

# Transcript of Proceedings

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Interview with

MR. WYATT

(THIS TRANSCRIPT WAS PREPARED FROM A TAPE RECORDING OF VERY  
POOR QUALITY.)

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Interview with

MR. WYATT

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P R O C E E D I N G S

1  
2 VOICE: You probably weren't involved too much in  
3 the early days which I was not too well informed on in the  
4 evolution, in the coming of von Braun -- you see, he  
5 came to Washington with Abe Silverstein.

6 MR. WYATT: Yes.

7 VOICE: Maybe you want to preface this with your  
8 recollections.

9 What these chaps need now is the Headquarters' per-  
10 spective, you know, down there in this arsenal-minded, very  
11 competent group, well-structured, line channeled, and all that,  
12 and they've had some problems in putting this story together.  
13 As you know, there was funding, and they made the basic deci-  
14 sions where NASA was evolved. (Inaudible.)

15 Maybe you can preface this with what do you think  
16 they would need to appreciate, if you were writing the Saturn  
17 story? Is that a good way to put it, Roger, just to get started?

18 MR. WYATT: Well, if I were writing the Saturn story  
19 I'd probably look for another job -- I mean not Saturn, if I  
20 were writing a story I'd probably look for another job.

21 Seriously, my concern here is I want to be as helpful  
22 as I can. I don't keep journals. Not knowing what you want to  
23 talk about, I have not and probably don't have accessibility --  
24 everything is probably in dead storage that I could refresh my-  
25 self on in any detail.



1 I don't really know how to advise you on what ought  
2 to be included in an approach development of a Saturn history.

3 QUESTION: What was the view Saturn, which brought  
4 about --

5 MR. WYATT: Well, I was going to say from my view,  
6 we had a lot of relevance here that, in a sense, just grewed,  
7 like Topsy, in a sense were very much guided simultaneously --  
8 We had the Saturn I program already underway by ARPA. And I'm  
9 not sure I can recall at this time what ARPA even had in mind  
10 as a potential end use of the --

11 QUESTION: They never (inaudible.)

12 MR. WYATT: No, but they nonetheless had a vehicle.  
13 Well, first stage.

14 QUESTION: (Inaudible.)

15 MR. WYATT: So we had that. We did have the capability-  
16 ty represented by the Development Operation Division at Hunts-  
17 ville, at the arsenal, that had produced the Redstones and  
18 Jupiters and whatnot. I was not on the NACA survey team that  
19 looked at Marshall for potential incorporation. I was on a West  
20 Coast team that looked at JPL and China Lake and Point Magob. <sup>Mugu</sup>

21 QUESTION: The whole country was surveyed.

22 MR. WYATT: And White Sands. There was another team  
23 that looked at Fort Monmouth and several on the East Coast, in-  
24 cluding von Braun's teams. So I can't speak to that. This was  
done in the summer, August of '58, before NASA formally was  
organized.



1 But I do know the recommendations at that time.  
2 There were two recommendations that were adopted: One is that  
3 the Army contract with JPL ought to be transferred to NASA, and  
4 we ought to acquire basically JPL as a laboratory. The second  
5 recommendation was that the Development Operation Division that  
6 Wernher operated ought to be transferred to Huntsville. Of  
7 course, this was resisted in that period, as I'm sure you're  
8 very well aware. It was resisted by Medaris and the Army be-  
9 cause they still had visions of being a missile power in the  
10 total force structure, so they said no thank you in 1958. And  
11 then in 1959 they lost the interservice roles and missions  
12 battle with the Air Force, and it was decided that the Air Force  
13 would be responsible for all missiles.

14 So in the fall of '59, as I recall, they came back  
15 to NASA and said, "Hey, would you still be interested in ac-  
16 quiring Dr. von Braun because it looks like we are not going to  
17 be able to justify really keeping him for the Army. There is  
18 not going to be a missile role for the Army."

19 And then I was involved in one of the teams that  
20 went down the range for the physical transfer of DOD to NASA in  
21 that period, from then until the summer of 1960.

22 QUESTION: Could you go into a little bit some of the  
23 problems you faced during that period, some of the considera-  
24 tions that might have come up, long-range planning?

25 MR. WYATT: Well, I wasn't in long-range planning at  
that time. I was still over in Abe's Development Division.



1 QUESTION: The Silverstein committee on upper stages  
2 were you in on that at all?

3 MR. WYATT: No, I wasn't a participant in that.  
4 My involvement was more with the mechanics, who, how many, what  
5 kind were going to be involved in the transfer, what physical  
6 facilities at the Redstone site would be part of the transfer,  
7 what wouldn't.

8 I frankly just offhand don't remember really any  
9 noteworthy things. We went down and tried to determine -- you  
10 see, I was at that time trying to organize for Abe a program  
11 control for the whole program, and that's the way I got in-  
12 volved here -- okay, what are the numbers and the kinds and  
13 the costs that we're going to get associated with, not from  
14 strictly the administrative side. That was handled by Al Secret  
15 and people from the Administration.

16 I don't recall any terribly noteworthy things. I can  
17 recall one thing, and frankly I wouldn't mind telling you but  
18 I'm not sure I'd even want it on the tape.

19 I think that experience showed that von Braun did have  
20 a team down there that had reasonable to good management. I  
21 don't know how much of it was Wernher's personal involvement,  
22 or how much of it was Eberhart Reese, and Harry Gorman. I don't  
23 remember whether Harry Gorman was there at the time. At any  
24 rate, it did turn out that they had sort of the internal  
25 management capabilities, I think.



1           We acquired this asset of people, and this, what I  
2 guess I could fairly say was at that time maybe a dubious  
3 asset of the S-I stage, not knowing, of course, at that time,  
4 what the S-I stage would be used for.

