ORAL HISTORY 2 TRANSCRIPT

ROBERT C. SEAMANS, JR.
INTERVIEWED BY MICHELLE KELLY
BEVERLY, MASSACHUSETTS – 20 NOVEMBER 1998

The following interview of Dr. Robert Seamans was conducted in Cambridge, Massachusetts by Michelle Kelly on November 20, 1998.

SEAMANS: Okay, we're on the air.

KELLY: Yes, we are. What I'd first like to ask you is, I think, where we left off last time is we discussed the decision to go to the moon and how that decision came about. Can you talk a little bit about some of the committees that you put together, which conducted some studies in order to get to that decision?

SEAMANS: Sure. I'd be happy to. First let me just say that I have a file at home and I tried to collect what I think are the pertinent memos and so on, related to this whole area. One of the subjects I'm still investigating myself is exactly which committees we had and the time sequence of the committees. I'm a little bit vague on it, I'll just tell you at the start.

But there was the Heaton Committee. Donald [H.] Heaton was a colonel in the Air Force. He and somebody named Bill [William A.] Fleming worked directly for me, my assistants, and each one of them headed up a committee. Bill Fleming is, even now…interested in this very same thing we're talking about. I plan to meet with him and with somebody named Al Kelly [phonetic], who's [at MIT, the Massachusetts Institute of Technology], who comes here to work on a part-time basis, because we're all three interested in this subject.

But one of the committees, I think it was the Heaton Committee, had to do with the best way to go to the moon. By "way to go," I mean taking a look at direct ascent, which I think we discussed last time what it means, Earth Orbit Rendezvous. I tried to get the group to take a look at lunar orbit rendezvous, but they really didn't do very much on that subject. I think this is the Heaton Committee, as I've said. It's not that Don Heaton didn't want it to be that way, it's just that nobody in the organization really thought that was the right way to go and didn't want to spend any time on it. This is now in the period, I think, right after [Yuri A.] Gagarin flew, but maybe it carried out beyond when [President John F.] Kennedy went to the Hill. It was right in that period, we were getting information at that time.

We got into such issues as, if you're going to orbit around the Earth and you [have] given-sized vehicles you want to put up about the same amount of weight each time, let's say you used just two launches to do it, then how do you divide up this kluge of stuff so they would have equal weight. The only way you could do it was to split up the fuel, because the fuel is an awful lot of the weight.

That got us into the issues of fueling in orbit. It's a very difficult thing to do in a vacuum and weightless and all kinds of technical issues that came into it. You'd prefer to have the fuel contained in a can, and then you can put it together with other things and connect some hoses and turn it on, as it were, and not have to pump stuff back and forth. That was one of the issues we got into.

The outcome, I'd say, was somewhat inconclusive. As a result of that study, we still had felt, at least as a backup, we had to consider the possibility of going direct. By going direct, it meant that we needed something that was at least twice as big as what we ultimately used. So we're talking about a massive piece of hardware that was called Nova. It is for that reason that we bought as much land as we did down at Merritt Island [Florida]. Merritt Island is just across the—I always forget whether it's the Banana or the Indian River. I think it's the Banana River from Cape Canaveral. We ended up acquiring 85,000 acres of land,

which is a lot of land, for the NASA complex there. A lot of it was never used, because we never did have to build Nova.

The Fleming Committee, I believe, if my recollection is correct, is what I want to investigate, had to do with trying to get some idea of the cost of doing this [mission]. To develop the cost figures, you had to figure out all of the so-called work packages. A work package could be building a launch pad, or a building, or recruiting astronauts, or training astronauts. I think we ended up with something like 10,000 work packages. Then you have to estimate how many man hours of work required on each of them on that basis and come out with some cost figures for [all those] package[s].

Then you have to figure out which ones you can do in parallel and which ones you have to do in series. On that basis, you can figure out not only what the cost is going to be, but how long it's going to take. It's not a name you hear so much today, but it was very fashionable then, so-called PERT [phonetic] charts, where you had the whole thing plotted out. PERT is an acronym for something, I don't know, Performance Evaluation or something like that. I don't know what it stands for. I forget.

As a result of these two studies, and there may have been another one, there was a related one that was not just a NASA study, it was a study to be carried out with the Department of Defense. I think it became known as the Golovin Committee. The purpose of that study was to be sure that [how]ever these boosters were built, that we got maximum benefit out of them, that is, that if NASA developed a booster, that it was configured so that it might take care of a military mission, conversely that the military, in developing boosters, would develop them in such a way that it could be available for NASA.

As it turned out, the study was pretty hypothetical in the main. It also got into risk factors and the probability that these boosters were going to work. We were getting figures like failure rates of 50 percent and numbers like that, which were quite horrifying. But we're very much subject to guesswork, because you had to guess what all the parts, what each

individual part, how reliable it was. Then on that basis you could figure out what the reliability of the whole machine was.

So I didn't take too much stock in that, but at the same time, I had to worry about it, because if it came out that we were risking astronauts at the rate of 50 percent per launch, you can see that would be pretty horrifying from a public relations standpoint. Fortunately, it did not work out that way.

The one outcome of the Golovin Committee was that the Defense Department did go ahead with the so-called Titan booster based on the Titan missile, and that's what we used in Gemini. Gemini was an overgrown Mercury capsule originally called Mercury II. I felt that we had to have a better name than that for it, and used an old trick my boss here, Dr. [C. Stark] Draper, used to use now and then, which is to put up a prize of a bottle of whiskey for whomever came up with the name that was selected. We got some pretty good names. But the name that we picked was Gemini, because the purpose of the Gemini Program was to give us advanced operational training and experience prior to the time we had the Apollo, which was going to be the vehicle to go to the moon.

