INTERVIEW OF

JOHN McLUCAS

January 9, 2001

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I N T E R V I E W

MR. GARBER: Good afternoon. Today is January 9, 2001, my name is Stephen Garber from the NASA History Office and I am here with Dr. John McLucas in Alexandria, Virginia.

Dr. McLucas, would you like to introduce yourself briefly for the record, please.

DR. McLUCAS: I'm John McLucas. Someone said to me recently “This man used to be a former Secretary of the Air Force”, and I said “I'm still a former Secretary of the Air Force!” [People make such crazy statements!]

[Are you looking for a synopsis or anything?]

MR. GARBER: I just wanted to hear your voice so my transcriber can go ahead with the transcript. I've got a little bio sheet here for my reference.

DR. McLUCAS: My voice is getting a little shaky, [but I hope] she'll be able to understand it.

MR. GARBER: That's fine.

I would like to focus today on the period of time roughly from 1969 to 1973, which is when you were Air Force Undersecretary, and also a little bit less so on the years 1973 to 1975 when you were Secretary of the Air Force.

I would like to talk about the space shuttle

and the influence of the military and intelligence communities on its design in the early '70s.

So, to begin with, perhaps you could briefly tell us how you became the Air Force Undersecretary under Dr. Robert Seamans.

DR. McLUCAS: I'll have to collect my thoughts on that. How did it happen? At [that] time I was running the [MITRE] Corporation [in Bedford, Mass and I was living in Concord, Mass]. I knew Dr. Seamans but not terribly well.

[Melvin Laird and David Packard] were setting up their team and [were working with] lists of names of people [who were candidates] for various senior jobs and my name was on one of those lists. So at some point, Dr. Seamans was talking to them about me as a possible candidate for the job of Undersecretary. They didn't know me personally, but apparently I had some sort of a reputation as being a good guy. So Bob Seamans [called] and set up a meeting at [Hanscom Air Force Base] where we met and talked for about half an hour.

He wanted to talk about my becoming under secretary and as I heard him describe the job he wanted me to do, I became more interested. So we both agreed to do some further thinking about my joining him in

Washington. His next step was to call the chairman of the board of MITRE, Dr. James Killian who was also chairman of MIT.

So, anyway, he heard good things from the various people with and so we arranged for me to come to Washington to meet Melvin Laird and David Packard. Those meetings went well and I got more serious about the job. About this time I decided I'd better check with my wife about this business of moving again. She liked to put down roots and stay in the same community as long as possible. We had lived in the Penn State community for 15 years and felt very much at home there. Then in 1962, I had taken a job in the Pentagon where I worked for two years before leaving for a job at NATO in Paris. In 1966, we had moved to Concord, MA where my wife settled in very comfortably, thinking our moving days were over. She knew that area very well from having been in college at Wellesley – only a few miles from Concord. So coming to Concord meant she was coming back to a nice familiar place. When Dr. Seamans said he wanted me to move back to Washington, we had lived in Concord only three years and she did not take kindly to the idea of moving again. She said she thought it was a lousy idea.

We had lived in Washington from 1962 to 1964

and as far as she was concerned, we had done our bit for our country and that should be the end of it. This was especially true since the country (especially the Northeast) was getting pretty antsy about our involvement in Vietnam.

So, anyway, in about two weeks, I decided I was going to do it in spite of the fact that my wife was quite unhappy about it. She agreed to move but you might say she agreed against her better judgment. So I called Dr. Seamans and said “If you and Mr. Laird and Mr. Packard still want me, I think I’m ready to sign up.”

MR. GARBER: Okay, thank you. In your discussions with Dr. Seamans that you mentioned before you took the job, did you talk about your prospective role regarding space issues and, in particular, your dual- hatted role as head of the National Reconnaissance Office?

DR. McLUCAS: Yes, we did. In fact, that was the turning point in my thinking about the whole idea. The idea of being [merely the] Undersecretary did not appeal to me. But I knew enough about the history of the Air Force from my earlier tour in the Pentagon and my work on advisory committees while I was at MITRE that sometimes the Undersecretary served as the head of

the NRO and that other people did not.

For example, under the previous administration, Harold Brown had been the Secretary of the Air Force and the Undersecretary [Townsend Hoopes] had nothing to do with NRO. Yet earlier Joe Charyk and later Brock McMillan both served as Undersecretaries and then later, directors of NRO. So I knew the precedent was there and as I think back on it, Harold Brown was the first Air Force secretary who didn't think it was a good idea to have the Undersecretary also serve as director of the NRO.

You can make a good argument that the under secretary is busy enough without the NRO in his portfolio. And that's what Harold Brown presumably did by having Townsend Hoopes as his under secretary. But as you know, these jobs frequently have a strong political flavor and it may be that the administration had some reason for wanting Townsend Hoopes to have a good job - or at least a good title - and left the rest up to Dr. Brown.

Anyway, Dr. Brown had Dr. Al Flax as assistant secretary for R&D and also chose him as head of the NRO. He was an excellent choice and did a good job. But in my case, I would not have taken the job as under secretary unless NRO had been included with it.

Have I lost track of your question?

MR. GARBER: No, you have answered it very well, Thank you.

I would like to move on and ask you some more about the organizational set up in the Secretary of the Air Force's office regarding space issues. In particular, I have already spoken to some other folks such as Dr. Seamans, Dr. Yarymovych and Dr. Naka. I haven't been able to speak with Grant Hansen because I understand he is not well. But I'd like to ask you what was the organizational setup among those folks regarding space issues. What was the break out of who did what?

DR. McLUCAS: Well, let’s cover the NRO quickly. There was an agreement between the SecDef and the DCI (Director of Central Intelligence) that the DNRO would be appointed by and report to the SecDef and that the deputy to the NRO director would be appointed by the DCI. Both officials would sign off both appointments. As a courtesy, I felt I should let Dr. Seamans know from time to time what was going on at the NRO since he had most of the clearances, but I didn’t feel I had to seek his advice or concurrence.

So let's say that the NRO was different. On other space issues, he and I had an agreement. It will

be interesting to compare my version of this agreement with his.

MR. GARBER: You are speaking of Dr. Seamans now still?

DR. McLUCAS: Yes. Let me say a word about how he and I divided up the main work in the office. We had about 20 programs that were considered to be the most important ones under our jurisdiction. So we both tried to keep up to date on those programs. Dr. Seamans was of course the boss so he took his pick of which programs he would spend most of his time on. He said that if we had a clean slate, it might be hard to decide which programs we each should concentrate on. But in our case, it would be easier to divide things up, because we had rather different backgrounds – his being mainly aeronautical and mine being mainly electronic. For the major programs that were aeronautical in nature, he would take the lead in maintaining oversight of them.

One might think that AWACS is another airplane program which would fall under his jurisdiction but the airplane was actually a Boeing 707 and hence not much of a challenge. The real innovation on the AWACS was the radar so that program became part of the group of programs where I took the lead in maintaining

oversight. Typically for things that were space-related, they were more electronic than aeronautical, so I tended to maintain oversight over those areas as well.

Now he didn't ever say that because he counted on me to keep a sharp eye on AWACS that he would abstain from making any input into AWACS. And when it comes to things like the DSCS program (Defense Satellite Communications System), which was a large item at the time, he counted on me to keep an eye on it but reserved the right to make his own input. As far as I was concerned, that was a normal Air Force program and was handled by Grant Hansen and Mike Yarymovych, with me looking over their shoulders. Dr. Seamans also counted on me to keep an eye on various drone programs. Essentially all those programs were being developed with reconnaissance missions in mind.

To sum up, I would say then that programs that were principally related to electronics were my responsibility while the ones principally related to aviation were his. Drones were a special case, considered to be of low overall importance, so he was happy to have someone else keeping an eye on them.

As assistant secretary for R&D, Grant Hansen and Mike were in the chain on things like DSCS, AWACS

and whatever. I worked with all these people and usually there was no question about who had the authority. We had a sort of collegial arrangement where we shared the responsibility. The chain of command showed Bob Seamans and me in the top box, with him listed first and then Hansen and Yarymovych in a lower box with Hansen listed first. Seamans would look at the aeronautical systems and I would look at the electronic items and Grant Hansen and Yarymovych would be involved in both types of activity.