5           We had some problems, or had had some problems any-  
6 how, in technical crossing of the minds between Silverstein  
7 and von Braun in earlier meetings in his department. Abe had,  
8 of course, pushed and we had put into development the F-1  
9 engine back in January of 1959 without any mission, but based  
10 on parametric studies that said something like a million-and-a-  
11 half pounds, looked like it would be very useful either singly  
12 or in combination.

13           Wernher seemed to always operate -- when I say Wernher  
14 I'm talking about Huntsville -- seemed to operate on the  
15 philosophy that let's do it with things we know something about,  
16 so you know if you have to cluster eight engines, cluster eight  
17 engines; if, God forbid, it should be twenty engines, cluster  
18 twenty engines, but don't develop a whole new engine to replace  
19 pieces of them. There had already been some crossing of tech-  
20 nical viewpoints even on the configuration of the S-I stage.  
21 Abe felt they should go for some bigger engines, and fewer of  
22 them, and von Braun felt that, no, we know this engine very  
23 well and we should stay with this engine.

24           QUESTION: Even clustering was controversial, though,  
25 wasn't it?



1 MR. WYATT: Well, clustering was controversial, as  
2 I say --

3 QUESTION: Why did they have such high confidence  
4 in it? I never could understand that.

5 MR. WYATT: I think their confidence was that they  
6 could control the bird so that they wouldn't release until they  
7 had X number of engines, say one engine out as a maximum, be-  
8 fore they'd ever release it.

9 QUESTION: Do you think they knew the Russian work at  
10 this time?

11 MR. WYATT: As far as I know, I have no reason to  
12 believe that they did. Now, I don't know whether they did or  
13 not, but I have no reason to believe that --

14 QUESTION: You didn't know --

15 MR. WYATT: No, I know the Russian booster was a  
16 big surprise, I think to most everybody, when it was finally  
17 revealed.

18 QUESTION: Everybody expected, though, that they  
19 had some sort --

20 MR. WYATT: Yes. Really what it represented was a  
21 philosophy. I think one could say their philosophy was stay  
22 with pieces, components that we know, and even if they get  
23 pretty complicated in the aggregate if we can handle them --  
24 and basically we can handle them because we don't have to re-  
25 lease until we know they're firing, and once they're firing the



1 odds of them cutting just intermittently is pretty low, so they  
2 felt they were on fairly safe grounds.

3 I think Abe more represented the other viewpoint,  
4 say that's an awfully untidy technical way of going about a  
5 solution, build yourself a big engine, and replace all these  
6 small engines. That was the philosophy that led to the F-1.  
7 I don't know how we'd use it but sometime we're going to need  
8 thrust in the order of one-and-a-half or multiples of one-and-a-  
9 half million pounds, and we'd do better to have it in one  
10 chamber than trying to make it up out of 300,000-pound chambers.

11 So we had had that kind of a technical conflict. We  
12 did have the F-1 engine under development, and we had this S-I  
13 stage, but you know it wasn't obvious. As you say, it wasn't  
14 a vehicle, it was a stage. It wasn't obvious just what it should  
15 be used for.

16 QUESTION: How tense was this?

17 MR. WYATT: I wouldn't describe it as tense. It  
18 represented two differing philosophies. Abe was never one to --

19 QUESTION: (Inaudible.)

20 MR. WYATT: Knowing Abe as I did, I don't think there  
21 was anything personal about it.

22 QUESTION: He could be very antagonizing.

23 MR. WYATT: Well, he could be very abrasive because  
24 Abe is one of those people that is very intolerant of incompe-  
25 tence, mediocrity, or lack of thinking something out. I've



1 worked with Abe for many years. I knew what his position was.  
2 No matter how good a thing you brought in and said, "Here is  
3 what we ought to do," Abe would always say, "Go back and think  
4 about it, and you will find the fourth generation is probably  
5 going to be not only different but a heck of a lot better.  
6 But this looks all right, but there is probably going to be  
7 some better way, if you go back and think about it again and  
8 again and again; you can refine this in your mind."

9           And Abe always tended to be relatively intolerant  
10 of people who said there's only one way to do it. What he said  
11 was, "You've only thought of one way. You haven't thought your  
12 problem through."

13           So he has this kind of abrasive thing but I don't  
14 think it was attached to any personal -- in fact, I know that  
15 Abe personally admired what Wernher as a team leader was able  
16 to accomplish, because at that time we were in the throes of  
17 using the Redstones and the Jupiters, and I know Abe indicated,  
18 you know, you had to give them credit, that they made something.  
19 But philosophically he didn't necessarily agree that they were  
20 on the right engineering track when it came to complexity.

21           I don't know what more -- the thing turned around,  
22 of course, until Apollo became a project and we began to try  
23 to detail what the hell Saturn really was.

24           QUESTION: Is that where you got into costing?

25           MR. WYATT: Well, we got into it -- Initially we



1 didn't try to cost down really to the detail level. We had been  
2 costing on the whole project concepts with just sort of repre-  
3 sentative -- if you had an engine or if you had a stage or  
4 booster that looked about thus and so it would take about thus  
5 and such to develop it. But this was before we had nailed down  
6 whether we were talking about an S-II, an S-III, an S-V, an S-VI,  
7 an S-VIII, you know, in terms of number of engines. We didn't  
8 know. At one point it looked like we might want to go to as  
9 much as 12 million pounds of take-off thrust, as one possibility.  
10 And here again, I think, as I recall, there was some technical  
11 disagreement about whether or not we should really incorporate  
12 hydrogen in the upper stages. Abe felt very strongly that we  
13 should although we had never flown any hydrogen stage, obviously.  
14 He felt very much that we should because it would result in a  
15 lower thrust and lower complexity for the take-off stage. And  
16 I believe, although I'm not positive of this, that again the  
17 Huntsville team tended to lean toward let's stay with the RP's  
18 or fuels that we were familiar with and accept penalty in terms  
19 of a larger first stage, more compact.