One of the biggest concerns ultimately when we selected lunar orbit rendezvous was the ability to rendezvous. So, when you rendezvous, there are obviously two objects that are going to rendezvous. Hence, the name Gemini, which is the star formation made up of Caster and Polux, two stars. So it's called the Gemini twins, hence, Gemini the vehicle was going to rendezvous with the Agena, unmanned, hence the terminology.

KELLY: Who won the bottle of whiskey?

SEAMANS: I didn't win it myself. I had to buy a bottle of whiskey. It was worth it; it was a good name. [Laughter] I wasn't smart enough to think of the name.

So out of all of that grew a committee, which I co-chaired with somebody named Brock [Brockway] McMillan. [I believe] it was called the Gemini Review [Board]...It's genesis was a suggestion I made to Jim (James E.) Webb that we provide the DoD (Department of Defense) with an opportunity to fly their experiments on Gemini.] We took a look at the problems with the vehicle and the problems that we were having with the Gemini capsule itself, and the question of whether the Air Force might want some experiments and so on. I'm getting way ahead of my story.

Coming back to the period right around May of '61, we had two issues that had to be faced before Kennedy made his speech. One was how soon could we go to the moon. The other one was how much was it going to cost. I think it's on the record, but just to be sure it is, on the cost side, our PERT investigation came out at, as I remember it, 12 million dollars. Kennedy was aware of this and so on, but Mr. Webb, who had been director of the budget for Harry Truman, knew something about cost figures from experience, hard experience, and he put in what he called an administrator's discount. Now, by that I don't mean he discounted the number. Rather, he discounted our ability to predict the number. So he said, "It's going to be 20 billion dollars." He just about doubled the figure that we had, and that proved to be pretty accurate, actually. It finally came out to be, depending on what you throw in, somewhere in that ballpark, maybe 21 billion or something like that.

The other was time. Going back to—I think I discussed testified before the House and being asked if we could go to the moon in '67, because that was the fiftieth anniversary of the Red Revolution, it might be a time they tried to go to the moon, so some congressman speculated. It did appear to be a reasonable date, and our PERT investigation sort of came out that way partly because, I guess, we made it come out that way. We were trying to see if we could go in '67.

We were horror-stuck, however—and I may have mentioned this before—when Mr. Webb got a call from Ed Sorenson, who was a speech-writer for Kennedy, who said he was

going to send over that part of the President's message to Congress that related to what became Apollo. When we read it, it said that the President would recommend to Congress that we go to the moon in 1967. We just felt that there were so many uncertainties at that time that we as a nation shouldn't—we didn't have to stick our necks out that far, though we knew we had to state what our goal was.

So Sorenson obviously said, "Well, what do you want me to put in, Jim?"

He said, "Well, why don't we put in 'within the decade.'" So that's how the studies at that time tied in with what actually happened and was done.

Do you want me to discuss the LOR [Lunar Orbit Rendezvous] situation or not?

KELLY: Sure, I'd love for you to.

SEAMANS: I'm sure I've already mentioned the fact that I went down to Langley the first week that I was in NASA, September of '60, and met John [C.] Houbolt. Of all the presentations that I had there, his was the least elegant. Some were looking at high-powered machinery and wind tunnels and mock-up of the Mercury capsule. His job was with a couple of guys in a room not much bigger than this one with an easel and a grease pencil. He'd obviously, maybe an hour before I arrived, put some stuff on paper to explain what lunar orbit rendezvous was. Then he explained, himself, what the advantages were.

As I think I already mentioned, it made a lot of sense to me. You could see that the advantages, they're easy to understand. You can get away with a booster that's half the size, which is clearly advantageous. That was the one that at least I was thinking of at the time. There was still another advantage that turned out when it was studied more carefully; namely, that you could design a vehicle specifically for the lunar environment, entirely a vacuum. You don't have to worry about pressure of air or anything like that. One-sixth gravity when you land, it can be much lighter. More specifically, you can design it so that

people can fly it, maneuver it, when it's coming down. You can get much better visibility from it and so on. But as I say, it proved to be very difficult to get people to even think about it.

Are you going to see John Houbolt? Is somebody going to interview him?

KELLY: I'd love to. I really would.

SEAMANS: Well, he's been interviewed quite extensively. He will tell you that he had a lot of difficulty. Even when he was invited to meetings, people would tend to walk out of the room, or they wouldn't listen, or they'd say, "Well, that's just crazy to try to do something as dangerous as that around the moon." It went on that way.

From time to time, say, with the Heaton Committee, I'd say, "Be sure you study lunar orbit rendezvous," and it would come back and it would be something like a paragraph that would define what the role of a rendezvous was, but then it would sort of give it the back of the hand.

I think I received two letters from John. The first one was fairly mild. It said that he hoped that we were still considering lunar orbit rendezvous. I think I wrote back and said, "Oh, yes." But the second one was a pretty stiff letter where he said, "This is not going to be a very polite letter." He said that right at the start. He realized it was not protocol to jump over I don't know how many echelons to write me the letter, but he went on to say that it was just stupid for everybody to be building and considering these great big giant things like Nova, when by a much simpler process, mainly lunar orbit rendezvous, you could much more easily and much more cheaply and much more quickly go to the moon.

I think I've already said, but maybe not, that when I first read it, my hackles went up. I thought, "I'm getting sick of this guy. He's a pest." I thought, "But, you know, I think maybe he's right."

So I would go to the head of the Manned Space Program at that time, Brainerd Holmes, and say, "We really should be considering this carefully." By then he had put together a good organization. Brainerd came from RCA, where he had managed a very large project. He really knew how to run things. Running something in NASA this big was not easy, because you had to pull together three major factions: people at the Cape, the people at Huntsville, and the people at Houston. You had to get them to agree on things and then go do it. But he also had to deal with Goddard, because they were ones who were building the electronic network around the world that was going to permit communication at all times with Apollo. So they were sort of a—they weren't a loose cannon, but that was another element that he had to deal with, if not directly, under his purview.

