

George M. Low Oral History Interview – JFK#1, 05/01/1964
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Biographical Note

George M. Low (1926-1984) was the Deputy Director for Programs of the Office of Manned Space Flight, National Aeronautics and Space Administration from 1963 to 1964. This interview covers the space program during the Kennedy administration, in particular the Mercury and Apollo programs, and the space race with the Soviet Union, among other topics.

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George M. Low– JFK #1

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ORAL HISTORY PROJECT

JOHN F. KENNEDY LIBRARY

Interview with
Mr. George M. Low

Deputy Director
Manned Spacecraft Center
National Aeronautics
and Space Administration

Recorded on May 1, 1964, at
NASA Headquarters, Washington, D.C.

Interviewee:

George M. Low

George M. Low

Interviewers:

Addison M. Rothrock

Addison M. Rothrock, NASA Consultant

Eugene M. Emme

Eugene M. Emme, NASA Historian

Jay Holmes

Jay Holmes, Office of Manned Space Flight

Interview with Mr. George M. Low

Dr. Emme: This is an oral history interview for the John F. Kennedy Library and the NASA Historical Program with George M. Low, Deputy Director of the NASA Manned Spacecraft Center, Houston, Texas. Mr. Low has been responsible for manned space flight programs in NASA Headquarters since October 1958, until his transfer to Houston this month.

This interview was made at NASA Headquarters on May 1, 1964. Also participating were Dr. Eugene M. Emme, NASA Historian, Mr. Jay Holmes of the Office of Manned Space Flight, and Mr. Addison Rothrock, NASA Consultant.

George, I believe we should start our historical review of NASA's manned space flight program during the administration of President Kennedy by asking you the places and events that you had personal contact with the late President.

Mr. Low: Unfortunately, I had only one contact with President Kennedy, and this was six days before he was assassinated. As you will recall, he visited Cape Canaveral on November 16, 1963, for a fairly brief tour. He reviewed the manned space flight program, flew over the new Cape Canaveral area, the so-called Merritt Island Launch Area (MILA), in a helicopter, and went out to sea to watch a Polaris launching.

My own part in the proceedings that day was a relatively short one. The President arrived during the morning of the 16th on the skid strip at the Cape and immediately went in a motorcade to Launch Complex 37, the Saturn launch complex. Outside of this complex we had the first Gemini spacecraft, the spacecraft that was subsequently launched on April 8, 1964.

The President's first stop on the tour was at this spacecraft, where we briefed him on the Gemini program. During this briefing, which was conducted by Astronauts Gordon Cooper and Gus Grissom, and myself, we discussed the Gemini program and its current status.

I was very impressed, at that time, by the President. As I mentioned, it was the first time I had met him personally.

the Kennedy Administration and the national space program, particularly the manned space flight aspects of the national program, you had a key role in NASA's side of the work that went on, arriving at the historic decision announced by the President before the Congress on May 25, 1961.

The decision to land an American on the moon in this decade followed rather a tortuous history as far as manned space flight was concerned. It started quite apart from the hard work and problems of the Mercury program, which was coming into the launch phase of its program in early '61. President-elect Kennedy had appointed a Committee, under Dr. Jerome Wiesner, to make recommendations to him concerning the national space program. This, in turn, followed a rather crimping budgetary treatment of Mercury and Apollo in the last Eisenhower budget.

I wonder if we might talk now about this transition period from the Eisenhower Administration to the Kennedy Administration, and how this affected you people in the NASA manned space program. Obviously, the Wiesner Report of January 10, 1961, was a detailed written report, an unclassified version of which was public knowledge two days later.* It was very critical of Mercury and the NASA leadership. What about this period of transition from one administration to the other?

Mr. Low: Before I go into details on that, I think it might be interesting to note that three years ago today, early in May 1961, four or five days before Alan Shepard's flight, most of us concerned with manned space flight were very deeply involved in the Mercury program. We worried about the day-to-day details of that program, and our future was tied completely to the Mercury program. But we did not know whether there would be any manned space flight program beyond Mercury. We did not know whether the country would support a major effort beyond Mercury in manned space flight.

Two years ago today, ground had not yet been broken on the Manned Spacecraft Center at Houston. As you know, today we have a going concern there, with 2500 people working on a day-by-day basis on the Gemini and Apollo programs. In the same time period, launch vehicle development facilities were being built in Alabama, Mississippi, and Louisiana; launch facilities in Florida; and a team of contractors to build boosters and spacecraft for the Gemini and Apollo missions started work.

This, perhaps, paints a clear picture of what has happened in this three-year period. The work leading up to that, of course, did take place during 1960 and early 1961. The Space Task Group at Langley Field, the group that is now the Manned Spacecraft Center at Houston, prepared preliminary plans for a program beyond Mercury, early in 1960. I don't recall the exact dates, but I believe that in the

* For unclassified report to the President-elect by the Ad Hoc Committee on Space, see NK-33 [NASA] microfilm roll 11, classified confidential.

spring of 1960 the team from the Space Task Group went out and briefed all of the other NASA Centers on our thoughts for manned space flight beyond Mercury.