20 QUESTION: said Abe pretty much strong-armed  
21 the NASA committee on the upper stages.

22 MR. WYATT: What?

23 QUESTION: Abe pretty well strong-armed the rest of  
24 the committee in NASA in December of '59 on the liquid hydrogen.

25 MR. WYATT: I know he felt very strongly that that's



1 the direction we must go, and part of it was just again techni-  
2 cal neatness, so to speak, but part of it was resulting reduc-  
3 tion in complexity of the lower stages. Why go around incorpora-  
4 ting engines that you didn't really need, to make it a more com-  
5 plex first stage, in order to fly a lower ISP second stage.

6 QUESTION: Do you remember any specific instances of  
7 opposition towards using high energy upper stages from the  
8 Huntsville group?

9 MR. WYATT: No, I couldn't cite any specifics, but I  
10 do recall that sort of in keeping with this general feeling that  
11 you stay with what you know something about, that they were not  
12 at all sure that we were ready to commit ourselves to an upper  
13 stages that had to be hydrogen.

14 QUESTION: The first Apollo was the second  
15 would have used the Saturn I.

16 MR. WYATT: Well, when you say the first Apollo --

17 QUESTION: The second lunar --

18 MR. WYATT: We used the word "Apollo," but I differ-  
19 entiate between Apollo as a concept and Apollo as a mission. We  
20 had been looking as an outgrowth of Mercury -- Gemini didn't  
21 exist at this time -- as an outgrowth of Mercury, what were the  
22 next steps that one would do in the manned flight area, and it  
23 did seem rather obvious that you wouldn't just try to fly more  
24 and more around the earth, but the next thing was to go up and  
25 fly around the moon. And it had been studied in that form, and  
it resulted in not too unreasonable a booster requirement, if



1 you wanted to simply do that.

2 QUESTION: (Inaudible.)

3 MR. WYATT: Yes, I guess it was in the fall of '59,  
4 wasn't it, that Don --

5 QUESTION: Is that right, lost  
6 the launch vehicles.

7 QUESTION: Silverstein had everything, all programs.

8 MR. WYATT: He had all programs there.

9 QUESTION: And NASA opened up the doors, and I guess  
10 the Office of Launch Vehicles was the first major delineation  
11 from Abe's --

12 MR. WYATT: That was the first major split, was to  
13 separate the launch vehicles from the missions themselves. It  
14 was originally Space Flight Development. I forget what they  
15 called it when they made that split. There was launch vehicles  
16 and then there was --

17 QUESTION: George Low was the whole Office of Manned  
18 Space Flight.

19 MR. WYATT: Yes.

20 QUESTION: Until John Discher came in to help with  
21 the planning phase. I believe that was mid-1959.

22 MR. WYATT: That's right, he was the whole office.

23 QUESTION: Well, we don't want to test your memory  
24 here. Where next do you come into this Saturn story then?



1 MR. WYATT: Well, the next thing that I remember,  
2 as a really concrete thing on the Saturn story, is that as we  
3 developed the concept for Apollo, and knew that we were going  
4 to have to have something like a Saturn V, or a Saturn V by that  
5 point, for the actual landing on the moon, and therefore we had  
6 to have an S-II and an S-IV-B stage, we were already then  
7 committed to an S-IV stage for the Saturn I, and the one thing  
8 that I can remember -- and I couldn't give you the exact date  
9 on this -- but there was a presentation to Glennan in which  
10 Ostrander and the Marshall people came up and said we really  
11 ought to introduce the S-IB into the series, that the S-I  
12 wouldn't hack it for earth orbital missions, really, and that  
13 we ought to go into this S-IB, both to give earth orbital  
14 capability before you could have the whole S-V vehicle, and  
15 also to give, very importantly, some flight experience on this  
16 hydrogen stage, this S-IV-B stage. That's a way to get some  
17 flight experience before we get the commitment of the whole  
18 Saturn V vehicle.

19 And they presented the rationale, and the thing I  
20 recall is that they presented their funding estimates sort of  
21 along this line, that they said we've already got the S-IV-B  
22 under contract, so basically that doesn't cost us anything; we've  
23 already got the S-I under development, so basically that doesn't  
24 cost us anything. Now, we know there are going to have to be  
25 some mods to the S-I in order to accommodate the S-IV-B, some



1 structural mod, and this sort of thing, and they estimated --  
2 I'm not sure of the number of vehicles, but I think it was of  
3 the order of eight or ten Saturn I-B launch vehicles could be  
4 had in the program for something like \$110 million or \$120  
5 million, over and above the development of the S-IV- B stage and  
6 the S-I stage, both of which were already underway. So for an  
7 incremental cost of about \$110 million or \$120 million, they said  
8 we could have -- I'm not sure if it was 12 S-IB, but some num-  
9 ber.

10 And in those days, they were already beginning to  
11 raise questions about the validity of some of the cost projec-  
12 tions because, although we weren't that far into the program,  
13 we were far enough in a lot of projects to know that initial  
14 cost estimates tend to be pretty low, but we didn't have any  
15 real developed experience to go back and say where. But I  
16 recall this because it turned out, of course, we spent almost  
17 \$900 million on the development that is allocated as R&D costs  
18 for the Saturn IB vehicles that we bought over and above the  
19 development of this IV-B stage and the S-I.

20 QUESTION: About that time period, Mercury was part of  
21 the funding --

22 MR. WYATT: Well, Mercury was beginning --

23 QUESTION: I mean as far as your estimate --

24 MR. WYATT: Yes, except Mercury never really got  
25 that far out of line. The original funding estimates for the



1 spacecraft contract were about \$30 million. That's the basis  
2 on which we projected the cost at the time we got the contract  
3 that was the Government's estimate -- and that came out to be  
4 something like \$120 million. So you know, by factor, we had a  
5 factor of four, but it didn't -- it was beginning to creep up;  
6 we knew it was going up. It was later on, after the Gemini  
7 program, that we really began to realize the magnifying factor  
8 that we were going to put in some of these cost estimates, but  
9 that came later.

