

**INTERVIEW WITH DR. CHARLES LUNDQUIST
INTERVIEWED BY STEPHEN P. WARING
21 AUGUST 1990
UAH HUNTSVILLE, ALABAMA**

1. LUNDQUIST: I am Charles Lundquist. I ended up in Huntsville as a result of being drafted. I was an Assistant Professor of Engineering Research at Penn State University. [I was] working in the Ordinance Research Lab at Penn State, on homing torpedoes. This was at toward the tail-end of the Korea War. I had deferments from military service from the draft because I was in school and so forth. In about that time frame, there was a decision made to draft virtually everybody that had ever had a deferment. So I was drafted. My basic training company in the Army had lots of other university profs and lawyers, CPA's and all kinds of special people. So we were run through a very brief basic training. Then we were sent out to various installations where our capabilities would be useful. So at that time, and this is a thing you may want to give a little more attention to in one of your early chapters, there were lots of people brought in to augment the von Braun team, by that process. Many of them ended up in quite senior positions eventually in Marshall. People like Bob Linstrom, who was the manager of one of the Apollo stages and later manager of the whole shuttle program at Marshall, reached Huntsville that way. Jim Kingsbury, who was the head of Science and Engineering for a number of years, was brought in that way. So there was a whole other block of people that were sort of a second echelon under the German folks, that were brought in via the Army. By that process. It's another sort of interesting story. It is almost another group of pioneers that ended up in that.

2. WARING: That's a group that we are planning on giving more attention to when we revise. Yes, it is an important part of the story.

3. LUNDQUIST: There were a lot of them actually. I was one of them. People like

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Linstrom...

4. **WARING:** Were you treated differently because you were draftees? You had professional degrees on one hand, but yet you were, what were you, a Private?

5. **LUNDQUIST:** Yes, I was a Private! No actually, the von Braun team was more attune to the academic or professional capabilities than they were to the military status. A bunch of them had gone through the same process in Germany. Ernest Stuhlinger, for instance, had been run back and forth between the Eastern front in Russia and the various technical jobs several times, so they had all been through the same thing themselves, so they were...some had not all. But, they were attune to working with military assignees and they understood how we got there, so they made the best use the could of us.

So when I arrived in the fall of 1954, I already had some experience in guidance systems and homing torpedoes and that kind of thing, so working into rocketry wasn't that big of a change. Relatively soon after arriving in Huntsville, at that time in what was called the Technical Feasibility Study Office. I got assigned to work on plans for satellites, which was one of the things the technical Feasibility Study Office was working on. So I got involved in orbital studies for artificial satellites. This was a few months after von Braun had written his memo that said with existing hardware, a satellite could be done, which was as I remember it, in the Spring of 1954. So it was a few months after that that I arrived and got assigned to working on artificial satellites.

6. **WARING:** When you were working on satellites then, was ABMA thinking of designing satellites on their own?

7. **LUNDQUIST:** ABMA didn't exist at that point. This was before ABMA.

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8. WARING: Was the Army group working with university scientists?

9. LUNDQUIST: Well, they were working with a Navy team to look at doing artificial satellites. A fellow by the name of Hoover, Commander Hoover, was a key person in that. Then there was quite a competition in the Department of Defense over who would get the assignment to work on the artificial satellites for the nation. Somewhere along in that time frame you have the date Eisenhower made his commitment that the U.S. would do a satellite for the IGY which was in '57, '58. There was quite a competition who in DOD would get the assignment to do it. Finally, it got assigned to Vanguard and we were told to destroy all our files on satellites things, which we didn't quite do. We just sort of hid them, rather than destroy them! You know the whole history thereafter.

10. WARING: Did you remain in that sort of work, this Technical Feasibility Study Office, did that become the Research Project Office?