So when Grant or Mike needed guidance, they could turn to either one of us and we had sort of an informal understanding, which seemed to work quite well. I don't remember, frankly, any areas where Grant was receiving instructions from Seamans and me that were incompatible.

MR. GARBER: Okay. What about Dr. Yarymovych and Dr. Naka?

DR. McLUCAS: Well, Dr. Naka's area of interest was only NRO. His title was deputy director of NRO. That job, by the way, had always been held by a person designated by the DCI – the head of the CIA.

When I came in, a man named Jim Reber was in the job as deputy. I had nothing against him but I didn’t know him or how far I could trust him. So I

called Richard Helms, the DCI and asked him if I could bring in Bob Naka as my deputy. I had hired Bob Naka as my chief scientist at MITRE and had found that we worked quite well together. I didn't like the idea of having to break in a new deputy so I asked Helm's permission to bring Bob Naka in as my deputy. Helms readily agreed.

I heard that some people were asking how the hell McLucas could get away with this when everybody knew that the deputy was always chosen by the DCI.

But it turned out that the two of them had worked closely together in a previous incarnation and so when Dick Helms heard that I wanted Bob Naka, he said that Bob would be a very good choice. And all three of us worked together on the programs with no disagreements.

In fact, we were very strong supporters of each other all the way through.

Yarymovych was on the non-NRO side of space and had a good reputation and a good manner about him and I was very fond of him. He was spending a lot of time on certain things like the DSP program. Are you familiar with that?

MR. GARBER: Yes, I am.

DR. McLUCAS: DSP was an area where he and I

worked closely together. So on the non-NRO space activities, Yarymovych was the senior operating person for that type of space activities, reporting directly to Grant Hansen with me maintaining oversight. Mike and I worked very closely together. We traveled together and visited the Australian installations together and had a good working relationship.

MR. GARBER: In your capacity as Air Force Undersecretary, as well as NRO director, what was your involvement in transmitting the military and intelligence communities requirements for the space shuttle to NASA?

DR. McLUCAS: Well, I hesitate to speak too strongly on this subject because I am never sure whether I'm remembering this time or a time three years later. My version of the story is that the Air Force military had little or no interest in the shuttle. The Air Force was involved in space thru something called MOL (Manned Orbital Laboratory). The MOL program existed because there were some people in both DOD and the Air Force who felt that the military man in space was a critical need. They didn’t want to have the man-in-space program totally in the hands of NASA.

I was not one of them. I felt that there was really no role for man in space in the Air Force. I

felt that Ike's decision to put man in space through NASA in a totally separate civilian program was an excellent idea. I believed that the things that we (the Air Force) needed to do and knew how to do in space did not require putting people in space.

MR. GARBER: On the military side, you mean. Is that correct?

DR. McLUCAS: Yes. I thought that Ike had made the right decision. He said that NASA is a separate civilian space operation which complements the military role in space. As far as I know, Ike never got involved in the specific question of whether the military needed to put a man in space from a military standpoint. I don't believe be took a position on that but if he did, I don't remember it.

So it was really a question of the Air Force having a requirement to show a need for a man in space.

There was an earlier USAF program called DynaSoar, which would put a military man in space. It was a program that never went too far because as time went on, its mission got ever more vague so the support for it got weaker and weaker. MOL was conceived to be a more realistic system than DynaSoar to do a real mission which was a reconnaissance mission. So MOL

displaced Dynasoar. To do the MOL mission, large sums of money were needed. MOL became a huge program. The thinking behind MOL was that we couldn't afford not to do it because it might turn out that there was really a role for a man in space and we should have, at least, some experimental activities going on to see what that role might be. The most obvious one was in reconnaissance and we tried to tailor MOL to do that job. But by the time that MOL came along, we had already showed that we could collect very good intelligence with unmanned spacecraft, such as the Corona which eventually was declassified.

Since Corona was working so well, we were left with the question what would a man add to this if we put him in space with the Corona camera – or even a better camera. It's not obvious he would add anything. One thought was that if we built a better camera than Corona and rigged it so the man could point it at a ground target which he could see from space, then that might allow us to do a better job of reconnaissance. So steps were taken to try to achieve that capability. But it turned out that a man could not react quickly enough and so we had to automate this feature. So we were back where we started and were still wondering what the man could add to the mission. MOL creaked

along for several years while we tried to get a better handle on this issue but when the MOL expenses got to be more than a quarter of the whole Air Force R&D budget, we decided it wasn't worth the candle.

When Dr. Seamans came over from NASA to the Air Force, he was very happy to see that the Air Force still had plans to keep MOL going. He thought that we might very well learn something worthwhile from the exercise.

So when the idea started to spread that maybe we couldn't afford it since it was costing so much, he said we really ought to keep it going. I remember the budget at about that time; the Air Force R&D budget was like 2-1/2 billion and MOL was like 600 million, which is about 25 percent of the R&D budget.

I was strongly advising Dr. Seamans that no way was MOL worth that kind of money. In my view, the high cost of MOL was distorting the whole USAF R&D budget and I felt we should not allow that to continue. His view was that the Air Force should at least keep MOL going a little longer so we could learn what it might add to our capability. And when keeping the mission going became controversial, I found myself talking against him and telling Dave Packard that it wasn't worth continuing it. I saw MOL as another way to

do part of the NRO mission but its costs were getting out of hand. Dave Packard and the others at his level agreed with me and that became the recommendation to the President.

Dr. Seamans felt so strongly about it that he requested an audience with President Nixon to try to get the decision turned around. He went over and spent an hour-and-a-half with the President trying to save it, but he failed and so it was cancelled. I still remember the date it happened – June 10, 1969.

Let's have another question, I'm not sure where I am.

MR. GARBER: Okay, sure. You have given me a good outline of the different positions that people in the Air Force took on having a human in space, and in particular their feelings about the MOL program.

Going to the area of research that I am particularly interested in, the space shuttle, I was wondering how the intelligence and military communities' requirements were transmitted to NASA and whether you had a significant role in that or whether somebody above you or below you did that or how that worked.

DR. McLUCAS: Yes. Again, this is one man's version. The shuttle was going to be developed by NASA

as sort of the next logical step in manned space flight. It would have two main missions, one being a sort of trucking operation to take satellites to orbit and the other being to conduct scientific experiments in space. If I remember correctly, it was conceived as part of a package that included a permanent space station in orbit plus a shuttle, which would take people and hardware back and forth. The shuttle was an essential companion of the space station. It could take materials up to the station and it could rotate crews from Earth to orbit and back. Estimates of the cost of the whole endeavor got quite large and so we decided to go with the shuttle only – deferring the cost of the station until later. In the interim until the station got built, the shuttle could provide a delivery service for satellites going to orbit and also act as a small space station where various manned and unmanned experiments could be carried out.

Over time, the design of it was shifting back and forth about which mission should get priority and also what was the most cost-effective way to go about doing it. It would have provision for both manned and unmanned types of payload interaction. In other words, in some cases it might be just like a truck taking something up and dropping it off and in other cases

there might be a hands-on role where you wanted to do something to the spacecraft that you had taken up.

Maybe you would set certain controls on it, drop it overboard and come back later to pick it up, et cetera. But the main driving force for the space shuttle did not come from the Pentagon; we were minor players.

In effect, the Pentagon was asked: what does the military need that the shuttle might supply? Two people that were being asked that question were Drs. Bob Seamans and Johnny Foster. And since Dr. Foster was the head of R&D for the whole Pentagon, he was the primary witness speaking to the issue of which particular needs of the military might the shuttle fulfill.

I, on the other hand, was the head of NRO and so you might say if you take Johnny's responsibility for the whole Pentagon, the spokesman for any needs the Pentagon might have, then underneath Johnny is a series of people in the Air Force and elsewhere who might have some use for the shuttle – including me.