10 QUESTION: You talked about this increase of around  
11 \$100 million to around \$900 million. Do you remember some of  
12 the factors involved? Was it a general thing that you tended  
13 to underestimate, or were there a lot of problems?

14 MR. WYATT: I think there were just a whole bunch of  
15 things. I know Wernher has quoted as saying, in some context  
16 at some time, that when he came into NASA he in essence knew  
17 how to go to the moon, but he didn't know what a billion dollars  
18 was. That's about it. Everybody was naive as hell about how  
19 much effort it took and why costs ran. I can tell you some of  
20 the problems that we had that we know were not strictly techni-  
21 cal problems at all.

22 We made cost estimates on what has subsequently  
23 turned out to be a very naive viewpoint, and that is that you  
24 could break the overall task down into component tasks, and  
25 that you could develop this component, and then from a costing



1 viewpoint you said, okay, it's developed, it's accepted here,   
2 there's no more cost on that contract; when in fact what we   
3 find out is that we don't have confidence, and this is de-   
4 livered, say, three years before flight, we've got to keep that   
5 team on, or at least elements of that team on, until we   
6 actually use it, because if anything goes wrong three years   
7 hence we've got to have the people available who designed and   
8 developed and built it. And so instead of your costs running   
9 to zero, they stay up at a very substantial level.

10 Now you multiply this through hundreds or thousands   
11 of contractors, and it's easy to see where, just the recogni-   
12 tion -- not the recognition -- the reality of this as compared   
13 with the concept that this guy is through development at this   
14 point and therefore I have no further costs, contributes to a   
15 very large measure to these kinds of costs. And there were,   
16 of course, technical problems you ran into.

17 But from my viewpoint, as much as anything, it was   
18 just simply we didn't appreciate that you're dealing now with   
19 essentially a captive industry or, at least within a company,   
20 a captive division. It has to be set up wholly for your pur-   
21 poses because they are far beyond the normal commercial channels;   
22 you can't just throw something into a commercial line and cull   
23 it out. So you have to have them set up anything from an S&ID   
24 division, like North American did, to whole divisions or what-   
25 ever you call them within Rocketdyne, just to do ourself, and



1 we're the only customer. And you know instead of going down  
2 to the grocery store and saying I can buy a can of peas for 27  
3 cents, you suddenly realize that I own the grocery store and  
4 I'm the only customer at the grocery store, and therefore I've  
5 got to pay for the cost of keeping that grocery store, and it's  
6 not 27 cents a can anymore; it's whatever the more I buy the  
7 less it costs me, but it's going to cost me the salary of the  
8 clerks and everything else, whether I buy or not. That's the  
9 thing you run into, you see. And that's the situation. You're  
10 dealing with industry subsegments here that are peculiarly  
11 tailored and don't in general have any other business that they  
12 can go to when you're not using them, so you pay them when  
13 you're not using them.

14 Now, what you do is give them other tasks to do. You  
15 make work, not just for the sake of making work, but you keep  
16 assigning them tasks, so it's not that they sit on their hands,  
17 but the net result is that the draw down from the Treasury at  
18 the end of five years is a hell of a lot more than you thought  
19 it was when you said, "I ought to be able to buy this piece  
20 for this amount of dollars, and I ought to be able to buy this  
21 piece for this amount of dollars, including development."

22 QUESTION: That's where that lunar exploration work  
23 came in, the '67 period.

24 MR. WYATT: What do you mean by lunar exploration?

25 QUESTION: The rover, the land rover --



1 MR. WYATT: No, I don't think that was put in quite  
2 for that reason. That was put in because we were sort of  
3 looking at that time, that obviously you wouldn't go to the moon  
4 once or twice or three times. We saw it as an indefinitely  
5 continuing program, but again not one in which you would touch  
6 down and come back but one in which you would build up your  
7 capabilities, not only with the kind of roving vehicle we have  
8 now, but you would build up in a Mark 2, Mark 3 version, so you  
9 could stay not three days but a week, and eventually two weeks,  
10 and this sort of thing, and then because you're going to stay  
11 two weeks, now you've got time to go very extensively, there-  
12 fore you need a vehicle that can take you a long ways.

13 We built from a programmatic concept, not from  
14 just what do you do to keep these guys busy. It's very hard  
15 to ever put your finger on what it is you are doing to keep the  
16 guys busy, versus what are you doing because you have a  
17 legitimate program desire, because these things will always  
18 merge back together. And you say, well, I know they are going  
19 to be capable in the design shop of putting some time, let's  
20 have them work on this; I think this is something we'll want;  
21 whereas if you are really cutting costs and could afford to do  
22 it, you'd simply say, "Well, I don't need them in the design  
23 shop; you find somebody else to pay them; I'm not going to pay  
24 them," and get them off the payroll. But we found we couldn't  
25 quite do that. So you've got to pay them, so you look and it



1 kind of merges and it's very difficult to say make work, versus  
2 legitimate program plans.

3 But this is, I think, the best explanation I have  
4 as to why we ran into these very notorious cost overruns, not  
5 only in manned flight but in everything else.

6 QUESTION: (Inaudible.)

7 MR. WYATT: Yes, I was in the budget control business  
8 from the spring or summer of '61 on, about April of '61, I  
9 guess. But I don't recall -- you'll have to refresh me here --  
10 I don't recall any terribly traumatic --

11 QUESTION: Well, Kennedy said, "Well, what do you  
12 mean by a space ? I thought we were just going to land  
13 a man on the moon," and the idea of one flight was expressed  
14 to him.