11. LUNDQUIST: That became the Research Project's Lab when ABMA was created. My first boss when I got here was Geoff Teal, one of the original Germans, who then went off...he was only here a year or two, overlapping with me. He then went off into industry and eventually became a Vice-President of TRW. So I saw him from time to time in his TRW role. Then the next director of the Technical Feasibility Study Office was Ernest Stuhlinger. That whole office, or the majority of it, not quite the whole office, I guess, but a chunk of that became the beginnings of the Research Projects Lab. Then eventually the Space Sciences Lab under Marshall.

12. WARING: What sort of things did the Research Projects Office do in the Saturn years? Did you work for PEGASUS, for instance?

13. LUNDQUIST: PEGASUS came out of the Research Projects Lab. I left just as PEGASUS was getting going. In fact, I remember in my exit interview with Wernher von Braun that one of the things he asked was whether PEGASUS was a good thing for the Center to do. I gave it a hearty endorsement. So that was one of the several things.

14. WARING: How long were you out of Marshall?

15. LUNDQUIST: Well, I was then transferred over with the people that were transferred over in 1960. I spent two more years then in the Research Projects Lab. Then in 1962, I went up to the Smithsonian Astrophysical Observatory to be the Assistant Director for Science of it. In the course of the early satellite work, I had gotten to know Fred Wipple, who was the Director, up there quite well, because we had been working on satellite tracking things together. I had been responsible for instance, for a contract from the Army to SAO to do the orbits on Explorers 3 & 4, which was the Argus experiments on the Explorers. So I had been working closely with them and when Alan Heinecke, whom you may know from...well he was one, eventually, he was one of the great studiers of whether there were or were not UFOs, after he left the Army. He left the Smithsonian to take a position, I believe, as Chairman of Astronomy at Northwestern. Fred Wipple had a vacancy for an assistant director of the Science Program. There were two assistant directors, one for the Science Program and one for Administration. So he lured me up there to take the Science Program.

16. WARING: How long were you there?

17. LUNDQUIST: I was there from 1962 through 1973. Then I came back in 1973 to a replace Gerhard Heller as Director of the Space Science Lab. Gerhard was killed in an automobile accident. So I got lured back in 1973 to be Director of the Space Sciences Lab.

18. WARING: Was Marshall a very different place in 1973 from 1962? What were the changes that you noticed?

19. LUNDQUIST: It wasn't terribly changed.

20. WARING: Were you surprised by that?

21. LUNDQUIST: Not really, because I had been in pretty close touch with them during that interval. I had, in my Smithsonian role, been a member of a thing called The Group for Lunar Exploration Planning, which was the advisory group that did the planning of where the Apollo missions would go on the moon, what they would do and so forth. So in that context I had been pretty close to the NASA operation and Marshall affairs.

Sort of a funny story in a sense. One of the last things I did at the Smithsonian, because Comet Kohoutek has just come along, was have some meetings on the Friday afternoon that I left, sort of wrapping up at the Smithsonian, planning to observe the Comet. So, therefore, I had in my briefcase, rather than packed away in my stuff that I had had shipped, orbits and a lot of information about that Comet. So I arrived on a Monday morning, the following Monday, having driven all weekend, it was during the time when there was the big grain sale to Russia. So all of the trucks that otherwise would have been available to move people's household goods, were all pulled off of that use and were hauling grain to the seaports to sale grain to Russia. So my moving van shrunk! So I had to rent the biggest U-HAUL-IT I could find, load everything in to my own U-HAUL-IT and drive down from Massachusetts to Huntsville over the weekend. So, I essentially drove the whole weekend after checking out at 5:00 o'clock Friday afternoon from SAO and having these last meetings on comments. I drove all weekend to get my stuff down here. I put my family on an airplane. I think it took two cabs to get them to the airport. Forty or fifty

pieces of luggage. Everything that we could pack in all our suitcases. We have five kids, so there were six of them that all flew down. So they were ahead of me. We had a house by then. I arrived in the wee hours of Monday morning, caught a little sleep and then went to work.