So I was asked whether NRO could use the shuttle. I said if it is cost-effective, we could use it. I said it obviously would be cheaper to put small payloads up by some other means. You don't need this

big shuttle with all the man-rated features and so forth just to put up some small satellites. The only ones where it would make sense for us to use the shuttle is where we have really large satellites.

I said we have satellites that are very large, they have weight and volume requirements that are huge compared to most payloads. So if the shuttle is big enough and carries a big enough payload, it could be the answer to our problems of how to launch our largest satellites.

He said, how big are these things? I said, well, we need a volume that is 15 feet in diameter and 60 feet long. And we need a weight capability of 60,000 pounds.

In any case, the volume sized the payload bay and I said I cannot justify asking for any Air Force money to go into the shuttle unless it can handle a payload of this size. They weren't getting many Air Force customers, so I guess they had to pay attention to my spec of 15 [by] 60 feet. I gather that other people were not as specific as I was about size, etc. So I guess that ended up sizing the shuttle.

There was a time when people were focusing on the shuttle being able to carry NRO payloads. There were also times when people were saying that sizing the

shuttle to handle NRO's largest payloads would oversize it – in effect they were saying that we shouldn't size the shuttle just for a few payloads. I said, well, our requirement is to have a booster that can get us into orbit with these big satellites. If NASA can supply them through the shuttle, that's fine. If not, we will buy Titan IVs or whatever from current suppliers and do it that way.

This got down to the question of how much money is the Air Force willing to put into the shuttle R&D process -- [End tape 1A)

My answer to that was we could put 10 or 20 million into the budget just to show good faith, but we are not interested in becoming a major supporter of the shuttle program. We've got enough problems of our own. So we were willing to make some sort of a gesture, but not a heavy commitment of money.

I specifically remember some of those conversations. I don't remember the dates nor the details of the context, but I was very reluctant to become heavily involved in supporting the shuttle. I also thought it would be like most programs of that nature where they end up costing two or three times the projected estimate, and I didn't want to be any part of [that kind of exercise].

So my only role was to say this is what the shuttle would have to supply to make the NRO interested, but I did not speak for the Air Force and I did not speak for the Pentagon. That was primarily Johnny Foster's job and Bob Seamans' to some extent. But the person I remember being most involved with was Johnny Foster.

Have you had any contact with him?

MR. GARBER: I haven't spoken with him yet, no.

DR. McLUCAS: I think it would be worthwhile if you did, I mean if that question is important.

MR. GARBER: Are you saying that he was speaking for the Air Force or the Pentagon as a whole while you spoke for the NRO?

DR. McLUCAS: Yes, he spoke for the Pentagon as a whole. In other words, Bob Seamans was considered tainted in the sense that he was only Air Force, but Johnny was overall.

MR. GARBER: I see, okay. That's helpful in clarifying things.

DR. McLUCAS: Okay.

MR. GARBER: Thank you.

Who did you speak to on your staff, as well as on the NASA side, to communicate those requirements?

Who provided you with the information to bring that requirement for the 15 by 60 payload bay over to the NASA folks? Was it somebody like Dr. Naka or somebody else?

DR. McLUCAS: It was probably Dr. Naka. We discussed which payloads. By the way, although I said he worked for me and not CIA, he also worked for the CIA in a generic sense. He was a good friend of Dick Helms and there was no antagonism or reservation or anything else in this relationship. So when I say Dr. Naka was there, he was my interface to the CIA. He was in touch with all the CIA engineers and people who would be working on future payloads and would make sure that when I spoke that I was speaking after having understood what their requirements were too.

I can't name anyone else that I specifically discussed it with, but I am sure there were others. [I] had a sort of fraternal arrangement with Bob Naka and Mike Yarymovych. We would discuss issues like this with them or Grant Hansen - questions such as: does the Air Force need the shuttle? If so, for what purposes and so on. We had an easy way of tossing these questions around and arriving at consensus. We may have debated my statements about the need for a 15 by 60 payload bay. I don't even remember who initiated it

except that it was derived from the fact we had satellites already in design that would require that.

MR. GARBER: Air Force satellites, specifically?

DR. McLUCAS: Yes.

MR. GARBER: Okay. So the discussion with people like Yarymovych and Naka and presumably Grant Hansen, as well, would be a little bit broader about what the role for the Air Force, the Pentagon or NRO should be in supporting or not supporting the shuttle writ large as opposed to the specific payload capacity? Is that correct?

DR. McLUCAS: Yes.

MR. GARBER: Okay. What is your memory of those kinds of discussions? Did you sit down and meet often? Was it one or two meetings and roughly what time period was this?

DR. McLUCAS: I would say that the time was like 1972.[I later found out it was earlier. Bob Naka thinks it was earlier, like ’70 or ’71. We had a few discussions but I don’t remember that we had more than just a few. Johnny probably wanted to know what our needs were and what our druthers were and the extent to which we were willing to support the shuttle. And I think I've given you my take on those questions.]

I remember that I didn't want to get too deeply involved in supporting the shuttle. I didn't want to be considered a [dominant] person for saying, look, because I'm putting up so much money, I should get first-class treatment. I didn't want to put up very much money and I was willing to take whatever treatment I got.

MR. GARBER: Okay. You've just described your role as perhaps a reluctant supporter at best of the shuttle from the NRO perspective. What is your recollection of the positions that people like Dr. Seamans took on behalf of the Air Force and Dr. Foster on behalf of the Pentagon? Dr. Seamans, of course, came from NASA, but he also spoke out with some rather, what I would consider, lukewarm endorsements of the shuttle. So what is your recollection of those two individuals regarding the shuttle?

DR. McLUCAS: I'm afraid I don't have any strong memories. But my memory is this: Johnny Foster had been asked to be the spokesman for the Pentagon. Some great white father [over at NASA] says NASA wants to do this. [Imagine this conversation:] “Johnny, you are representing the Pentagon; what do you want?” And he ended up signing a piece of paper, which said “This is what I want.”

Then the Pentagon would launch up to umpty-ump satellites over the next several years. They would be of various sizes, mostly about so big. There would be a few that were this big, and so on. So in order to get us to use the shuttle you'll have to be able to accommodate that payload mix. We're giving you the figures, the launches. We are giving you the weight and the volume requirements." So I have in my mind -- I assume it exists in reality -- a letter signed by Johnny which went to the administrator of NASA saying these various things that I just mentioned. It was also probably signed by Bob Seamans, as a principle user of space, that the Air Force needs so and so, which would be everything except the NRO.

I don't remember ever signing a document, but I'm not saying I didn't. I seem to remember people coming to me and saying what do you need? What could you use, and so forth.

And I said if you can accommodate this payload, we'd be happy to put it on the shuttle. [If you choose not to meet my needs, we can get along without it.]

MR. GARBER: Okay. What about Alexander Flax, now he had been your predecessor as NRO director, correct?

DR. McLUCAS: Yes.

MR. GARBER: Then he became head of a special outside review committee that was looking at the shuttle. I don't know how much of this you remember, but I wanted to get your input on how important you thought he was to the process of shaping the shuttle's design?

DR. McLUCAS: Well, you know, I had lost track of the fact that he had such a role [until I spoke to him recently. He said he was working with Ed David at the White House on this.] I can imagine he could be helpful in terms of continuity. Some of the largest payloads that we had in NRO were started under his direction, but they got bigger after that.

I just don't have enough memory of it to be of much help with that question.

MR. GARBER: Going back to 1969, I was wondering if you were at all involved with the Space Task Group that looked at the shuttle?

DR. McLUCAS: I don't remember.

MR. GARBER: Okay. Well, hopefully, to give me a sense of how you were juggling the many issues that were on your plate on a daily basis, roughly how much of your time was devoted to thinking about the shuttle? Was it just a meeting every once in a while?

Were you working on it more steadily? What kind of demand did it put on your time?

DR. McLUCAS: I'd say it was very sporadic. It did not involve a lot of time. It was mainly a question of drawing on my knowledge of the overall workload that we had and if someone comes in and asks [me] questions and I give them answers, I don't remember any times I said “Well, I'll have to do some work and get you an answer later.” In other words, it was very general in nature.