By the time this whole decision was getting really hot and it had to be made, he had a very good team working with him. The principals were Bob [Dr. Robert R.] Gilruth from the Manned Spacecraft Center, Wernher von Braun from Huntsville, [Alabama], and [Dr.] Kurt [H.] Debus from the Cape. All three groups, particularly Huntsville, which was going to build the launch vehicle, and Houston, which were going to have to do the flying and train the astronauts and had to consider the risks of the astronauts and so on, obviously, involved.

The first ones to come in strongly in favor was the Houston group under Bob Gilruth. I want to come back to that. It's a matter of history. The group at Huntsville were really very antagonistic. They knew launch vehicles. They knew they could build the biggest launch vehicle in the world and then build an even bigger one. Very confident. They had built the V-1 and V-2 and the Jupiter and the Saturn I and so on, or were about to. They had the Saturn I under way.

It would be interesting to know, and I never did talk to Wernher about it, but somewhere along the line, on his own, without the support of the people who worked for him, he said he was for the lunar orbit rendezvous, which was quite shocking to his troops. Now, Wernher is a fascinating study, and the way he ran his center was with what he called

his apostles. I think there were twelve. But whether there were or not makes no difference; he ran it that way. He would come to a meeting and he would throw out the issue and get his people to talk about it. Near the end of the meeting, he'd say, "Here's what we're going to do," and everybody would salute and they'd go do it. But he wouldn't listen. So he wasn't completely Germanic in the way he ran things.

I don't know this, it would be interesting to find out, whether that group of twelve discussed this and agreed on lunar orbit rendezvous or whether he, on this one, just left them all behind. But once he came in and said that's the way it would go, it was decided, because I know by then I felt it was the way to go, suddenly Brainerd was pretty sure that was the way to go. He always wanted to see what people reporting to him felt. Bob Gilruth by then had already come out for it. The people at the Cape didn't carry too large a vote on that one.

Now, we still had a big problem in the White House, but before we get to that—if I'm repeating stuff, you tell me, from last time. There was a very unusual situation came about with regard to a prize for a major contribution. NASA had a fund such that they could give a prize of something like [100],000 dollars for somebody who was responsible for a major important innovation, NASA, and the question was whether or not Houbolt should get it or not. And it was decided he should get part of it. I think he got 10,000 dollars as part of it, but that we should until they knew whether it really worked or not before giving him the whole prize.

Once it worked and a lunar module was built and we went to the moon and everything, questions came up as to whether this was really John's idea or not, and he eventually did not get the full amount, because there were dissenters on the committee. This is an interesting issue. Some of those at Houston felt that John deserved some of the credit, but not the full amount. Even today you could probably get a heated discussion on that subject. I'm not going to say here and now, because I'm really not sure exactly how that

should have come out, because I wasn't involved in the committee decision on that. I don't know all the details.

So where are we?

KELLY: I'd like to ask you one question that refers back to the LOR decision. What was the actual turning point in your opinion of actually deciding to go to the moon through lunar orbit rendezvous?

SEAMANS: I think that the turning point was when Bob Gilruth came in and said it was definitely the way to go. I would suspect that, in part, that Wernher, who was certainly—he had very good sensitivity, politically speaking, realized that that's the way it was going and he wanted to be part of the decision. That may be unfair to Wernher. But, in any event, it was definitely when Bob and the group at what is now the Johnson Space Center decided that was what was best. They decided, as I sort of implied earlier, that it was not just to save on the size of the booster, but it was the ability to build a much better lander.

KELLY: Do you think that technology had anything to do with that decision, or the advancement of the current technology that was around at that time?

SEAMANS: That's a good question. I don't think so. Well, let's see. In one area it certainly did, and that's in the area of ability to rendezvous and dock. That obviously required some radar and some computers and so on. I think that was an important element in the decision. But the element of the design of the spacecraft itself and its ability to maneuver and land, I think that was [thanks to] Mother Nature, just going to be an easier thing to do than to have….a massive heat shield and a lot of heavy things, where it would be very difficult to put

the astronauts in a position where they could actually look down and see the moon. I think that's a very good point. I hadn't thought very much about that.

What we were faced with [was] first [a] consensus [by] Brainerd and his team, and he kept me posted, so I didn't need any briefing or anything. I was involved really in what was going on as it went along. But then obviously there was going to have to be discussion with Dr. [Hugh L.] Dryden and with Mr. Webb, [although I had also kept them reasonably up-to-date.]

Now, you were asking about my relation with Dr. Dryden, anyway, so I might just say a few words about him, then I can explain his view with this. He was a wonderful person. He was highly respected for his own scientific achievements, going back to the Bureau of Standards and later on when he was involved with the NACA and then became the director of the NACA, which had a board that was intimately involved in the running, but the actual day-to-day operation was his responsibility.

He had friends, associates, not only in the United States, but around the world. He was on close terms with many of the people in aerodynamics, aeronautics, and so on, particularly in Great Britain, but also in other European countries. He worked very effectively with his counterpart, who was in the Soviet Union, a person named [Anatoliy Arkadyevich] Blagonravov. [Hugh] was in the National Academy of Sciences. He was the home secretary. He was a real presence. He was a very strong church person. I believe he was a Presbyterian. He was a reader. He took that very seriously. He was not the kind of person who liked to go out with the boys and have a good time. But he was a very, very pleasant person to be with.

He was looked at by the NACA people, who became the focus for all of NASA in the beginning, as their leader. So when this whole matter of this decision came along, the question was, how did the NACA people feel about it. Their spokesman was a guy named Abe Silverstein. When I went down to NASA, Abe was in charge of all of the space

programs, running them out of headquarters. He was a very able guy. He and Hugh Dryden were very close.