My first appointment was with the then, Director, Rocco Petrone. So I met with him a little after eight on a Monday morning and talked about what my thoughts were about organizing the Space Science Lab and so forth. After that meeting, the acting Director of the Space Science Lab, Walter Hauserman, turned the reigns over to me and said, "Oh by the way, this TRX just came in. The Space Science lab has just been given the assignment of planning the observations of Comet Kohoutek from Skylab, [which was then sort of underway] so I guess the problem is yours!" He gave me the deadline for the planning of the Skylab observations of the Comet was that Friday. So I got out my briefcase where I had all the stuff and I called a meeting of the appropriate people. By mid-afternoon, I had all that planning well underway. Then it occurred to me that I needed to go over to Personnel and check-in. I had arrived and was working at the place. So late Monday afternoon, after having done a days work already, I went over to Personnel to sign in. So I didn't miss a step between Friday afternoon and Monday morning. It was sort of amusing how it worked out, that I just happened to have all the right stuff in my briefcase, to get on with the first assignment! They hired the right guy!

So I arrived in the beginning stages of the operation of Skylab. Of course I knew about Skylab from all my other contacts, it wasn't a new thing to me. So I ended up with the Space Science Lab having quite a team of people down at Houston involved in the operations of Skylab.

22. WARING: These were Marshall people?

23. LUNDQUIST: Yes, these were Marshall people from the Space Science Lab. In fact,

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it got so many down there that I eventually sent my assistant director from the lab, Ray Hembry, down there because I had so such a large faction (about 10% or so) of the lab down there. I actually sent down an assistant director from the lab to keep everything in order.

24. WARING: Were these people assisting in the operation of the Telescope Mount?

25. LUNDQUIST: All kinds of things. They were involved in the ATM, in some of the meteor observations. They were involved in the Material Sciences experiments on board. There were a whole battery of things they were involved in. We had a deep involvement in Skylab in the beginning.

26. WARING: Would you say that Space Science in the 1970's at Marshall was quite different than what it had been at Marshall during the Saturn years? Because in many ways, weren't scientist in the Saturn years pretty much assistants to the engineers? Do you think there was new autonomy, a new status for scientist?

27. LUNDQUIST: Well, we built a new one. That was part of what I did was, and I am not being at all critical of the predecessors. Times were changing, Skylab was up and the follow-ons were planned and so forth. One of the things that brought me back, really, was to get in on the ground floor of the Shuttle so the science could be done with the Shuttle coming up.

28. WARING: What do you thing allowed that new autonomy for scientist in NASA and Marshall?

29. LUNDQUIST: I think it was just evolution of the times. The whole field of Space

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Science was maturing, evolving from the early pioneering days to a more orderly systematic pursuit of science. Skylab was a real step forward in that direction. It signalled a change from, "let's try something and see what in the world will happen back" during the first decade or so of the space program, to a more orderly, I wouldn't quite say routine, but more orderly systematic program rather than trial and error thing that we were really dealing with at first. They had no idea what all was going to evolve in Space Science before we launched the first satellite.

30. WARING: Was there quite a bit of encouragement of the Space Science Lab to take on new...?

31. LUNDQUIST: Yes, I had a lot of encouragement. So we put in lots of proposals and got out folks involved as Principal Investigators in lots of different experiments, or co-investigators.

But there always was sort of a dual role in the Space Science Lab. One role was to be an innovator and an investigator disciplined in the doing of Space Science. The other was to provide a support to the other projects at Marshall. For example as the buff during Skylab and later at Apollo-Soyuz, still later the Shuttle, when a project needed a project scientist, it was our role to pick an appropriate scientist and put him in the project scientist role in a bigger Marshall project.

32. WARING: Were most of the people with Science degrees at Marshall located in the Space Science Lab?

33. LUNDQUIST: The majority of them. There were some over in the Materials and Processes Lab and few others here and there. But the majority of them were in the Space Sciences Lab. One of the things that I got assigned to do fairly early after my arrival here

was to consolidate an Atmospheric group into the Space Sciences Lab. They had been off in another laboratory and the suggestion was made to consolidate them into the Space Sciences Lab. There was also some consolidation of the more fundamental materials things, so some decisions made about fundamental materials were from the Space Sciences Lab. I reorganized on a Division basis, a Materials Science Division.