MR. GARBER: Now as Undersecretary of the Air Force at this time period, again, '69 to '73, were you involved in the Air Force agreeing to be a shuttle partner in 1971 and then in 1972 to kick in some money for building the launch facilities at Vandenberg Air Force Base? Was that more Dr. Seamans' role?

DR. McLUCAS: Well, I would say that was more his role. The way we -- I should make a comment about our mode of operating together. Those items in which he was the leader and I was his alter ego, we would talk over the issues involved in that particular program at that time. The way we operated was I would sit in on his staff meetings, find out what issues were on the table, sit with him and discuss with him and his assistants whatever those items were to the point where

I understood what his position was. [Obviously, I also made various points myself.]

Then as long as he was in the building and people asked questions, he would respond. If he was away, which he frequently was, I would say well, I've talked this over with Dr. Seamans and here's his position. (Usually it was my position too.) But since this whole thing was his responsibility, then I'd be speaking, I'd say, for him and not just with my own thoughts in mind.

So this reply in response to the question that you're asking is [how did he and I work together?] Could you rephrase your question?

MR. GARBER: Sure. Well, specifically, I was interested in the Air Force agreeing on paper to be a shuttle partner in 1971 and then in the next year, 1972, the Air Force agreed to kick in some money to fund the development of the launch facilities at Vandenberg. And I was wondering what your involvement was in those decisions.

DR. McLUCAS: Well, I think -- I would say now that my view then was, okay, to keep peace in the family I'd go along with this but not with any great joy. [I’m pretty sure that the number I came up with was $10 million.] If Dr. Seamans thinks it is enough of

an asset to the Air Force to invest some money in it, why so be it. He's gone beyond my own perspective as to how much I would be willing to pay for it. He wants to pay a little more in terms of being willing to build this facility, but so be it. In other words, I would be a somewhat reluctant supporter of the policy.

MR. GARBER: Okay. You implied, if I heard you correctly before, that the driver for the payload bay size requirements that you communicated to NASA were coming from the NRO side of the house rather than the Air Force side of the house. I wanted to confirm with you that that was correct and also ask you if you can discuss now what kinds of payloads these were? I don't need to know the specific details, but basically whether they were reconnaissance or some sort of military versus intelligence payloads that you were looking at flying on the shuttle.

DR. McLUCAS: We were talking about reconnaissance payloads which we wanted a certain precision which required photographic systems big enough to achieve the resolutions that we wanted. [We were] talking from the perspective of the time. Of course, everything involved in that was very hush-hush at that time -- most of it still is -- but I find it an interesting coincidence that the Hubble telescope looks

an awful lot like some of the satellites we built in those days. Why reinvent the wheel?

MR. GARBER: That sounds like an interesting story we can talk about at another time. Thank you.

In addition to the payload bay size, one other requirement that I'm interested in is the cross-range capability of the shuttle. In particular, it seems that the Air Force or perhaps the Pentagon at large or perhaps the NRO -- I'd like to try and parse out those distinctions a little bit more -- was interested in the cross-range capability because of the ability to do a polar orbit once around the earth and then to land again.

Now, this has been written about a little bit, but I wanted to get your impressions about whether this was really the driver for cross range or whether it was something else?

DR. McLUCAS: [Well, what I remember now is that I made no case for it at the time.]

MR. GARBER: Okay.

DR. McLUCAS: Now it may [very well be someone else's interpretation of the NRO requirement, but it is not one that I remember discussing in connection with the shuttle. As I said just now, Mike Yarymovych thinks he might have been the source of some comments

along those lines. But of course, he was not speaking as an NRO spokesman when he said whatever he said.]

How did I get so involved in this story?

MR. GARBER: Well, we were talking about the mission for the shuttle, the proposed mission for the shuttle to do a once around polar orbit and the implied requirement of cross range.

DR. McLUCAS: Yes.

MR. GARBER: Now you just described how a true reconnaissance satellite would be in orbit all the time. The reconnaissance satellites would be in geosync orbit so they would be watching the same spot all the time or they would come around every so often to look at a spot on the ground. But I'm still not quite clear on what the mission would be for a once around polar orbit. Would that be more of an Air Force military mission to launch something or to retrieve a satellite before the Soviets even knew what happened, or would it be somehow more for reconnaissance purposes? Would it be more of an Air Force mission or an NRO mission?

DR. McLUCAS: A good question. When I was running it, NRO was interested in that quick up and down mode, and there were people who felt that that was an important mission to be able to carry out.

In fact, it would be worth building an airplane that could do that if you could do such a thing.

MR. GARBER: A reconnaissance airplane?

DR. McLUCAS: Yes.

MR. GARBER: Like the U2 or something like that?

DR. McLUCAS: Like the DynaSoar.

MR. GARBER: Okay.

DR. McLUCAS: No, the U2 is a very slow airplane.

MR. GARBER: Or SR71, something like that?

DR. McLUCAS: Yes, extrapolation of the SR71 mission. [When you mention that, I get distracted by thinking about my SR71 flight.] But there is a class of, shall I say, military dreamers who think that it makes perfectly good sense to be able to, within a couple of hours, put an aircraft into space, overfly a target and come back down. [Sometimes these people want to drop something like a bomb, but realizing that it is very hard to drop something, they fall back on just going up to get some information.]

[Let’s talk about an example where you might want such a capability. Let’s say you wake up one morning and find that the Russians have invaded

Czechoslovakia. You don’t know what’s going on so you want to get information immediately. You would like to be able to launch something on very short notice, fly over the target area, get the information and give it to the President in a couple hours' time. From time to time, such questions came up and we did a number of studies of what might be good alternatives to achieve such a capability.]

Frankly, I don't remember raising that issue with the shuttle. That doesn't mean that I have a perfect memory or anything else. I don't know why it had that cross-range requirement [unless the people at NASA or the people higher up in the administration felt they wanted it. There were PSAC panels reviewing such things all the time and they might have been the source for such things.]

MR. GARBER: So you don't remember specifically what the once around polar orbit mission would have been for; is that correct?

DR. McLUCAS: Yes.

MR. GARBER: Okay. Let me ask it one more way and then we will move on to something else. Do you remember it being pushed by somebody on the Air Force side versus somebody on the NRO side?

DR. McLUCAS: No, I don't.

MR. GARBER: You don't recall either way?

DR. McLUCAS: I just don't remember either way.

MR. GARBER: Okay.

DR. McLUCAS: You should have been here 15 years ago [when I might have remembered it.]

MR. GARBER: Okay. In talking to some other NASA folks about the shuttle development, they mentioned that there was such a thing called the configuration change or the change control board. I'm not quite sure exactly what it was called, CCB, where they would sit down and hammer out different requirements and how that would affect the various subsystems and that was fairly frequently. I'm not quite sure how often, but fairly frequently. Did you participate in any of those meetings from your Air Force/NRO capacity?

DR. McLUCAS: Frankly, I don't remember doing it [but]I know that it is a standard practice to have such CCBs. I don't remember being personally involved in one for the shuttle.

Okay. So you don't recall if there was somebody else like Dr. Naka involved with that either, then, I guess?

DR. McLUCAS: No, I don't. You said you

talked to him?

MR. GARBER: I talked to him, yes.

DR. McLUCAS: As we sit here, I think of other people that I hope you talk to like Philip Culbertson.

MR. GARBER: Okay.

DR. McLUCAS: Have you talked to him?

MR. GARBER: I just made an appointment to talk to him in another month or so.

DR. McLUCAS: Okay. Because he is probably a very good witness.

MR. GARBER: Perhaps at the end we can go over the list of folks I have spoken to and you can give me more suggestions; is that okay?

DR. McLUCAS: Okay.

MR. GARBER: I'm fine.

Let's talk a little bit more about the different communities in and around the Air Force. You've given me an overview on the shuttle issue, but maybe you could just broaden the scope of your answer to address this question: what were the relations between the NRO, the Air Force and NASA like writ large during this time period, '69 to '73? Or you can continue to say '75 when you were still here as Air Force secretary?