Abe Silverstein felt that the lunar orbit rendezvous was a terrible way to go. Again, you talk about motivations. When it was decided that we were going to organize the way we did for going to the moon, it left Abe out. He and I discussed this even before the decision was made. He said, "Now, if it ends up that I'm not running the lunar program, can I have a handshake that I can go back to Lewis and be the director there?" That's where he'd come from. He was a propulsion person.

So he was back there. Lewis was going to have a major role in the lander if it had been part of either the direct descent or Earth orbit rendezvous, we had to build [a vehicle] that…[would] land on the moon and then go back to Earth. So this decision meant that Lewis would not have a very sizeable part of the program.

Now, in my discussions with Hugh as to the best way to go and the briefings that we had for him and for Mr. Webb, I would say, from my recollection, that he was not critical of it. He accepted the decision. He didn't say, "Absolutely that's the way to go," but he didn't say, "I think you're making a big mistake." I thought before it actually came down to the final decision, that he might, because I knew that Abe Silverstein was giving him a lot of the reasons why it would be a bad decision.

However, even after we had nailed it down within NASA, we still had a big problem on that decision because of the White House. We didn't discuss this last time, did we?

KELLY: No, we didn't.

SEAMANS: …I mentioned Nick [Nicholas E.] Golovin already. He carried out the large launch vehicle study that I've already referred to. Nick was working for NASA. Now, he was brought into NASA by my predecessor, Dick [Richard E.] Horner, to try to get a better

handle on all the failures that were occurring, because in the early days there would be a countdown [getting] down to one and then [a] supposed lift off, and, instead, there would be a giant explosion. You know, that kind of thing was happening all too regularly. The first year I was in NASA, 50 percent of the launches were failures.

So Nick was brought in to carry out reliability studies ahead of time, so that hopefully we could head off these explosions or these failures. I think that there is a role for reliability risk kinds of studies, but that should not be the sole basis for these decisions, and you shouldn't try to run the organization on that basis. But Nick was a bear of a man, very rugged, strong willed, and very uncompromising. By the time I got to NASA, he was cordially disliked. I tried to get across to him these studies could be helpful, but that it had to be just one of many tools, and sort of downgraded to some extent the work he was doing. On that basis, he resigned.

About a month after he resigned, I got a call from Jerry [Jerome B.] Wiesner. I knew Jerry from MIT [Massachusetts Institute of Technology] days. After he left the White House, he was president here at MIT. He was a man of real substance… He called me on the phone and he said, "We're thinking of hiring a person named Nick Golovin. Do you remember him?"

I said, "I certainly do, Jerry."

He said, "Well, what do you think of him?"

Well, I tried to be reasonably positive, but point out some of the pitfalls. I really questioned in my mind whether that was the kind of person you wanted to have at the White House level. But anyway, I did my best to be fair and at same time point out the difficulties that might ensue.

Finally, Jerry said, "Well, thank you. I think we'll hire him."

I said, "Okay. Good."

Nick Golovin was the one that took great exception to lunar orbit rendezvous because of the risk factor. If you don't connect, to get across into the landing vehicle, [the astronauts are] going to be left…around the moon forever, or their bodies will be. Obviously not a pleasant prospect, but there were so many possibilities…[of failure] that you had to think of all of the risk factors and then try and do something that would minimize all of the risk factors. You didn't want to have a landing on the moon and have the vehicle tip over. So it has men on the moon all right, but they couldn't lift off from the moon. There were so many things that could go wrong, that to just single out one of them was a big mistake.

But he got Jerry to worry about it, and I think it was in '61, it might have been early '62, before this decision was finally made, and not because of the decision, but the President decided he wanted to go and take a look at the facilities and meet some of the people involved in the space program, and he wanted the Vice President to come with him.

So we sent out a caravan, you could think of it, with two airplanes, because the President and Vice President can't go in the same airplane, the old risk factor. Jim Webb felt that I should go with Kennedy, because he said, "You're younger. I'm more of the age of the Vice President, I'll go with him." So that's the way we set out.

The first place we went to was Huntsville, and we saw a rocket being fired. Then we went into an assembly area where it was a mock-up of the Saturn I. It was a big building, and over at one side of it was this big rocket. Then there was a roped-off area and the press were all behind the rope all the way around this way. I don't know how many were there, 100 or something. We were out in the middle of a floor where Wernher was about to describe the vehicle, when Kennedy said, "Could somebody tell me a little bit about lunar orbit rendezvous?"

It was an amazing discussion, because [we] had the science advisor from Great Britain there, Sir Zolli Zuckerman…[Secretary of Defense Robert S.] McNamara, and obviously you had—let's see, we didn't have Bob Gilruth there, but you had Brainerd

Holmes, I was there, Webb was there, and here we were right out with the President haggling about lunar orbit versus the other possibilities.

Afterwards, as you can imagine, the press, everybody they could see out there, they were saying, "What was the discussion about?" Because it was obviously—the people weren't smiling or anything. You know, they were really in there. They got a pretty good feel for what the discussion was about.

I think it was soon after that trip that Kennedy invited Jerry—this is what Jerry's told me—and said, "Look, Jerry, you've got you and your staff of four or five people. On the one hand, you feel this way about it, and on the other hand there's Jim Webb and he's sitting over there with 30,000 people all set to go. Is there anything I can do but support Jim Webb?"

Even after the successful landing on the moon, I talked to Jerry, and he still feels that we went the wrong way. In part, he feels we went the wrong way because he said we had to build something that was just special for that mission. The reason that there wasn't a follow-on program is because we had everything so specialized that it couldn't be used for general exploration. I disagree with that.

So anyway, I think that's probably enough on how the decision was made, unless you have some more questions about it.

KELLY: No, actually right off the top of my head I don't.