15 MR. WYATT: I'll tell you my recollections on that.  
16 In the summer of '61 --

17 QUESTION: The budget still had some years to peak.

18 MR. WYATT: Oh, yes. I don't exactly place this,  
19 but let me tell you. In the summer of '61 I was one of two  
20 or three people that went over to Jim Webb when he gave one of  
21 these lengthy interviews at Business Week. I still get Business  
22 Week complimentary as a result because I was over there.

23 Questions were raised in this interview about, is  
24 this a stunt? What's the real value of landing on the moon?  
25 But if you go back and read that issue, which appeared sometime



1 in the summer of '61, I think you'll find very clearly that  
2 Jim had in mind very strongly, first, that we were really  
3 attempting to build a long-term large capability. This was  
4 the underlying purpose. And secondly, that insofar as a race  
5 with the USSR was concerned, he didn't view it as a technologi-  
6 cal race per se; he viewed it as a societal organization race.  
7 He said we have something here that is so difficult that they  
8 can't pull it off the shelf and do it. They're going to have  
9 to develop the equivalent kinds of systems that we have, and  
10 therefore we, in a sense, have a chance, where we're not  
11 starting clear -- they're not clear out of the shops yet, they  
12 may or may not be ahead of us, but when you get down to the  
13 elements they've got to do this terrific organizational task,  
14 because it's a big job, and he said what really is at play then  
15 is: Can the democratic capitalistic system of the United  
16 States organize and produce itself better than the Communist  
17 society? He said, I think we can; I think that's the real  
18 test that we're testing here, which society can organize the  
19 total range of resources that are required to pull off this  
20 job.

21 QUESTION: I suspect this was after Kennedy shook  
22 Webb --

23 MR. WYATT: This was in the summer of '61.

24 QUESTION: He started his open campaign. He started  
25 from scratch on this.



1 MR. WYATT: Yes.

2 QUESTION: When he took the job he said he wouldn't  
3 take it unless he were free to fight for the program. He  
4 started out with this but he --

5 MR. WYATT: You know internally Jim used to get  
6 boiling mad. As being responsible for the budget, I was also  
7 responsible for the books we had for the Congress, the Congres-  
8 sional books, and I don't remember what period this was but it  
9 was about '64, I would guess, maybe '63. The write-up on the  
10 Apollo program started off something to the effect that the  
11 objective of Apollo was to land a man on the moon and return  
12 him safely to earth, and we had the thing all ready to go up to  
13 the Hill and Jim took a quick look -- and that was the first  
14 chapter of the Apollo program -- and he hit the ceiling. He  
15 said, "That is not the objective of the Apollo program. The  
16 objective of the Apollo program is to build a capability and  
17 to demonstrate it by landing men on the moon," and we had to pull  
18 the damn books back and rush and rewrite and reprint and  
19 everything else. And he was livid because he said, "Haven't  
20 these guys, don't they understand yet what the purpose of this  
21 program is? It is not to land man on the moon." And as far  
22 as I know, Jim felt this, right from the summer of '61 on.  
23 There was never any question in Jim's mind -- I'm not sure when  
24 and to some elements whether yet it has penetrated throughout  
25 the manned space flight organization that there really is a



1 difference, you know.

2 QUESTION: It got around to the  
3 We certainly got hooked on it, and are suffering because of it.

4 MR. WYATT: Yes. But he was very, very clear on this  
5 point, in his mind, and he thought he was articulating. This  
6 is why he got exasperated and said, "Don't these guys under-  
7 stand yet?" "Yet," meaning we were three or four years into  
8 the program, something like that.

9 Now, you mentioned when the Budget Bureau began to --  
10 that doesn't ring a bell with me. The thing that rings a bell:  
11 In the 1963-64 period, Margaret Chase Smith asked -- we had  
12 talked about this program will cost in the range of \$20 billion  
13 to \$40 billion. Incidentally, my recollection is very clear  
14 on that one. That first started with Keith Glennan, not with  
15 Jim Webb. Some of the presentations that George Low made to  
16 Keith Glennan and George Kistiakowsky, in the waning days of  
17 1960 on the Apollo concept of a circumlunar flight as perhaps the  
18 next step that we ought to undertake in manned flight. So you  
19 have got to remember that we were fighting to get some recog-  
20 nition in the budget, the last budget submitted by Eisenhower,  
21 in January of '61 -- that would be the '62 budget -- that  
22 there would be some program beyond Mercury, and it was finally  
23 decided at the Eisenhower Administration level, that no, there  
24 would not be any commitment to any program until we had accom-  
25 plished the Mercury objective, is the way I think it roughly



1 came out. But we had been pushing, that this was the time,  
2 from a timing viewpoint, that we had to look to what we are  
3 going to do next. And in about November or December of 1960, I  
4 remember George making a presentation to Glennan and George  
5 Kistiakowsky on concepts for lunar exploration, and cost esti-  
6 mates -- I forget who was estimating this -- as I recall some-  
7 thing like the order of \$9 billion to \$10 billion, and I  
8 remember Keith Glennan sort of snorthing and saying, " Well, I  
9 haven't been in this business very long, but I've been in it  
10 enough to know if you say 9 to 10 billion, it's going to run 20  
11 to 40 billion; I know that." And that's the first time this  
12 20 to 40 billion phrase was used, to my knowledge, and then it  
13 was picked up in the President's speech, and we had an awful  
14 time, never did really satisfactorily figure out, where did  
15 the President use it, whether he was talking about our cost  
16 estimates for the whole program for the whole decade. One of  
17 Abe Hyatt's layout indicated something in the 30 billion range.  
18 Is that what he was talking about or what was he talking about?  
19 At any rate, he used the phrase that this would cost us up in  
20 the 30's, as I recall, \$30 billion.

21 Webb, of course, was pretty astute, and when we did  
22 the first cost analysis of the whole Apollo program in the  
23 summer of 1961, Lemming ran a study, we came up on the order of  
24 something like 11 or 12 billion, and Jim said, "Look, I've got  
25 to apply a discount; I don't know what it's going to cost, but



1 I know it's going to cost something more than that and I think  
2 we probably better talk in the range of 20 to 40 billion. That  
3 number has been used."