DR. McLUCAS: Well, let's see. I remember the

relationship as being a very warm one. I remember meeting with Jim Fletcher and, let's see, who are the different administrators that would -- do you remember when Jim Fletcher served?

MR. GARBER: Fletcher started, I think it was '72. [Actually ‘71]. Paine was in office right before that.

DR. McLUCAS: Well, I'm going to be a disappointing witness here. My memory is that we had, shall I say, very cordial interaction[s with each other.] We had a high-ranking Air Force general who was sort of an official liaison [officer] and he was well-liked by the Air Force and well-liked by the NASA people. He was very effective in his role of dampening down any problems that might arise because of lack of information. General Jake Smart was in that role [for a while after he retired from the Air Force. I'm not going to remember who else served in that capacity.] I don't remember any problems--I just remember good working relations. [On another subject, I remember going to NASA when I was with DDR&E and talking to Ray Bisplinghof about my concern about the lack of NASA research for the benefit of the Pentagon. I said, look, you guys are not doing enough basic research on airplanes. You ought to do more. Ray gave me their

pitch about all the good things which he said they were doing on our behalf.] {As you ask me these questions, I'm describing a sort of a sweetness and light situation. I remember our relations as being generally good. It's probably not totally realistic, but that's the way I remember it.

MR. GARBER: What about the relations, in general, between the NRO and the Air Force at that time? You were in a prime position to see both sides of the house.

DR. McLUCAS: Well, that was a mixed bag. I was very sensitive to the fact that a lot of senior bluesuiters in the Air Force resented the existence of NRO. Some of the best people in the Air Force were very resentful about the NRO, which was a great disappointment to me because as head of the NRO, I thought we were one hell of a good outfit and we were doing all these wonderful things and satisfying a good fraction of the requirements that the President's office needed answers to.

At the same time, most of the senior Air Force officers thought that given the same amount of money, the Air Force would do a better job than the NRO was doing and that the creation of the NRO had been a mistake and that there were ways already established

whereby the Air Force Systems Command could work with NASA/CIA and could deliver anything that the NRO could do.

Well, if you [ask] what was the difference between having NRO manage it and having Air Force manage it, the main difference was we were bypassing various levels of Air Force management which some people thought were adding bureaucracy, but not adding capability.

MR. GARBER: I'm sorry, bureaucracy, in which side, the NRO side, you mean?

DR. McLUCAS: No, on the part of the Air Force. There were too many levels of review -- too many steps in the chain of command in the regular Air Force.

MR. GARBER: Oh, I see. The NRO subverted that or found out a quicker way to get the job done?

DR. McLUCAS: Yes. So we considered ourselves a streamlined management that could do things faster, that did not overlay everything with several layers of unnecessary management. [And we felt that we did not lose efficiency by skipping some essential layers in terms of productivity or anything else. It was just a streamlined and better way to go.] That was the NRO view. I supported that view, but I thought it was

too bad that the Air Force didn't appreciate what we were doing and especially it seemed to me like sour grapes on their part to downplay what we were doing. They felt so strongly against NRO because they were jealous, envious, et cetera. So to the extent possible, I tried to play that down. First, I tried to be a good guy, when wearing my hat as a deputy to Dr. Seamans. I would work with most of the top Air Force people on other issues than NRO. So that if I came around on these other issues, I would not be considered compromised by the fact that I was from the NRO. Rather, on those other overtures, I was coming into their lives as his alter ego. And to some extent, I was successful.

I think there were a lot of people in the hierarchy who felt that the NRO was a bad idea, but if it was McLucas doing it, it's probably better than it would otherwise be.

MR. GARBER: Well, that is a nice compliment for you, certainly. Going back to after you outlined those relations between those three entities, the NRO, the Air Force and NASA, given that background, let me go back to something we talked about a little bit earlier, which is who is pushing for what and how that related to the shuttle. Let me ask it this way:

Outside of NASA, were there any clear advocates or clear opponents to the shuttle? I'm thinking about, obviously, the Air Force or the NRO or someone else at the Pentagon.

You described yourself as a reluctant subscriber to shuttle and Dr. Seamans as well, as I understand it. What about other people that were there, were there any other people clearly pushing one way or the other that you recall?

DR. McLUCAS: A quick answer is no. I don't remember that as being much of a big deal. I'm afraid I'm just not very helpful on that subject.

MR. GARBER: Okay. So your fuzzy memory is just roughly that everybody was sort of in the middle, and reluctantly agreeing to it. Is that roughly accurate?

DR. McLUCAS: Yes, I think so. I don't think many people in the Air Force felt they had to worry all that much about the shuttle. I think most people in the Air Force felt it was NASA’s problem to deal with. On the one hand, we don't want to take it on as our problem, but, okay, let them do it if they want to.

MR. GARBER: Again, you had meetings every once in a while to discuss this, but, say, in the four years that you were Air Force under secretary, roughly

how many meetings do you think you had to talk about this?

DR. McLUCAS: Use of the shuttle?

MR. GARBER: To cover the shuttle design and use of the shuttle?

DR. McLUCAS: Maybe about half a dozen.

MR. GARBER: Okay. Again, you recommended that I talk to Johnny Foster, but you had just roughly, from your opinion, put him in this general camp of sort of middle of the road endorsing shuttle. Is that correct?

DR. McLUCAS: Uh-huh.

MR. GARBER: Okay.

DR. McLUCAS: [Johnny Foster is really such an outgoing guy.] He's not a passive participant on any subject. He's up front, he's enthusiastic. The last time I saw him he was still running up the stairs. He'd say: Well, gentlemen, what are we meeting for today? Let's get on with it! He's that kind of guy. So if he was asked to round up support for the shuttle, he would do it. In this case, I think he was asked to speak for the Department of Defense (DoD) as a whole about their possible utilization of the shuttle and when subsequent questions came up, he should be a good representative for the whole shebang and he would

understand the views of all the potential customers and the potential uses and be in a position to represent them properly.

MR. GARBER: What do you think about the contention that the main reason that the Air Force supported shuttle was simply to advance the state of technology?

DR. McLUCAS: I hadn't heard that, but I'm sure that was a subsidiary, a desirable thing about the shuttle. It would push the technology of aerospace. I don't ever remember seeing this focus being put on it as far as the Air Force was concerned.

MR. GARBER: So are you implying that NASA was doing it just to push the edge of the envelope technology for them instead of the Air Force?

DR. McLUCAS: Well, I'm saying there is certainly a class of people, in which I include myself, [that believe that NASA is the descendent of the NACA and as such, they should continue NACA’s role of making advances in the aerospace field, irrespective of whether there are specific requirements for everything they do].

MR. GARBER: Okay. After you communicated the requirements for payload bay size and -- well, I was going to say cross range, but it sounds like

perhaps you weren't so involved in the cross range aspect of it; is that correct?

DR. McLUCAS: I think that's correct.

MR. GARBER: Let's talk about the payload bay requirements and the size, the dimensions and the payload capacity. After you communicated those to NASA, that's basically what the shuttle ended up with, it's a 15 by 60 bay with, I think, a 60,000 pounds capacity. Do you feel that in retrospect now that the military/NRO's input on this in defining those requirements was critical? On the one hand, you could say, yes, because that's the way it came out. On the other hand, potentially you could say no and say that NASA perhaps would have done this anyway. I have spoken to some people who have come down on both sides of this issue, so I was wondering what your take would be?

DR. McLUCAS: Your specific question is?

MR. GARBER: The specific question is how significant do you think the military/NRO's role was in defining the payload bay requirements for shuttle? Would NASA have done that the same way without your input?

DR. McLUCAS: Well, I think the answer to that is no, they would not have. I think that NASA would

have been better off if they had not had that requirement and had settled for something somewhat smaller.

NASA struggled over the years to get a reliable engine for the shuttle to achieve those, shall I say, somewhat extreme requirements. To get the ability to handle those huge payloads. They could have handled 90 percent of the requirements with, let's say, a 40,000 pound payload versus 60,000.

MR. GARBER: I'm sorry to interrupt, but you are saying that NASA could have handled its own payloads that way, not counting NRO or Air Force payloads with a 40,000 pound payload?