SEAMANS: I should say that during the several months, and I can't quite remember when the trip was in relationship to the final decision, there were quite a few decisions and quite a few meetings and letter-writing and so on. Joe [Joseph F.] Shea was hired at just about that point to work with Brainerd Holmes. He came over to see me and what he remembers my saying—I don't remember this—I said, "Joe, you've got one major assignment: sell lunar orbit rendezvous."

KELLY: He was given that task then to do that?

SEAMANS: Yes, while working for Brainerd Holmes, I mean, but underlying the specific things he had to do, "Just remember, your job is to sell it." By selling, I meant not out in the public, but I meant in discussions. We were already having discussions with the White House and eventually with Congress, too.

KELLY: Was it really a matter of getting the opinion of the White House and Congress behind the decision, or was it a matter of—

SEAMANS: I think once the White House agreed, I don't think that we had any trouble with the Congress on that.

KELLY: How about the NASA workforce, the people actually building the launch vehicle and command module and all that?

SEAMANS: I can't recall any adverse reaction. I mentioned Abe Silverstein, him and some other people at the Lewis [Research] Center [Cleveland, Ohio]. I can't recall.

KELLY: Speaking of the centers, I know that all of the centers at that time reported to you, is that correct?

SEAMANS: The answer is yes. I'm a little slow. I'm trying to remember the date when we changed it. That whole shifting of lines on the chart was a little troublesome. It started off, when I arrived there, with the old NACA Center, the Langley [Virginia], the Lewis [Ohio],

the Ames [California], and the Dryden Flight Test Center [California] out in the desert, were coupled together and run almost the way the old NACA was, except that certain of the centers were doing some special projects for the space program, but they were still being run by Ez [Ira H. A.] Abbott…an old-time NACA type.

The [unmanned earth orbital] flight programs were being run by Goddard [Space Flight Center, Greenbelt, Maryland], which grew very rapidly; JPL [Jet Propulsion Laboratory, Pasadena, California], which [ran the unmanned lunar and planetary program] was acquired; the group at Huntsville [have already been mentioned]. Then down at Langley, about 1,000 people from that group had been shifted over to what's called a Space Task Group, and Bob Gilruth was in charge of it. When I say Langley, I'm talking about the part that was left behind. There's a question of how the programs and these centers lined up. The idea, of course, was to try to line them up so that the work that this program office was doing here would be carried out by one or two centers, that you wouldn't have every one of these programs involved in every one of the centers.

After we got Brainerd Holmes and we were really proceeding with a brand-new, greatly expanded [agenda], it wasn't too clear how [all the centers were] going to fit together. So it was decided, at least for the time being, that while it was being sorted out, that I'd be in charge of all the centers, as well as all the programs, and then my job was to be just sort of switching engineer to try to get the locomotive[s] going down the right tracks to the right places and so on, and to try to tie it together. You [can] probably see that there were a lot of problems when you do that. Two program officers may want to see the same set of people at one center working for them. What's the center director going to do about it? How does he know what he's supposed to do? So that's when it would be my responsibility to try to sort it out and allocate the funds and all of that to the center.

The program people disliked this intensely, particularly Brainerd Holmes. Brainerd was used to an in-line organization. All the people he needed worked directly for him. He

didn't have to worry about anybody else. He was very upset that some things he wanted done by the old NACA labs, for example, weren't getting done. There was a meeting when he got very upset with Ez Abbott. There was a meeting with me and the other program officers and that night Ez Abbott handed in his resignation because of the pressures that were developing from all of this.

After a couple of years, when it became obvious what the alignment was going to be, we turned it back and Brainerd became then responsible for the three principal centers. Two of them were obvious. I mean, by then what had been the Space Task Group was moved to Houston, but 1,010 people were asked to move, and all but one moved. They were really dedicated. Some of them moved, recognizing that it was probably the end of their marriages. They were a really dedicated group. So that was nailed down and that was obviously [the] manned spacecraft [center].

The same was pretty much true of von Braun and his team. It was not so true down at the Cape. When I arrived in NASA, you had—I can't tell you exactly how many, I think [we] had four or five independent groups working down at the Cape, some of them working for Goddard, some of them working for the Space Task Group, some of them working for Huntsville, each for their own leader. And this was very awkward from the standpoint of working relations with the Air Force, which ran Cape Canaveral, because they had to deal with a whole bunch of different NASA people [who] could be putting demands on them for anything from range safety to photographic services.

One of the things that [was] accomplished by having me take over was to take over that whole group and make a center out of it. Kurt Debus was clearly the most able of all of the people running the stuff down there. But to get something that, say, the Jet Propulsion Lab was doing, going to, say, a planetary mission, underneath Kurt Debus, who was very busy with Apollo, was difficult, but it had to be done that way.

That was a very hectic period of time. I did have, working directly for me, this is after the period when I had Fleming and Heaton working for me, we hired two people from industry, and one of them had responsibility for the centers and the other had responsibility to see what was going on in the program area, to try to help me sort this out.

KELLY: When you were working with Mr. Holmes, he then was in charge of working with the Apollo Program with the centers under him?

SEAMANS: Not to begin with.

KELLY: Then you had changed it?

SEAMANS: Right. Remember, he had not only Apollo, but he had Gemini and he had Mercury. Even then we were trying to plan what we were going to do beyond going to the moon. So that would be actually four different projects.

KELLY: He didn't stay in that position very long.

SEAMANS: No, he didn't, and that was sort of a sad situation. I guess you can say it was partly his background that he was used to running a one-man show. It had [the] specific objective of putting very large antennas in northern Greenland and Alaska and Great Britain so we could detect ICBMs [Inter-Continental Ballistic Missiles]. That's what the project was, and a tremendously difficult project not unlike Apollo.