34. WARING: Well that sounds like that reorganization was a sign that Space Science had become more important in Marshall.

35. LUNDQUIST: Yes, that was happening not only in our case, but in some of the other assignments, things like [263] became the Space Telescope. A number of the other big science projects were captured by Marshall. I helped with that role of capturing them and executing them.

36. WARING: Yes, the scientist were not adjuncts to other labs or to the projects, they had their own role.

37. LUNDQUIST: They had their own role. We would give a project scientist the second hat as project scientist on something or other. Now Space Telescope was an exception. It was big enough that they brought in Bob O'Dell as project scientist, not through the Space Science Lab, but directly.

38. WARING: Could you describe the relationship between the scientist at Marshall and say, some of the academic scientist during the 1970s? How did that work?

39. LUNDQUIST: We took a little different point of view than, say Goddard. Our point of view was that we would make a lot of use of academic scientists. For instance, on the

Apollo solar observations with the Skylab telescope, we had contracts out of Marshall with many academic people to do various instruments, to do various analyzes and so forth. So we didn't staff up with large numbers of people to do a large of fraction of it in-house. We wanted to have enough in-house people ability that we could deal with the academic world as an equal and not just as contract monitors, so we insisted on doing some piece of things ourselves. But we were very comfortable with having the majority of it done out in academia. Whereas Goddard took the other point of view. Goddard was rather insistent on doing most of it in-house and pulling people into Goddard to do it. That was sort of a basic difference in philosophy that we have and that Goddard has.

40. WARING: Why do you think that Goddard wanted to do it that way? Would they have more control over the projects or would it just be simpler?

41. LUNDQUIST: I think it was mostly empire building, don't quote me on that! There were some empire builders at Goddard. That went back to where they came from, their history. Whereas, the Army and then Marshall did have a good relationship with the academic institutions and felt comfortable working with universities and trusting them to do things right, instead of feeling that they had to do things themselves.

42. WARING: Well, that is interesting. Was it also response, do you think, to the fact that there were all of these budget personnel cutbacks in the 1970's that made it impossible in many ways for Marshall to hire scientists? Or was it a conscious philosophy?

43. LUNDQUIST: In my thoughts, it was a conscious philosophy. I had seen a fair amount of both. In my role at SAO, I had quite a few dealings with Goddard too, as well as Marshall. So from an outsider point of view, I could see both options or had had experience with both options. I felt that the right way to do it was to make use of the

nation's academic capabilities and not try to pull people out of it and concentrate them at a NASA center.

44. WARING: Let's turn to materials processing and material science. Can you give me a brief history of material processing in space?

45. LUNDQUIST: Okay, I can try. During the early Apollo missions there were some people at Marshall, by the way of Wincher [329?], Matt Siebolt, and a few others, who recognized that the absence ... the Apollo program, these forward-looking people defined some simple exploratory experiments. Now those...[tape is interrupted by public announcement system]. [Describes Bob Naumann's book on subject]

Then during Skylab, a very useful exploratory... a lot of material things done on Skylab and that is well described in here. Then sometime after I got to Marshall, Marshall made a decision that they wanted to have a division level organization devoted to material processing in space. To establish a division for material processing in space which I did.

46. WARING: Do you remember what date that was? 1974 or 75?

47. LUNDQUIST: Somewhere along in there I guess. You could follow through the organizational charts, you must have an annual version of those somewhere out there. I twisted Bob Naumann's arm to change fields a little bit and be the head of that division. He had previously been the head of the physics and astrophysics division. So I convinced him to make a career change to move into materials. I don't know whether he is happy that I did that to him or not. So thereafter he headed that division, built it up.

48. WARING: What sort of things were done? What sort of experiments were carried on?

49. LUNDQUIST: Well, the best place to get that is in this book. This is a book that Naumann did for viewing all of this early stuff. It is very well done in here. It is as good a source as I could find for you. If I were going to try to cover some of this I would go and look it up myself rather than rely on my memory.