DR. McLUCAS: I think NASA would have been better off to build a shuttle that did not have such extreme requirements. If the shuttle had been smaller, it would have been easier to build. That's all I'm saying because, you know, the engines are always on the edge ready to blow up because you're driving them too hard. [Also the larger shuttle means] various other requirements such as the size of the booster rockets and so forth are all affected.

I don't think NASA had any requirement for that large a payload bay. I don't think they would have built it that way if there weren't some potential

customers whose business they really felt that they had to have. I frankly don't know that I understand the NASA philosophy on this, but my version of it is that they said we've got to build a shuttle that will handle everyone's needs, otherwise we won't get the support needed. If we go to the Hill to testify and get asked whether this will handle not only our own payloads but those of the Air Force, etc., we have to say yes. If we say no, they'll say well, how can you justify this thing if it won't even handle the payloads we know about much less the ones that haven't been invented yet?

I'm making this up, I don't really know. I guess there are people who have the specific answer to that question. There should be people like Jim Fletcher, Tom Paine, and so forth, who would know the answer but both of whom are dead.

On the other hand, Phil Culbertson is sitting there in Florida waiting for your phone call.

MR. GARBER: I hope to speak with him soon. I'm going down to Florida at the end of February.

Do you feel that overall the NRO/Air Force got everything that you wanted in terms of capabilities of the shuttle?

DR. McLUCAS: That's a trick question.

MR. GARBER: I didn't mean it that way.

DR. McLUCAS: I mean it implies that the Air Force wanted the shuttle.

MR. GARBER: Well -- okay, go ahead.

DR. McLUCAS: We wanted to have boosters to launch certain payloads. As far as I know in 95 percent of the requirements there was no need for a man on board. I'm not saying 100 percent, because I don't know about that last 5 percent. I don't know personally of any payloads which required a man on board, so what we needed was a big booster, which we eventually had in the Titan IV and the timing of that was based on how hard we worked to get it. We had Titan IIIs a long time before we had Titan IVs. If no shuttle had been built, we could have had Titan IVs sooner.

So I have trouble justifying the shuttle from a military standpoint.

MR. GARBER: What do you think the prime Air Force mission was? How was it articulated for the shuttle? Do you recall discussions of that? Like once the Air Force committed verbally or politically to going ahead with the shuttle, even though it wasn't kicking in any money except for the launch facilities at Vandenberg. Okay, the Air Force had agreed to

support it politically but what was the real Air Force mission? Do you feel that there never was one clearly defined?

DR. McLUCAS: No, I agree with you, I don't think there was an Air Force mission clearly defined. I think there was an agreement which was put together by Johnny Foster which said that the shuttle will be available -- will be capable of certain things and that to that extent the military should use it in the normal course of business. That it has certain payload capabilities and that the extent to which NASA can build a launch[er] to meet those requirements, to that extent it would be valuable to the military which I think is different than saying there was a requirement for the shuttle.

There is a requirement to be able to launch certain payloads and the launchers can be like the shuttle or like the old expendable boosters and the military didn't have a strong feeling one way or the other.

MR. GARBER: Okay. Are you ready for another question. In your book called Space Commerce, you wrote that at the end of the Carter Administration when the shuttle program was in jeopardy in the late 70s, "that as the cost of the shuttle grew, all financial

realism and pricing policy went out the window and prices were set for purely political reasons." That last part's a quote.

DR. McLUCAS: It sounds like a quote.

MR. GARBER: Pardon me for reading it verbatim.

How far back in time do you think that this applies, that the unrealistic pricing policy for political reasons applies?

DR. McLUCAS: From the opening day. Everything was overstated. Some of that was NASA's fault. A lot of it was just a sign of the times, that space was going to be this wonderful new environment, people would be going up every few days. We never came within an order of magnitude of the total volume of traffic that we had in mind when we were contemplating building the shuttle.

My story is that we envisioned a system that would be launched every week, maybe once a week or maybe twice. We would even put up such a system so often that you would get the economies of scale and you would achieve unit launch costs in the few million dollar range.

I seem to remember 5 million a launch. I'm not sure about that figure, but, anyway, a low number

like 5 or 10 million, but what we ended up with was a system where the launch costs were measured in the range of hundreds of millions. It depends on when you look as to what the estimates were, but there is a string of dots you could connect that shows the cost going up, up, up. The later it is, the higher the estimate is.

So instead of achieving something where you reach a peak in cost as you make investments, and then as you make more and more launches, the cost comes down -- we never got to that state; this never occurred. So they went up into the hundreds of millions and stayed there.

MR. GARBER: In these discussions they had about shuttle design and for Air Force and NRO's participation, did you ever sit down and talk about what kind of flight rates seemed feasible?

DR. McLUCAS: Many times.

MR. GARBER: And what did you think at the time?

DR. McLUCAS: They were always overestimated.

And, of course, the shuttle loss, the Challenger loss, added several years of delay and several degrees of realism to the whole discussion. I think I said in the book that the psychology of this

whole thing was transformed by that accident and we totally flip-flopped on our policy. [As I said in the book, we went from a plan to launch as many payloads as possible on the shuttle to one where we would launch only those payloads which required the shuttle.]

I remember a conversation I had with Jim Beggs when he was NASA administrator. He called me and he was terribly enthusiastic (this was before the Challenger accident.) We had agreed to launch some of our payloads -- I was at COMSAT at the time -- on the shuttle. He said, John, tell me what our price would have to be so you would commit all your launches to go by shuttle? I said, there ain't no such price.

There are certain market conditions out there. You and everyone else in the business are quoting prices that have very little to do with costs and as long as that is the situation, there will never be a time when I can say that we can give you all of our business. There is a story going around and I can't prove it but I believe it is true.

[End Tape 2A]

Whatever prices are set by you at NASA, the Europeans at ESA will underprice you if only by a dollar. COMSAT is a member of the Intelsat consortium [and the other large members of Intelsat are the same

Europeans who build the Ariane rockets.] Therefore, we have to take their views into account. In order to get unanimity on NASA doing all the launches, we would have to do impossible things. There's no way we'd ever get ESA people to vote not to use Ariane as a launcher. [The French, for one, would demand that a certain fraction of the launches be done by them.]

Therefore, since you are using a nonrealistic price already, there is no way you can underbid the other supplier and force us to buy it from you, because some of our partners will underprice you a dollar after you have set your new price.

Well, enough of that.

MR. GARBER: On a related topic, though, in your Space Commerce book you also discuss how the Air Force tried to adapt as many of its payloads as possible a little later on -- I guess we're talking about the late '70s now. The Air Force tried to adapt as many of its payloads as possible to be able to fly on the shuttle.

DR. McLUCAS: Yes, it was a very expensive activity. By the way, I think it was the early 80s.

MR. GARBER: Uh-huh. How did the military or the intelligence community feel about this? Did they feel that it made sense or that it was a waste of time

and money and they resented it or what?

DR. McLUCAS: Well, I think the answer at that time would be that the people in charge felt that it was important enough to focus attention on the shuttle. The way to keep it viable was to make sure that any new payloads that were developed were developed with the shuttle in mind. I had my own attitude about what the people at that time did. Hans Mark was involved.

Have you talked to him?

MR. GARBER: No, but I plan to and I have a couple of questions for you about him, as well.

DR. McLUCAS: His attitude when he came to the Air Force after having served at NASA not surprisingly was pro-NASA. So he used his influence to bolster support in the Air Force for the shuttle.

I remember reading an article that someone wrote about the dangers of the militarization of NASA and I said to myself, that may be a danger, but a more serious danger is the NASAfication of the Air Force. It seemed that we had people going to the Air Force and using their clout in the front office to say that the Air Force had to adapt all those expensive payloads so that they would be shuttle compatible. Of course that will be very expensive. Not only did we incur a lot of costs that way but then the shuttle was grounded,

making the whole exercise very counterproductive.

MR. GARBER: When the shuttle got grounded after the Challenger accident, right?

DR. McLUCAS: Yes.