4 He used it, and then gradually he got around to the  
5 point of saying it's going to be on the low side; it will be  
6 closer to 20 than to 40. And in 1963 or '64 -- I don't remember  
7 the exact date -- Margaret Chase Smith said -- I'm giving you  
8 a little backup if you can use this -- "What will go into the  
9 \$20 billion?"

10 We had a hell of a time -- my office did it -- trying  
11 to back up the \$20 billion. We added up all the estimates that  
12 we had at that time, and they didn't come to \$20 billion. So  
13 we began to throw in everything that we thought could be iden-  
14 tified as part of the manned Apollo program, as we threw in  
15 OSO's because we were going to have to know whether or not  
16 there were sun spots flaring, and therefore we said we could  
17 really write that off as contributory. We threw in Ranger  
18 Surveyor, and I don't remember whether Orbiter was in the pro-  
19 gram. But anyway, whatever was in the program at that time, we  
20 threw that all in as, well, this obviously contributes. We  
21 threw in all the R&PM estimates for the Manned Flight Center. We  
22 threw in all the construction, not only direct but anything we  
23 could remotely say this will also be used -- we had to do that  
24 to get it up to \$19.7 billion.

25 At that time I think the Apollo itself, as we now



1 think of the Apollo project R&D costs, was --- I don't remember  
2 something like 14.5, 14.7 billion. So we established that this  
3 was. Then she got in the habit every year of saying, "Will  
4 you update your estimates," and of course every year the Apollo  
5 R&D costs kept going up so we kept sort of throwing things out  
6 and said, well, we don't really want to call Mercury -- origi-  
7 nally we had thrown Mercury in, we had thrown Gemini in. We  
8 don't really want to call that part of the Apollo costs. So  
9 then we went through this period of trying to throw things out  
10 and still make it come out around \$20 billion, and do it in a  
11 fashion that didn't look too obvious.

12 But this was the problem. We didn't have any hard  
13 estimates in that period that ran as much as \$20 billion.

14 Then, of course, when the bill finally came through,  
15 Webb's winning days, it was up around \$21.7 billion. Inciden-  
16 tally, I had a knock-down drag-out argument with Jim because I  
17 said we ought to go up with pride and say, so we missed, we  
18 missed by 5 percent. Now, are you going to hang us by our  
19 thumbs because it's going to turn out to be \$21 billion instead  
20 of \$20 billion. I think we ought to take credit for that.  
21 Nobody has ever run a project of this size for 5 percent cost  
22 overrun, and Jim would not hear of that. He said, "No, we've  
23 got to tell them that everything is the fault of Congress for  
24 not appropriating the monies that we requested. You know back  
25 in 1964, that \$600 million they cut." I said, "Jim, we didn't



1 make our initial estimates of what was in the \$20 billion pro-  
2 gram until after Congress had cut that fiscal year '64 money  
3 out, and therefore we cannot say it's your fault that the pro-  
4 gram cost is up because the first cost estimate we really pulled  
5 together for Margaret Chase Smith was after that," and I re-  
6 member Jim turning on me, shaking his finger at me and saying,  
7 "Don't ever tell me what I would have done or wouldn't have  
8 done with that \$600 million." He said, "I say it's the cut" --  
9 and that was the only year that Congress made any appreciable  
10 cut, in that one year -- "I say it's their fault, and that's  
11 the story that we'll carry forth, that the costs are up and  
12 it's too bad."

13 QUESTION: Dryden made a very strong statement.

14 MR. WYATT: Yes. But the only real sizable cut in  
15 the program was in '64, the only year. The rest of them were  
16 more or less token cuts. But Jim had something going, and I  
17 never did understand exactly, but he had something going with  
18 the Hill, that by golly he was going to pin this on the legis-  
19 lature. It wasn't anybody's else's fault. He wouldn't accept  
20 what I thought was a very reasonable position to say, "Let's go  
21 and brag about how we are going to finish it for 5 percent over  
22 estimates," a very reasonable position, and I said cost of  
23 living alone, I can assure you, would result in at least a 5  
24 percent, in fact 10 or 15 percent, over a space of seven or  
25 eight years. No, he wouldn't have any of that.



1 We really had a rather bitter exchange on that one.

2 QUESTION: For Saturn --

3 MR. WYATT: Frankly, on Saturn itself, as a project,  
4 I don't really have too many definite recollections.

5 QUESTION: Do you know something about the cost over-  
6 run on the S-II, for example? Do you have anything to add to that?

7 MR. WYATT: No, it was a combination; of course,  
8 severe technical problems on the installation and on the  
9 welding and all that sort of thing, and also -- and I don't  
10 know that I could prove this conclusively, but I know part of  
11 the costs there is we didn't realize, in our cost estimating,  
12 that we would be buying S&ID. I mean we were 100 percent cus-  
13 tomers, for S&ID, and somebody's got to pay the bill. It seemed  
14 for a long time -- and this is what happened -- if we had had  
15 some post-Apollo activity that we could have fed in at the  
16 right time, we wouldn't have had to increase the number of people  
17 because we could have retained them for use when we flew the  
18 S-II stages. In the meantime we could have given them, say,  
19 space station modules or something like that to build, and  
20 charged them off that way, and that would have reduced markedly  
21 the costs that we ultimately had to charge to the S-II stage.  
22 This is what you get into. It takes some large number of people.  
23 And you can give them other work. We were counting for a long  
24 time on obviously there would be some post-Apollo activities  
25 and they would be picked up in a timely fashion.



1           So all this goes into it. They did actually run into  
2 some very major technological problems, but in my view those  
3 were almost second order when it comes to cost considerations.