Let's see if I can tell you when it started to come apart. I guess the real crunch was that after a couple of years—this would now be, we're now talking about '63, I think, in the spring—our budget had been rapidly increasing… It had gone from one billion under

[President Dwight D.] Eisenhower to, I think, something like 3.7, right at that juncture, heading towards 6. Multiply those numbers by three if you want to have it in today's dollars.

He came up with the idea, somewhere in the spring, with the idea that if we went for a supplemental, a 400-million-dollar supplemental, that we could go to the moon in '66 rather than '67. Even though we hadn't announced the '67 date, we were still working towards it. This is, from a political standpoint, very interesting to Kennedy, because he had a good chance of being reelected and that would have still been within his administration. And to do it a year sooner, so much the better.

I know I was horror-struck when I heard that Brainerd had this idea. I immediately—I can't remember whether I had a meeting with Brainerd and Webb and Dryden, or whether I first told them about it. But all three of us, Webb, Dryden and myself, felt this was very unwise, that we already had our hands full, and the thought of trying to speed the program up even more seemed very unlikely. We felt that if [we] went for more money, it might make it easier to maintain the dates we had, [but] we were [not] going to be able to speed it up.

Well, Brainerd was a very spectacular sort of person and the media loved him, because he said things that were sometimes a little outlandish and it made good copy. So all of sudden, in *Time* magazine there was an article that there was a big rift within NASA, and it then described what the issue was. It implied that the rift was so great that either Mr. Holmes or Mr. Webb might soon be leaving the agency.

The White House is always alert to that kind of thing, you know, different parts of the government not getting along well, or particularly when it's internal, and particularly where something that was of very great interest to the President. So all of a sudden we were, almost overnight, faced with a meeting with the President, where Brainerd had an opportunity to explain to the President what he had in mind. Then it was up to us to rebut it.

I took on the job of rebutting it from a standpoint of running the Apollo Program, but it soon got into a discussion more political in nature, which Mr. Webb then handled. Jim

made the point that with all we were doing with the Congress, the thought of going out for a supplemental on top of already dealing with several sets of authorization committees and appropriation committees, was just mind-boggling.

Then Kennedy said, "All right, Jim, but why don't we take money from the other programs that you have at NASA, take 400 million from them and put it over in the space program," which could have been done. Well, Mr. Webb dealt with that. We never even thought about that when we went to the meeting. So he struggled to explain that the other programs were important in their own right and shouldn't be sacrificed for the Apollo Program. Because…this ha[d] always been his theme, that he didn't want all the other programs to become subservient to the Apollo Program. "I don't want people going around here with an 'A' on their forehead. They work for NASA, they don't work for Apollo Program." And this is a hard thing to sell.

But in any event, the President then said, "Well, I don't know, Jim, I'm not sure that you and I really see eye to eye on our national objectives." He said, "Tell me what you think our national objective is."

See, Apollo had a DX priority for buying supplies or anything, a top priority in that sense. Jim gave a nice little speech on preeminence in space. "We don't want to just be looked at as people going to the moon, we want to be looked at as doing the top science and doing whatever we can, the top technology, the top communications and weather forecasting."

The President shook his head and said, "I don't know, Jim. I guess I'd like a letter from you in twenty-four hours to express these views more cogently. I'm not sure we see eye to eye on this." And that's how we left the meeting.

We really scurried around to write that letter. That was quite an exercise. It started with Hugh Dryden writing something. I took it from him and added some things that I thought might beef it up. I took it over to Mr. Webb's house, sat down at his dining room

table. He loved to do this. By then it was about a seven-page letter, typed letter. He loved to cross things out and write stuff in the margin up this way and underneath.

We sent the letter, and we never heard another word. If anybody wants to know what we were trying to accomplish in those days, at least seen by Mr. Webb, that was that letter.

But at that point we were not endeared to Brainerd… Then Brainerd did a couple of sort of silly things, and it just became necessary to do something about it. Brainerd went on to become the chief operating officer of Raytheon for many years, doing a good job.

KELLY: He was very successful.

SEAMANS: Yes.

KELLY: I believe after that, George [E.] Mueller came in to the program.

SEAMANS: Yes.

KELLY: At that time, were you in the process of restructuring the NASA organization?

SEAMANS: We already had. It had all been done. The final separation came at a time when I was just about to race a boat to Halifax. I wasn't sure that I ought to go. We already had some feelers out for a couple of people who might take Brainerd's place. Coming back from the race, there's an island on the main coast called Roeque Island, where seafaring people love to go. It's got a beautiful beach. If you've been out in the ocean being pounded and doused with saltwater, rendezvousing at that beach is heaven.

We came out of the fog and we hadn't any more than came out, and…boats [were] already anchored there, people yelled out, "Seamans aboard? Mr. Webb wants to speak to you."

I went aboard another boat that had much more powerful radio transmitter. Jim Webb said, "Well, Hugh and I have talked to George," and I knew George, anyway, "and he's very interested. Before going ahead, I wanted to be sure and get your vote."

I said, "Absolutely."

So George came that summer and he did a remarkable job. Brainerd did a great job, too. But what George added was, among other things, there were two things he did that were really important right at the start. One was to get more senior people running the program. We had a hard time hiring people from industry to come in and take jobs in NASA. Obviously they were going to take a big reduction in pay, and other reasons it wasn't really attractive. We did get some people to come. We got one person to come and run all the projects at Huntsville, a guy named Young, on a leave of absence from Aerospace, where he was the chief operating officer. But that's the kind of thing that's very hard to do.

By the time George got there, which was just about the time I got back from the cruise, and I met with him, he said, "You know, we've got to get some more people here. There are people I want to get." He had…a list of something like thirty Air Force generals and admirals that he wanted transferred.

I said, "That would be terrific to get all those people, but, geez, I don't know. Let's go up and see Jim Webb."

