people, especially in the years when the spirit wasn't there anymore. They all joined private industry and they made pretty good money. They also get their government pension. ....the government is losing out because NASA doesn't have to pay their pensions. So in that sense, I think an Arsenal concept would be cheaper, would save quite a bit of money and be more efficient. Of course it means a big government operation and that might wind up with the beginning of a bureaucracy. I hate to admit that. In order to avoid that you would need leaders of this bureaucracy to be of the type of Von Braun and Medaris. People who are willing to play around the rules if they have too. For good

reasons the present concepts might not be lost. ...its difficult to decide which way to do it. You never come up with firm figures or data so you have to depend on your judgment....

84. DUNAR You mentioned a time when the spirit was missing. What were the things that contributed to that other then the fact that the [tc 835] Apollo project was a single target goal?

85. DANNENBERG There was really no good long-range project.

86. DUNAR The lack of a long-range project?

87. DANNENBERG Yes. The Shuttle was not really so much our project and even shuttle payloads are not as much as a real lunar landing project or Mars type project. That does not keep too many people happy.

88. WARING Do you think that's the biggest change at Marshall over the three decades, the early period, the real focus on Saturn, they are getting now a fragmentation.

89. DANNENBERG I think that is a good point. I haven't thought too much about it, but I think that is a good point. A big question is still, what is going to be NASA's next big project after the Space Station? ...Marshall still has a pretty good role for the Space Station. I think that fact has improved the spirit quite a bit. I think also the fact that J.R. Thompson is

here. He is very familiar with the spirit of the people with whom he used to work in the old days. When he got here he listened to the complaints of the people and the fact that the Space Station really gets on its way. That might bring at least part of the old spirit back again. ....Boeing will take over from Marshall pretty soon. For Marshall the question still is, what is the

90. DUNAR After the Challenger accident there was a lot of criticism of Marshall management during that previous period. Do you think the problem was a management problem or do you think it was a lack of focus?

91. DANNENBERG Well, I don't really think it was that much of a management problem. With a real good manager like Von Braun, he had always had a good nose, so he might have smelled a problem without really knowing all the details. He may have put a little more emphasis on really digging into it. Von Braun had also, like J. R. Thompson, a constant open door, so people could come and talk to him. That might have thwarted such a problem. But then it is just speculation.

92. WARING Do you have any advice to us as historians writing the history here?

93. DANNENBERG Well you certainly have a very challenging task. Nothing has been done for quite a number of years, so there is a

lot of documentation that has to be generated. I think basically you have the right approach to talk to some of the people, not only the old timers, but some other people I mentioned earlier.

94. WARING Do you think there is something we might tend to overlook? Not knowing that much about the center ourselves, that we might overlook?

95. DANNENBERG Right off-hand, no.

96. DUNAR If anything does occur, let us know.

[discussion continues on how the book will be published. Book available at Space and Rocket Center on organization of Peenemunde. End of tape counter 925]