4           QUESTION: Anything of interest on Machou--

5           MR. WYATT: No, I don't recall anything about either  
6 one of those that I'm sure you've got available to you in other  
7 forms. I don't recall anything terribly noteworthy about either  
8 of those.

9           QUESTION: You talked about problems with the S-II  
10 in terms of keeping the capability in line. The parallel that  
11 strikes me is Marshall's own inhouse capability, which strikes  
12 me as being a tremendous budgeting saving in all these contracts.

13          MR. WYATT: What do you mean by saving?

14          QUESTION: Maybe I'm not phrasing it right, but  
15 there is a center that is an inhouse facility, and in that case  
16 it's very easy to use it for all kinds of things.

17          MR. WYATT: Oh, you're thinking of actually assembling  
18 or fabricating in place of the contractor, is that what you  
19 mean?

20          QUESTION: Well, possibly.

21          MR. WYATT: Well, they did this, of course, on proto-  
22 type stages, and this sort of thing, although Marshall denies  
23 that they were ever a fabricator arsenal, they said they were  
24 an assembly, they never did fabricate. Yes, this was considered.  
25 But first off, Jim Webb said, "Look, we're never going to carry



1 a program like this through unless it involves all elements of  
2 the country, geographically, and it's got to involve practi-  
3 cally all the major aerospace companies. If we begin to do this  
4 inhouse, any substantial piece of it, we're not going to be  
5 able to carry the support of the country for eight or nine years  
6 and at the cost levels."

7 Now, we did feel that, yes, this could make some  
8 substantial reductions in cost.

9 The second thing, however, is that we were wearing  
10 rose-colored glasses at that time, and we were talking about,  
11 this thing is obviously going to build up to ten, twelve or more  
12 a year, and this was far out of any assembly, test capability that  
13 Marshall had as such. As it turned out, at one or two a year,  
14 yes, I think Marshall probably could have assembled them and  
15 checked out, and we probably could have saved a lot of what  
16 went into prime contract costs.

17 But that's really kind of water over the dam because  
18 I think that Jim was probably right, that you couldn't sustain  
19 support, or really what you'd do is you'd get guys sniping at  
20 your program after a few years if they didn't have a piece of  
21 the action, so you've got to have a piece of the action spread  
22 as widely as you could and across a very broad segment of in-  
23 dustry. That's the only way you're going to keep them from  
24 sniping at you and tearing you down. And that seemed very  
25 sound.



1 QUESTION: This was part of the overall contracting  
2 philosophy, wasn't it, to spread the work around various areas?

3 MR. WYATT: Yes, spread it around over the country,  
4 and involve as many segments of the major industries as you  
5 could. A conscious effort, for example, of bringing companies  
6 like GE in on the support contracts, because Jim wanted GE to  
7 be a part of the action, and not be aloof, and, you know, you don't  
8 really care which way the space program goes because we're not  
9 involved. This way you can bring them in and it was in their  
10 interest to support us.

11 QUESTION: Do you know if that was one of the reasons  
12 why IBM was brought in?

13 MR. WYATT: No, I don't. I have a hunch that IBM  
14 may have been more on straight technical grounds, building this  
15 IU.

16 QUESTION: Fabrication and assembly of the IU.

17 MR. WYATT: Yes.

18 QUESTION: It wasn't particularly their line of work.

19 MR. WYATT: No, but I don't know about  
20 the IU. That's a detail I wouldn't have the slightest idea  
21 about.

22 QUESTION: You mean to Huntsville and getting to him--

23 MR. WYATT: It may have been part of it, that, okay,  
24 here's an opportunity to get them locked in very tightly again  
25 on the whole program so they are intimately involved. I know



1 this was Webb's general philosophy. I think it was very sound.  
2 If you're going to do something like this, you don't just look  
3 at it strictly from what's the cheapest way. You look at what  
4 is the way that's going to sustain us as well as -- incidentally,  
5 not disregarding costs, if you run something like this for  
6 three or four years and then it falls because it doesn't have  
7 support, that's a very costly thing because you end up with  
8 nothing, so you can't really say you are disregarding costs.  
9 It's one way of saying, it's such a complex thing to do that  
10 you've got to look beyond your first order cost estimates in  
11 order to understand what's involved.

12 QUESTION: Do you recall any other particular occa-  
13 sions or instances when Headquarters management, maybe it's  
14 within Headquarters, you know, manned space flight versus --

15 MR. WYATT: No, the only thing I recall that bears  
16 on this -- I'm sure you'll get ample -- is when we had to pull  
17 the Centaur out, because when the management responsibility  
18 shifted from ARPA to Huntsville on the Centaur, Huntsville did  
19 not seem to be very keen about putting their best talents on  
20 Centaur. They wanted to put their best talents, very obviously  
21 on the Saturns. And it finally reached the point where it was  
22 felt a decision had to be made, let's get the Centaur out and  
23 put it into a center that would put its best talent, and Lewis  
24 was the other obvious center. So we had to pull that out. But  
25 that was really the case.



1           You can't say Marshall was disinterested in Centaur,  
2 but their main interest was in Saturn and they were putting all  
3 their best teams together around Saturn, and the feeling was  
4 they weren't -- and again I'm not derogating the individuals  
5 who worked on Centaur, but they weren't given management  
6 support. It wasn't a first-priority task, as far as Headquar-  
7 ters was concerned. That's why it was finally pulled out.