50. WARING: Very good. Would you say that Marshall had a major role in materials processing in space?

51. LUNDQUIST: Oh yes, Marshall had the lead role in those days. During the Carter administration, Carter came in with rather a negative point of view, at least in his oral statements about civil servants in general and the government. It was during that period that, between Carter and the Congress, the salaries all got stacked so that in about 1980, all the positions under the political appointees, there were a few political appointees at NASA that had a higher salary, but then the top civil service people, the Center Directors, the people reporting to the center directors, the program managers at NASA headquarters, the lab directors of the center, the division directors, the branch chiefs and even some of the individual engineers, all got identical salaries. Absolutely no salary, everything was at the top. Congress had put a lid on civil service salaries. Carter had agreed to that. So, everybody was stacked at the same salary, from the people just under the administrator all the way down to individual engineers in the lab like mine. So I got the same salary as my division chiefs, my branch chiefs, some of my engineers, my boss, his boss, his boss... So there was understandably some morale problems. On top of that there was the instigation by Carter of the Senior Executive Service Program, which a lot of us got moved into. We had then, a very rigid set of performance criteria that we had to agree to, or negotiate with our boss. Each year we would negotiate. It was during the period when Carter's objectives were more on social programs than doing space projects, so that a large part of our goals that we agreed to were things like, affirmative action plans, OSHA, and all kinds of other

social things that had nothing to do with building workable space projects. Just between you and me, I would say if you want to ask people why the space telescope never happened it was because the managers interest was diverted to all these other things that were being required of them. That is what they were being graded on. They weren't being graded on whether they were making a good mirror or not. They were being graded on how many minorities they brought in, how they handled the safety problems, small businesses and all these other things that were being layered on top of NASA, and they all got written into people's performance appraisal documents. So since that was what they were being graded on that is what they paid attention to. That combined with everybody's salary being the same. It was a rather demoralized time. The space shuttle had long delays, so they had been a long period in there before 1981, when the first shuttle flew, when budgets were in terrible shape because NASA was taking all of its available money and putting it into the shuttle. That's the time when Marshall, for instance, lost a great deal of what it had, when say, you asked about material science. We had contracts with UAH. WE had people like Honas Walter [?471] and Otto here and elsewhere at other universities. The funding just dried up to keep those teams alive.

52. WARING: In Carter years?

53. LUNDQUIST: To keep those teams alive that had been built up in academia, to go back to Marshall's willingness to use academia, but we just couldn't fund them anymore. So Gunter Otto and Honas Walter for instance out of UAH (same thing happened at other universities) went back to Germany or back to Europe, and they are now the leaders of the material processing activity in Europe. They both wanted to stay here. The monies just went away for keeping them.

54. WARING: During these early years, what was the attitude of industry to materials

processing in space? Were they doing research on their own?

55. LUNDQUIST: Not a great deal. It was still very much a pioneering. "Let's see if it is real or not. Lets try to understand whether it is a genuine opportunity or not. Understand what it is and those sort of things."

56. WARING: Can you give me an overall evaluation of the research despite the funding obstacles, what were the important achievements of materials processing during those years?

57. LUNDQUIST: Well, between Skylab and a little bit on Apollo/Soyuz and the beginning of the Shuttle, nothing happened. Well, I guess that is a little unfair. There was the SPAR rockets. Marshall, in order to have something happen, had a set of suborbital sounding rockets. Some things got done there, but it was pretty limited. The KC-135 flights were instigated. The Drop tube and Drop tower. We did what we could in order to keep the program going. But when the shuttle was two or three years late for its first flight, we had to try to bridge that gap and keep things alive and going, despite there not being much money to do it.