We called a guy named Bozo McKee, who was the Vice Chief of Staff of the Air Force, whom Webb had known…for many years. He worked for [Curtis] LeMay. I can imagine how LeMay would probably react to something like this. And, by golly, we got most of them. That was something that Jim Webb helped execute.

The other thing he had was this idea of all up system testing. By then we had fired four Saturn Is. It was just the first stage. The upper stages had nothing but sand in them. This was the Germanic way of testing, to have lots of vehicles and you take the thing step by step by step, adding a little bit each time. Before they got a successful V-2, they'd fired seventy-seven V-2s, for example.

Even before George came, it was obvious to me that we weren't going to be able to land on the moon in the decade or even come close to it if we kept proceeding in the same sort of plodding way. But George came in and he said, "All up system testing." He said, "The very first Apollo launching will be with the complete vehicle, everything."

The Huntsville people, in particular, were absolutely aghast at that. They said, "It'll never work." The very first one, incidentally, was launched in November or December of '67. I remember seeing Wernher right afterwards, and he was shaking his head. He said, "I never, never thought it'd be possible."

But the idea was simple. It was, if you're going to go through the exercise and the hundreds of millions of dollars to test the first stage, you might as well put everything else on top of it. You may not get any data out of it, but you may. If you do, you're that much further ahead.

So, George took over. Brainerd was a whirlwind, but George was a double whirlwind or something. The days of the week meant nothing to him. There were meetings on Saturdays and Sundays. George was indefatigable. I mean, he just traveled everywhere.

He…formalized what Brainerd…had, anyway, which was to think of the organization as being made up of, like the chairman of the board, and then the directors of the board were the center directors. Then underneath him, George—by then Mercury didn't exist, but the head of Gemini and the head of Apollo, Sam [Samuel C.] Phillips, and the head of advanced planning. It would be up to them to come and present to the board weekly, or very frequently anyway, what the issues were, what the problems they faced, and so on. Then they would

decide with this configuration how to go about solving it, and it would obviously be divided up into the various centers and who would execute what.

In each one of the centers you had project people who were responsible, say, down at Huntsville for each one of the rocket stages. You go down to Houston and you have somebody in charge of the lunar module and somebody else in charge of the service module and somebody in charge of the Apollo capsule itself. Down at the Cape, similarly, you'd have people responsible for different things. It was set up so that Sam Phillips, running Apollo, did not have to go to Bob Gilruth, who was head of Houston, go through him, get his approval, before going to Joe Shea, who was in charge of the Apollo capsule. He'd go directly to him.

You say, well, what's Bob Gilruth doing, anyway? Here's somebody who, on paper, works for him, but he is not involved in the decision. He's involved in the decision at the higher level. George made it work. No perfect way to organization. So, no matter how you do it, you're going to have stresses, but George and Sam Phillips and people like Joe Shea got the job done.

Maybe we've got a few more minutes.

KELLY: I do have a few brief questions for you.

SEAMANS: Sure.

KELLY: Then maybe we can then go ahead and wrap up and, hopefully, if you wouldn't mind, I could have the opportunity to talk to you again. We can elaborate on these questions.

When you came into NASA Headquarters, the Mercury Program was already under way.

SEAMANS: Yes. The astronauts were selected a year before I arrived.

KELLY: How were you involved in the Mercury Program, if at all?

SEAMANS: Let's see. Was I involved at all?

KELLY: I understand on a much more top-level organization, you were working with the organization and helping Mr. Webb with the larger decisions.

SEAMANS: Yes. Well, there were still a few issues that had to be resolved, but, by and large, I was an observer. The first Mercurys, I didn't even go down to the Cape. Hugh Dryden went down. The end, I went down and came back with the astronauts. But in the beginning, I got something set up.

We were located then in the Dolly Madison House there on Lafayette Square of their headquarters. The Goddard Center was responsible for communications on Mercury, around the world, so they had the best information available. I got a microwave set up, so that we had a small viewing room, if you want to call it that, in Washington, D.C. On the first launch, for example, of Shepard, I had a couple of people in my cell and we sat there to see what was going on, realizing that an awful lot was at stake. But I had no say in the matter.

However, we had one really tough issue that came along, that I did get heavily involved in, on the Mercury Atlas. The Atlas is really a dirigible. It's kept erect before you launch it by the pressure inside of it, but the skin of that Atlas is only ten thousandths [0.010] of an inch thick, and it was not designed to have a Mercury sitting on top of it and then taking off with the…[stresses that developed from the lift off acceleration]. The thought was that—and it came up very late. It came up about the time Jim Webb arrived.

We get a letter from [General] Benny [Bernard] Schriever where he said—just imagine the situation. Bennie Shreiver came in and said he felt that his studies showed that it would be unsafe to launch the Mercury Atlas. Now, this was the only way we had of putting somebody into orbit. I mean, to cancel that program at that time would have been devastating, yet, [as] Bennie said, we not only have to have a deterrent in our [stand-off] with the Soviet Union, but we have to appear to have. If, on public television, you should see the Mercury go [up] with the Atlas pushing it up there and it blew up, I mean, that would cast doubt upon our whole ICBM counterforce.

Well, that was a really tough one. Abe Silverstein, who was still managing all the programs, including Mercury, obviously was immediately involved. The solution that he came up with—and I didn't come up with a solution, but Jim Webb and I had to sell it to McNamara and the Defense Department—was that we put what we called a bellyband on it… We made a [band] that would just fit, of about five one thousandths inch [0.005] thick, that would fit over the Atlas [nose cone] and add strength to it. We got it on by heating it up so it expanded and put it [on] and then let it shrink into place.

It was on that basis we had, obviously, a zillion calculations as to whether the Atlas would collapse or not. It wasn't a simple calculation. We had to know that everything was perfect. You could show that there was no danger in going ahead with the Atlas the way it was, but if you had certain adverse things happen, it could possibly have been stressed so that [it] thing blew up.