8           Again, Abe still felt that the Centaur by that  
9 point was to be, as I recall it still even on a schedule basis,  
10 showed that it would be the first real demonstration of a hydro-  
11 gen stage, although I don't know, there may have been some  
12 schedules along about that time that said the S-IV-B would be  
13 flying before --

14           QUESTION: That clobbered the space science programs.

15           MR. WYATT: Well, it had a very severe impact on  
16 the vehicles. The thing that was involved there, I think, was  
17 really another factor. The Centaur was also started by ARPA,  
18 and it was also started without too specific an end use, a  
19 little bit like the S-I stage, and they loaded that with a  
20 requirement that it be capable of almost everything, two burns  
21 this and that and everything else. And there was too much re-  
22 quirement for that stage of development, and when we got it,  
23 we were interested in it primarily for the Surveyor and the  
24 Mariner class escape missions, did not have the same require-  
25 ments on it for the synchronous traffic, and I think we suffered



1 because we tried to put too much, too early. Finally we did,  
2 as I recall, simplify --

3 QUESTION: Technical problems --

4 MR. WYATT: Well, technical problems, but these were  
5 compounded by the fact that we had to deal with the problems of  
6 insulating the tanks for the XDX hours, the coasting so we could  
7 relight them up at synchronous altitude and all, and it just made  
8 a hell of a range of problems to load on the vehicle, when the  
9 vehicle was still experimenting on liquid hydrogen.

10 QUESTION: I don't think we'll ever get -- there  
11 ought to be something done.

12 MR. WYATT: Yes, there ought to be something done  
13 there on that Centaur. That was the reason I think -- there  
14 were technical difficulties, but the technical difficulties  
15 need not have been quite as much as they were, but because it  
16 wasn't a clean design goal to start with, it had too many goals  
17 and gradually ARPA kept shifting out -- of course they came in  
18 with the Titan III and they kind of lost interest in Centaur for  
19 their missions, and we were still trying to carry along a Cen-  
20 taur vehicle that in part was designed to meet missions, and they  
21 finally backed out and went over to Titan III to satisfy their  
22 missions, and finally we did simplify the design of the --

23 QUESTION: Centaur II was used by Convair as kind  
24 of a booster thing, or an add-on thing for their Atlas. It was  
25 to bring the Atlas into a new kind of booster system.



1 MR. WYATT: Yes, but I don't think there were any  
2 real, as I recall, terribly great problems that arose because of  
3 that interface. You know the Atlas is still one of the best  
4 vehicles that's ever been designed in terms of structural weight  
5 and everything else, a terribly advanced vehicle, even by  
6 today's standards. I don't recall that that was a direct con-  
7 tributor too much.

8 But the problem as it involves Saturn was that  
9 Marshall just felt that their responsibility was Saturn, they  
10 had inherited the Centaur, they were not going to be the mission  
11 managers for the missions that were going to use Centaur, and  
12 they just didn't seem to feel that it had the priority that  
13 Headquarters thought that it should have.

14 QUESTION: said that Marshall was a  
15 very creative center and didn't like the idea of looking after  
16 somebody else's creative development.

17 MR. WYATT: Oh, I think this is part of it, not in-  
18 vented here. As I say, they inherited it just as a project.  
19 Here's a thing that's pretty well cast in concrete. They are  
20 not unique in that. This is something you run into almost  
21 every center, particularly -- well, I wouldn't single any of  
22 them out. I think they're all guilty of the same thing. If  
23 it's your idea you push it like hell; if it's somebody else's  
24 idea you probably will try to change it until it's your idea  
25 before you push it.



1 QUESTION: That's interesting because even in the  
2 development of the Centaur engine, there was a lot of stuff that  
3 came out of Lewis to begin with -- Silverstein.

4 MR. WYATT: Yes, the engines, and of course the basic  
5 R&D work on hydrogen. But at that time we were still suffering  
6 under the concept that was Hugh Dryden's as much as any, that  
7 we ought to keep a pristine line in order to protect the virgin-  
8 ity of the research centers, and we shouldn't get them involved  
9 in any project development. Otherwise they would put all their  
10 energies on running projects and stop doing research.

11 QUESTION: We're a long way from that now, aren't we?

12 MR. WYATT: Yes. I think it's turned out to be an  
13 experience that has actually been helpful to the centers to have  
14 projects because it gives them a focus for their research, but  
15 Hugh was terribly worried that everybody would desert the re-  
16 search side and want to become project managers, and therefore  
17 the conscious policy of not assigning projects to the research  
18 centers, and this was perhaps a first reversal of that.

19 QUESTION: (Inaudible.)

20 MR. WYATT: I don't recall. I wasn't involved so  
21 I don't recall. The only thing about that is I got to the  
22 point where I thought -- until Bob Seamons -- I thought every-  
23 body ought to be thrown out of court. Finally got into a  
24 hassle about some six or twelve positions, not people; were they  
25 or were they not going to be taken off the Marshall list. In



1 other words, were the positions going to go with the task assign-  
2 ment or was Cleveland going to have to find these within the  
3 complement that they already had. And this was only something  
4 like six or twelve people. And this came up and there was a  
5 hell of a lot of agonizing and negotiation back and forth with  
6 Bob Seamons, and I said, "Look, you ought to throw everybody  
7 out, starting with manned space flight, and Marshall, and  
8 Cleveland." If they can't solve -- Cleveland's got 4,000 people,  
9 Marshall at that point had 4,000 or 5,000 or 6,000 people; if  
10 they can't find six to twelve slots -- and this was when we were  
11 still somewhat growing; I don't think we had reached any major  
12 decline -- if they can't solve that, get yourself another set  
13 of managers. The only answer is, hell, this should never get  
14 to you. It's ridiculous to be worrying at the general manager's  
15 level about whether we should or shouldn't transfer six slots.  
16 I don't recall people though.

17 QUESTION: (Inaudible.)

18 MR. WYATT: I don't know. You'd have to check with  
19 somebody --

20 QUESTION: Was there a political side to sort of  
21 break up the German set that was referred to?

22 MR. WYATT: No, I'm just not aware on that one.

23 QUESTION: Well, we've taken a good hour of your  
24 time.

25 MR. WYATT: All right. I don't really offhand know



1 that I have anything else to contribute, or whether I've con-  
2 tributed anything so far.

3 QUESTION: It's very good.

4 (Whereupon, the interview was concluded.)  
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