58. WARING: So a lot of these, the SPAR rockets and the drop tubes were really stopgap measures, do you think?

59. LUNDQUIST: Yes. In fact, it was probably, in retrospect, it was probably unwise to stop the SPAR rockets. They had a continuing role in getting equipment checked out and prepared to go on things like the Shuttle. But Marshall for various reasons, elected once the shuttle started flying, to drop the SPAR rockets and continued the KC-135 and the Drop Tower. One of the things that UAH has done is to get the rocket program going

again, realizing there are some things that you can do in the rockets, and in particular you can go to the Shuttle with well developed and proven hardware and not waste the Shuttle flight time by getting their problems worked out on a shuttle flight.

60. WARING: What is the name of the UAH rocket program?

61. LUNDQUIST: Well, we have two rocket programs, described in this, the Consort and the Joust series of rockets.

62. WARING: Were you involved in Space Lab and materials processing experiments?

63. LUNDQUIST: Yes, all that was getting going at Marshall and planning for it in a very active way in the period... I was still at Marshall when the first shuttle flight took place. I think I left after the first or second.

64. WARING: Who would be the best person to talk about materials processing?

65. LUNDQUIST: Bob Naumann. He is now at UAH. He retired a month or two ago and is now Associate Dean of Science and author of this thing. Bob Naumann is by far the world's authority in that area. We were fortunate to get him at UAH. Between the time I started out on that track, he worked very hard and became really the world's leading person in this area.

I might just say though that organizationally, Marshall has never really gotten its act together in the materials area. They made that one effort that I mentioned, it died and then it got...the plan of course was to restart it in a more workable way, but it never got the leadership role it had previously. More of the program went out to places like Lewis and JPL.

66. WARING: Do you think that was just mainly because the top leadership was not as interested in it as big projects like the shuttle or the space telescope?

67. LUNDQUIST: I think they were interested in it, they just didn't know how to handle it. They just blew it. Again, don't quote me on it!

68. WARING: Well, that is a different sort of science project, than these big engineering programs like the Hubble Telescope. Do you think that many people at Marshall are still uncomfortable with those smaller research projects?

69. LUNDQUIST: Some are, some aren't. Part of the problem too, might have been....

70. WARING: Do you think that people in the material sciences lack the clout that astronomers have and lack the clout that engineers working on the shuttle have had in NASA? Do you think that is part of the problem?

71. LUNDQUIST: I don't think that it is so much the clout as it is the materials people have other outlets for their work. The astronomers in some areas have no option but to deal with NASA. So if they are going to do ultraviolet astronomy, or X-ray astronomy, or high precision astronomy all the space telescope, then NASA is the only game in town. Whereas, for the materials people, they can do a lot of things on the ground. So NASA is a long way from being the only game in town.

72. WARING: So rather than investing their career in NASA and it might work out, or it might not, they can just turn to industry or standing university and do a lot of good research.

73. LUNDQUIST: Exactly. So there is that very fundamental difference.

74. WARING: Well, that is very interesting. That is an important thing to recognize.

Many historians, in looking back on some projects, like some of the lunar exploration missions, or Skylab have seen a conflict between scientists and engineers. Often times, NASA tends to prefer these missions that lead to important technological achievements, but they did not design science in from the beginning. Do you think that is a fair assessment?

75. LUNDQUIST: That is a fair assessment. I don't know that it's a criticism. The scientist would in fact have felt uncomfortable if they had been the justification for the Apollo Program, or the justification for the Shuttle. They wouldn't have felt, or didn't feel, that the scientific things to be done could justify that scale of a program. On the other hand, as one piece of a program with multi-legs to stand on, they felt comfortable, because there was important science to be done on the moon, and it was done. But, it was not of itself, important enough to justify the whole Apollo program. That had to be justified on the basis of international prestige and technology development for the good of the nation. A number of the objectives including the science, but not for science alone. That is still the case with Space Station. Space Station can't be justified on the basis of the science to be done. There will be important science done on it and it will be a significant piece of the justification, but it is too big a project to be justified on the science alone. There has to be the technology, the national image, what it does for future capabilities and so forth.

76. WARING: That is a very good point. Do you think NASA has gotten better at building science in from the beginning? Do you think scientists are more influential now? The people who build the space station, do they think that science is there number two

priority?