KELLY: That's very interesting.

SEAMANS: I think, as I remember it now, that was my principal contribution.

KELLY: Did they also use that with the Atlas Agena, in launching the Agena?

SEAMANS: Yes, but nobody worried by then. That's true. Yes, the Agena was launched by the Atlas.

KELLY: I know that you were significantly involved, and maybe we can talk about this extremely briefly here, and I can go ahead and conduct some more research into this. But I know that you were involved in the Gemini Program and, more specifically, you were noted for creating the Gemini Review Board, I believe, after the Gemini IX flight. I'm wondering if you can tell me a little bit about your involvement in the Gemini Program.

SEAMANS: Well, let's see. [I suggested the Gemini Review Board as discussed previously, but not after Gemini IX. I did revise the Accident Review Board protocol at the time of Gemini IX, but because of the near disaster on Gemini VIII not because of Gemini IX.]

After the decision was made that we were going to go to the moon, the concern was, what were the astronauts going to do? How are we going to train them? How are we going to work out certain technical problems, particularly the rendezvous and docking? If we had to finish Mercury in '62 or '63 and then have to wait two or three years before we start to get the Apollo hardware, was there something we could do in the interim? I was very much involved in getting it started, though it was not my idea.

The idea came from, I guess, by then—I don't think, I'm not sure whether we quite moved the Space Task Group to Houston or not. There was a guy named Jim [James A.] Chamberlin, anyway, who had come down from Canada with quite a big group [of AVRO engineers] when Canada canceled a big so-called CF-105. He'd come down with that group and he was sort of the thinker of the group. He came up with the idea of working with McDonnell-Douglas, of just expanding Mercury in every direction, so that it would be

bigger. So you could put two people in and you could [run] quite a few of the tests that you could see were going to be required [for Apollo].

Mercury II—I already talked about how the name became Gemini. It was going to be too big for the Atlas, but the new Titan 2 booster could handle it. So the formulation of that program was something that I was right in the middle of, with Abe Silverstein.

Let's see. There were twelve missions spelled out, the first two unmanned and then manned. I'm trying to remember what happened along about IX—I guess it was VIII, [Gemini] VIII went, we almost lost—

KELLY: You mean Gemini VIII with [Neil A.] Armstrong?

SEAMANS: Armstrong and [David R.] Scott, yes. That's the one where we did rendezvous [and dock] with the Agena, if I'm not mistaken. Then they started spinning, and they thought that was the fault of the Agena [so] they disconnected it. The fault was in the Gemini, and they really started spinning. Was the Review Board for that purpose? I don't know.

KELLY: I believe it was created around Gemini IX, which was the [Thomas P.] Stafford and [Eugene A.] Cernan mission.

SEAMANS: That was the 76 [joint Gemini VII and Gemini VI mission]. That was the rendezvous one?

KELLY: That was, I believe, Stafford and [Walter M.] Schirra [Jr.], and then [Frank Borman] and [James A.] Lovell [Jr.] was VI and VII. Then I believe IX was—

SEAMANS: We had the so-called 76 Project.

KELLY: That's right.

SEAMANS: Where [Frank] Borman went up in VII and the idea was to clear the pad, we only had one pad, and put Gemini VI on it and go up and rendezvous. Wasn't that Stafford?

KELLY: It was, with Wally Schirra as command.

SEAMANS: Right.

KELLY: Then I believe IX, Stafford commanded with Cernan.

SEAMANS: I forget the specifics of IX.

KELLY: I believe they tried to dock with the ATDA [Augmented Target Docking Adaptor]—the angry alligator is what they called it.

SEAMANS: Right. Okay.

KELLY: It didn't unfold properly. There was the target docking adapter, the Agena target docking adapter.

SEAMANS: Okay.

KELLY: They didn't quite get to dock with it, because, I guess, the cover on top of the ATDA did not unfold properly. In addition to that, they had a few space walks, and I believe Mr.

Cernan had some trouble on his space walks where he lost about thirteen pounds just in trying to attempt the work package that was given.

SEAMANS: Right. Well, right in that period there, we were learning how difficult it was to get outside of a capsule and do anything worthwhile, because you'd try, with a screwdriver, to turn a screw this way and instead of the screw going, you'd start rotating yourself. We realized we had a lot to learn about how to operate in space, human beings operating in space. You had to have special footholds and handholds and all of those kinds of things. I think we did have a special committee to review that. I don't quite remember the specifics.

KELLY: The reason why I'm asking is because I've read about this Review Board in some of the history books, and they discuss that it was created after the IX mission, and I just wondered why it perhaps wasn't created under the VIII mission, because of the problem you had mentioned. But it didn't specifically say what the Review Board was for or give any of the results. That's why I was very curious if you might be able to shed some light on that.

SEAMANS: Let's see if we can find out.

KELLY: Maybe I'll do a little bit deeper digging.

SEAMANS: Yes. That was a period when we were really trying to lay to rest our ability to rendezvous and dock, as well as to operate, because as a backup, if we somehow or other hadn't been able to latch the two together so that you could crawl from the lunar module through into the capsule for the return, the backup was going to [require the astronauts] to egress the lunar module and go across and go into the [return] capsule, which would have

been a fairly tricky maneuver. But in desperation, it was possible. So that's one of the reasons that we had people outside for these so-called EVAs.

[I believe I established a "special group" following Gemini IX to recommend experiments for the final Gemini missions. The purpose of these experiments was to better understand why it was so difficult for an astronaut to function outside the capsule—EVA—and to find ways to minimize the difficulty.]

KELLY: Well, it seems like it's about time, so why don't we try to stop here.

SEAMANS: Yes, I think it is, because I've got to get in town.

[End of Interview]