MR. GARBER: But now in your book you also discussed that in the early '80s before the Challenger accident, but after the shuttle first flew operationally.

--

DR. McLUCAS: April 12th 1981.

MR. GARBER: Right. That after the shuttle first flew the Air Force changed its mind and realized that the shuttle-only policy wouldn't work. The Air Force went forward with the CELV, the complementary expendable launch vehicle program. What do you think made the Air Force change its mind at that point? Was it seeing the shuttle fly somehow and then realizing that somehow it couldn't do what they thought it could or what?

DR. McLUCAS: I think it was just a dose of realism. I credit Pete Aldridge with that and I used to say to him: “Every day I wake up and thank God for Pete Aldridge. Thank God he did not leave us dependent on the shuttle.” You know, Pete also started training for a space flight on the shuttle himself, which has

nothing to do with anything. But I considered it a very realistic thing to do to keep that complementary line going.

MR. GARBER: Well, we were talking about the Air Force's decision to go ahead in the early '80s and seek the CELV policy.

DR. McLUCAS: Right.

MR. GARBER: It seems like Hans Mark was a real pusher to get the Air Force to participate and then the Air Force sort of reversed itself. I wanted to get your views on that.

DR. McLUCAS: Well, I thought that Hans was letting his biases show in pressing the Pentagon to go his way to make NASA look better by getting everyone signed up to take the oath that they would use the shuttle. To spend hundreds of millions converting payloads to be shuttle compatible and to spend, I guess, it was literally billions on the West Coast launch facility. I don't know how much of that decision lay at Hans' feet, but I think a large part of it goes there.

I think that whole exercise of becoming dependent on the shuttle was counterproductive; the complementary ELV was essential and I still remember the sinking feeling about not being able to get into

orbit when we wanted to.

MR. GARBER: After Challenger, you mean?

DR. McLUCAS: Yes. That everybody knows that all launchers will fail at one time or another. Therefore, the more different launchers you have the better off you are. Usually we've decided to keep building at least one model of a given class.

But anyway, as I say, I was very grateful to Pete Aldridge for having taken a stand, you might say independent of the Hans Mark approach.

I saw Hans Mark recently at the secretary of the Air Force's Christmas party and he is still at the Pentagon, as you know.

MR. GARBER: Yes, he's DDR&E, right?

DR. McLUCAS: Right. Yes, he's got the title, but not the job.

MR. GARBER: Really. What do you mean by that?

DR. McLUCAS: Well, what used to be called DDR&E is now called the Undersecretary for acquisitions and technology – the job held most recently by Jacques Gansler, which is the old DDR&E job. DDR&E is now a shell. That's my statement. I don't know if you would agree.

MR. GARBER: Okay. Going back to your

statement that you are thankful to Pete Aldridge every day for diversifying the launcher fleet basically. That is in the early 80s that you're talking about, correct?

DR. McLUCAS: Yes.

MR. GARBER: Before that, though, did you ever feel that relying on the shuttle for all these NRO and Air Force payloads was a mistake? If so, when did you think that and what prompted that?

DR. McLUCAS: [I'm afraid I missed the critical phrase in there.]

MR. GARBER: I'm sorry. Did you ever think that relying on the shuttle to launch all the Air Force and NRO payloads, relying solely on the shuttle was a mistake before Pete Aldridge came into office in the early '80s? If so, what prompted your thinking that way and when did you think that?

DR. McLUCAS: Well, as far as I know, I thought it all along. In other words --

MR. GARBER: You characterized yourself as a reluctant supporter, but you still supported it somewhat, correct?

DR. McLUCAS: Yes. I supported it because how could I not support it? [If boosters are typically a problem in terms of launch reliability and someone has

another way of launching things, why not be able to use it?] But if somebody comes along later and says, that's the only way you [can get into orbit, that's a very] different statement. To say that you are willing to support it and use it if it will meet certain requirements is one statement, but nobody asked me [whether I would be willing to use it while we closed down every other booster production line]. Then you are asking a much more difficult question, and I've never been able to answer that one.

I'd have to say, look, I agreed to use it if it is available and it meets my requirements. I didn't agree I would close down everything else in order to generate business for the shuttle.

MR. GARBER: Well, when do you think those rules of the game changed, that it would be everything only on shuttle?

DR. McLUCAS: Well, I don't know, but it changed very closely after Hans came to the building. I don't know if he brought that line with him or whether he was executing a policy which someone else gave him, but it certainly happened about the time he showed up.

As well, of course, with Harold Brown. Wait a minute. Let me start over. Harold Brown was secretary

of Defense and that was in '76, right?

MR. GARBER: Carter Administration, right.

DR. McLUCAS: Harold Brown brought in John Stetson as the secretary of the Air Force. Hans was under secretary.

MR. GARBER: I believe Dr. Mark was secretary of the Air Force in the late '70s?

DR. McLUCAS: Yes. Well, he moved up when John Stetson left. According to me, John Stetson never found his way to the men's room, and it wasn't too long before Hans Mark moved up. Sometime in there about the time Hans Mark showed up is when we went to the shuttle only approach and the beginning of a very bad policy. [And by the way, if I'm not mistaken, when the Carter crowd left town, Hans moved back to NASA as deputy administrator.]

MR. GARBER: Okay. Now in the early '70s, however, the folks from Mathematica -- perhaps you recall that study -- they were predicting flight rates of 50 shuttle flights a year and basically assuming that everything, civilian payloads, scientific payloads, commercial, military, intelligence, everything would fly on the shuttle. So do you feel there is some kind of disconnect there, that you on the NRO and Air Force side didn't really sign up to that at

that point even though they were assuming that or how did that play out?

DR. McLUCAS: Well, I don't agree that we ever signed up for it, but I claimed that no one ever stood over me and said, look, this is going to be the only game in town. You've been acting reluctant about the shuttle, but if it is the only game in town, you'd be foolish to be so reluctant. You should be saying I not only support, but I want to make sure it gets supported in such a way that blah, blah, blah. [But no one ever went through this exercise with me.]

Now, whether they were doing it and I was ignoring it, that's conceivable. I may have been sort of laughing about this. You know, they were assuming all these launches being handled by the shuttle, and came up with these artificial launch rates based on their numbers – maybe I said: let them have their fun.

MR. GARBER: Okay. let's take a little bit different tack and I'd like to ask you what your take was on establishing or creating a reusable launch system instead of modifying existing ELVs. What do you think about that in hindsight or what did you think at the time?

DR. McLUCAS: I'm afraid I didn't track you.

MR. GARBER: The conventional wisdom at the

time, and I still believe it is the conventional wisdom, is that by going with a reusable launch vehicle, you save costs in the long run. It may cost a little bit more in terms of development up front, but that it will be cheaper in the long run because you will be able to use it repeatedly without manufacturing and throwing away components. So that is one approach, totally reusable.

The other approach, of course, is ELV where you launch it once and you never recover it. And the shuttle is sort of a mix. It is mostly reusable, but it is not totally reusable. The refurbishment of the rockets isn't exactly the most efficient system, the external tank burns up, so it is sort of a mix in terms of reusability. But the premise behind the shuttle, it seems to me, is that it was based on this concept of we should design something that is totally reusable and that in the long run that will be cheaper.

Do you think that assumption made sense in hindsight, and what did you think about that? Was there discussion about the two approaches of using an RLV versus an ELV approach at the time and what were you coming out and saying at that time in the early '70s?

DR. McLUCAS: I don't remember having a

position at that time. I don't remember being asked that question. I think my belief all along has been a mostly reusable system is the way to go. The argument has changed a little bit lately when people say single stage to orbit. I don't believe in that. If I had left my jacket on, I could show you a pin in the jacket.

MR. GARBER: You need a pen?

DR. McLUCAS: No, a P-I-N.

MR. GARBER: Oh, pin, I'm sorry.

DR. McLUCAS: A pin which shows a reusable rocket. It's an X34. It's small.

MR. GARBER: Two-stage?

DR. McLUCAS: Two stage. I don't think a single-stage is practical. You might be able to demonstrate it as a stunt, but I don't think it would be cost effective. I believe in reusability, I think it is the way to go.