77. LUNDQUIST: They try. My personal judgement is that they aren't doing it as successfully as they might. I don't quite know why it isn't more successful. The intent and the good will is there to do it. They have every intention of trying to make that go well. They work hard at it. Yet, there is a lack of total success. Some of it just boils down to style.

Let me make one stylistic observation here that really I think is important throughout the whole U.S. space program. Rather than doing an evolutionary program that builds on what you have and takes the next step, the U.S. has done something and then thrown it all away and started over again. Repeatedly. [They] had the Apollo program and then stopped production of the rockets that were very fine rockets and started over again totally, building the shuttle. The same thing is happening to space station. Those of us who were at Marshall during the 1970's, the latter half of the 1970's and later (I wasn't there, but I watched it).... (End of side one 734)

...that some kind of platform would be put in orbit where the Shuttle could come and dock and get power, leave things, astronomical instruments, not haul all of the equipment up and down every time if you wanted a material processing furnace you could leave it there and bring up new samples, and have that kind of an operation; which would be done in an evolutionary way towards a space station. The NASA machinery would just never accept doing it that way. I am still just absolutely flabbergasted that NASA is resisting that kind.

78. WARING: Well, that sounds like a low-tech alternative to a space station.

79. LUNDQUIST: Yes, but it would evolve into a very fine space station. Or let's say Skylab. There was a second Skylab, better than the first one, built. It now is in the

Smithsonian. But it was actually flight-hardware and of course being the second one, was better than the first. In order to do the shuttle program, they wanted to divert all the money into the Shuttle program, they didn't fly the second Skylab. So we had a space station that is in many respects better than what the Soviets now have and maybe better than what we will get with Space Station in the late '90s. We had that in the early '70s and because of this philosophy of stopping things and starting over again on something new, we threw away that whole capability. We have thrown away using the shuttle for what it is good for, hauling up and down.

80. WARING: Why do you think that is? Was it because NASA from the beginning was interested in the dramatic concepts of space and they are always trying to top that?

81. LUNDQUIST: Yes, sort of "The Right Stuff" attitude. I almost at one point a few years decided I would write a book, "The Wrong Stuff" and expose this absolutely wasteful way that NASA has gone about not using an evolutionary program in building on what you have, but throwing away what you have and starting all over again.

To me, that was one of the reasons why when I had an opportunity to get an early retirement out of NASA and start a new career, I did.

82. WARING: It was too frustrating to work for NASA?

83. LUNDQUIST: It was pretty frustrating, yes. It was right after, I left in '81, Reagan had just gotten into office. Turned out that he corrected a lot of things, but it wasn't clear when he came in that he was going to. Carter had gotten things into a total disarray.

The Carter years were just disastrous to the space program.

84. WARING: That's interesting because the way I have been thinking about it for

Marshall anyway, the early '70s were pretty bad. But that is a different perspective.

85. LUNDQUIST: Well, the early 1970's had Skylab, Apollo/Soyuz.

86. WARING: But they had a lot of RIFs and problems.

87. LUNDQUIST: Yes, they had that problem, but nevertheless, they were doing. Whereas during the Carter administration nothing was done to speak of.

88. WARING: Yes, there was a big gap between Skylab and the Shuttle.

89. LUNDQUIST: Right. Those things that could have been done weren't.

90. WARING: Were you involved in any of the satellite projects in the early days?

91. LUNDQUIST: Oh sure. I got my ears wet with that one.

92. WARING: I mean the HEAO's and the...

93. LUNDQUIST: Oh yes. I was on the Tiger Team for instance. Worked some of the HEAO's problems. That was again part of the role of the Space Science Lab.

94. WARING: Who would be the best people to talk with about that stuff?

95. LUNDQUIST: Speer. From the Science side, Tom Parnell would be a good one to talk to in the Space Science Lab. Jerry Fishman would be another. Parnell, particularly was pretty deeply involved in it. Marty Wiseman was involved of course, [he] would be a

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very good one to talk to.