I think it is very practical, as long as you don't make some statement like single stage. I've always felt this way. In other words, I'm not against the shuttle as a concept except it has to be man rated and, therefore, has all these features which come from being man rated which would not be required otherwise which made it cost a lot more money.

MR. GARBER: Speaking of that, more generally, do you feel that the shuttle is too complex a design beyond just the human rating? There are some people who would argue more generally that NASA likes to take a high tech approach to things and, in effect, over design[s] certain systems. Do you feel that's the case with the shuttle or not?

DR. McLUCAS: Well if you're going to take people on board, I don't think it is over designed. I think the main thing wrong with the shuttle development was the exaggerations, the talk which was unjustified about what the cost would be and, [therefore, we were led into it gradually so we never faced reality. What we thought we were doing was assisting them by agreeing to use the shuttle under certain conditions for certain payloads. I would like to think that if NASA had known what it would eventually cost, they probably would have waited longer to start it until they had better ideas.

MR. GARBER: Were you surprised at all by the final design of the shuttle?

DR. McLUCAS: Not really. They talked about how it was not nearly as good as it could have been if they had had more money. They had tried to build it cheaply. They tried to reduce the R&D cost by settling for a system which is more expensive to operate. I

don't know the extent to which that is a true statement.

The theory is they could have built a much simpler system if they had been willing to spend enough money during the R&D stage. That's not apparent to me. I'm not saying it's wrong, I just say I don't know whether it is true.

Do you have a feeling?

MR. GARBER: Well, I'm interested in your opinions today.

DR. McLUCAS: My opinion is that considering what they were trying to do, the shuttle is not too bad an approach except, as I said earlier, it ended up depending on the engine which was being overdriven and too close to its safe margins and that a lot of the exaggeration had taken place about the actual cost of the system. I also think it was a mistake not to make the tanks reusable.

I think I have something in my book about that.

MR. GARBER: Okay. I've just got a few more questions for you if that is okay. Your personal view on this, do you view space as an extension of air travel or something separate?

DR. McLUCAS: Totally separate.

MR. GARBER: Were you aware of the long

history of aerospace planes that were designed before the shuttle, some even before the space age began?

DR. McLUCAS: Aerospace planes?

MR. GARBER: Yes, like Valier's designs, Sanger's design for an antipodal bomber, that kind of thing?

DR. McLUCAS: Like DynaSoar?

MR. GARBER: DynaSoar.

DR. McLUCAS: Well, I don't think that I focused much on them. If you say was I aware? Yes, in a sort of general way.

MR. GARBER: Pardon me?

DR. McLUCAS: I'm aware in a general way that such designs have been considered. I was involved in the DynaSoar back in the 50s. [We made proposals on it. Like I said, when I was a potential subcontractor to Glenn L. Martin, the proposed prime contractor.]

MR. GARBER: Is that from your Mitre experience?

Is that what you mean?

DR. McLUCAS: No, that's before that, [at HRB] back in the '50s.

MR. GARBER: Okay. But you don't think that his history of aerospace plane designs had much of an influence on people's thinking in terms of shuttle?

DR. McLUCAS: I don't believe so.

MR. GARBER: Okay.

DR. McLUCAS: But I've never really, you know, focused on this issue. I don't claim to know how the NASA people got educated to the design they came up with.

MR. GARBER: Sure. Well, let me ask you an Air Force question then. Do you think that Air Force's affinity for airplanes rather than spacecraft influenced the design at all?

DR. McLUCAS: Well, yes, I think so.

MR. GARBER: How did that play out?

DR. McLUCAS: Well, I mean, it lands in a conventional fashion. I haven't thought about how else it could land.

MR. GARBER: Well, you could have a ballistic capsule or a parachute for example.

DR. McLUCAS: Yes, right. But would that be cheaper or better somehow?

MR. GARBER: You could have a pure lifting body without delta wings.

DR. McLUCAS: Yes.

MR. GARBER: The conventional wisdom is that the reason that the shuttle has wings at all is that the Air Force wanted the cross-range requirement and

then if you wanted cross range, you needed delta shaped wings instead of straight wings that Max Faget was pushing, right?

DR. McLUCAS: Sure. Am I saying that the ways to improve the design by giving up the cross range, I certainly buy that, [but I'm not smart enough to know whether we would need a cross-range capability. As far as I know, we have never used it.]

MR. GARBER: Right. But the conventional wisdom is that the Air Force, as some kind of nebulous institution, was pushing for this cross-range capability and I've been trying to nail down exactly who was pushing for that and why?

DR. McLUCAS: And you're not getting much comfort here. I don't know who it was.

MR. GARBER: Okay. So my question a few minutes ago to you about the Air Force's presumed affinity for airplanes rather than spacecraft, that's another way of getting at this question of why the shuttle has wings, basically.

DR. McLUCAS: Uh-huh.

MR. GARBER: It is really more of a broader social concept that in the background of somebody's mind they prefer airplanes rather than spacecraft and so they figure it should be viewed more as an airplane

rather than a spacecraft even though it is more of a launch vehicle, spacecraft and an airplane, all three.

DR. McLUCAS: You know, wings are hard to beat.

MR. GARBER: In what way?

DR. McLUCAS: For landing. We've even talked about putting wings on things to land on Mars. There you've got very little atmosphere to play with. Here you've got a very good atmosphere. Maybe too much atmosphere.

These are interesting questions you're raising, but I feel like I'm flunking the course.

MR. GARBER: It is just your opinion.

DR. McLUCAS: I'm not going to come up with anything.

MR. GARBER: Okay. Well, if you come up with anything later after we talk, please let me know.

I know this has been a long interview, but you have been very helpful and I've got through a lot of good questions here with you. You have provided some excellent information. Is there anything else that you would like to add for the record at this point?

DR. McLUCAS: Well, there's a couple of things I would like to see NASA do. My first contact with NASA was in 1962 when I went over to say that the

Pentagon felt that it was short changed by NASA not doing [enough work] on advanced aircraft systems.

As I look at the almost 40 years since then I think there's been a consistent feeling on people's part that NASA has gotten so taken by its space mission that it misses out on frequent opportunities to be more helpful on aeronautics.

I think that you cannot make a case in today's world that there is any given fraction of aeronautical research that ought to be done by NASA, but it ought to be a significant fraction of the total.

Let's say the Pentagon spends $10, NASA ought to spend a couple of dollars. In other words, they should be an important player.

What else do I think?

MR. GARBER: Anything else related to shuttle development?

DR. McLUCAS: I think the shuttle is not a bad compromise considering all the requirements that were laid on it and that when they say we're going to build a replacement, they're probably going to have trouble coming up with a better design, better in the sense of being considerably more cost efficient.

There was a version of the shuttle which I think was called the heavy lift vehicle. Let's see. I

haven't thought enough about it lately, but it was based on using the shuttle's engines, rockets, tanks, etc., but not having a man on board. It would be flown by an autopilot. You don't build a shuttle. You just take the propulsion system and build into the base of your rocket.

MR. GARBER: Use the space shuttle main engine and put that in another ELV?

DR. McLUCAS: Yes.

MR. GARBER: I'm not sure what you're referring to. That's an interesting concept though. What's a rough time period for this? What's the rough time period for this thing you're thinking of?

DR. McLUCAS: Ten years ago. Well, anyway --

MR. GARBER: Okay.

DR. McLUCAS: I mentioned something I felt strongly about and still do that NASA has done a lousy job by throwing away all those external tanks. That they should have a variation on their missions which allows the occasional tank to be left in orbit.

MR. GARBER: You've written about this.

DR. McLUCAS: And if we would do that once in a while, the outer sky would be full of NASA payload bays. They could be strapped together to make one hell of a space station. Oh, the lost opportunities!

That reminds me of, what was his name, Wolfe - - MR. GARBER: Pardon me.

DR. McLUCAS: I'm thinking of "Look Homeward Angel" by Thomas Wolfe. Anyway, I guess we've come to a logical stopping place?

MR. GARBER: Yes, that sounds good.

(The interview of John McLucas was concluded.)

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