This effort culminated in a briefing to NASA Administrator Glennan on July 9, 1960. At that time we gave Dr. Glennan, Dr. Dryden, and Mr. Horner, who was then Associate Administrator of NASA, a description of the advanced manned space flight program as we then saw it, its scheduling implications, and its costs.

Now at that time, the program we had planned was one not leading to a lunar landing but one that would stop after the circumlunar flight.

Mr. Rothrock: Gemini was not in it?

Mr. Low: Gemini was not in the picture. I was trying to recall some of the planning that occurred prior to this, in 1959 or early 1960. This was done by the Goett Committee. Do you have any record of that, Gene?

Dr. Emme: Just slight knowledge that such did exist. Who was in charge of the Space Task Group at Langley?

Mr. Low: Bob Gilruth was Director of the Space Task Group. The Space Task Group at that time reported to the Goddard Space Flight Center under Harry Goett. In 1959 or 1960, Abe Silverstein set up a Committee under Goett to study future manned space flights. Do you recall anything about this Committee?

Mr. Rothrock: I'm thinking back, George. I remember the Committee existed, and I'm thinking in terms of the NASA long-range plans that were issued at this time. We mentioned the manned lunar flight, the circumlunar flight, but as something post-1970 and as something that the various devices were leading to, but on which no decision had been made.

Mr. Low: The Goett Committee included people like Al Eggers from Ames and Max Faget from Space Task Group. I served on it representing Abe Silverstein. There were several other people--I don't recall who they were. As I recall, the Committee deliberated whether the next major step in manned space flight should concern itself with a large space station program or a deep space program. The basic conclusion of the (Goett) Committee was that a deep space program (and by deep space I mean anything beyond earth-orbital activities) would lead to a quicker, focused advancement of the technology needed for manned space flights.

On the other hand, the (Goett) Committee also felt that making a lunar landing, or planning for a lunar landing, was a step which was too far beyond what we were willing to talk about at that time. So the recommendation of the Committee was that the manned space flight effort of NASA should be focused on a circumlunar flight.

Out of this Committee's recommendations, then, the Space Task Group prepared a program plan. They presented this plan, as I mentioned before, to the NASA Research Centers, with primary emphasis on informing the Centers of the kinds of research which should be carried on to make such a program possible.

Dr. Emme: Who was Chairman of the Space Task Group team?

Mr. Low: Bob Piland was Chairman of the STG team. Piland, at the time, was Deputy to Max Faget, who was chief of one of three divisions in STG.

Dr. Emme: Were any industry studies emanated?

Mr. Low: Industry studies did not come until later. I have here copies of some of the slides that were used in this briefing to the Centers. This effort culminated in the presentation I mentioned earlier, to Dr. Glennan, Dr. Dryden, and Mr. Horner on July 9, 1960. At that time Dr. Glennan gave preliminary approval to the program. The briefing was

also conducted in the context of a forthcoming NASA-Industry Conference and the material which I was to present at this Industry Conference.

The general subject of the Industry Conference was to describe industry studies we would soon request for a circumlunar flight program, but at the same time to inform industry that we had no approval for the program beyond these studies; that we were, at this time, only talking about a study effort.

Dr. Emme: Then this was given at Langley in September as a specific STG briefing?

Mr. Low: The general briefing was July 29, 1960, in Washington at the NASA-Industry Conference. I think the subsequent briefing...

Dr. Emme: September 13?

Mr. Low: I believe there was one step in between, a more detailed industry conference conducted by Goddard at which the Space Task Group played a part. I believe this was also in Washington, probably during August or September. This was followed by a bidders' briefing at Space Task Group in September.

Mr. Holmes: There were other conferences at Marshall and JPL on details?

Mr. Low: Yes, on other details of NASA's program.

At the meeting on the 9th of July, the name Apollo was approved for the program. I had already prepared my paper for the Industry Conference before the meeting on the 9th, and later added a comment, "and we will call this program 'Apollo.'"

Now remember, at this time we still were talking about only circumlunar flight. In fact, we said Apollo was a program with two avenues of approach--one of them, the main stream, being the circumlunar flight program. We had planned a

program that, within this decade, would lead to a circumlunar flight; beyond this decade, Apollo would eventually lead to a lunar landing and to planetary exploration. We also proposed that, within this decade, Apollo could lead to, or could be part of, the space station program.

Dr. Emme: Were you thinking then of Mercury Mark II? For historians, you see, we should clarify that you are talking about future advanced missions and you have not yet had the first manned space flight. It is important to point out that you are talking about future advanced missions, projection of the technology which is feasible, and you have not yet had a successful manned space flight. No one has. What were you thinking about in terms of projecting Mercury, or weren't you thinking at this particular time about Mercury Mark II?

Mr. Low: At the time we had people at Space Task Group considering what we could do beyond Mercury. I don't think we were seriously thinking about Mercury Mark II, which later became the Gemini program, until the summer of 1961. The Gemini program was approved in December 1961. Also, you must remember that most of us at the time were spending full time on Mercury, and very little time was available to consider what would happen beyond Mercury. I mentioned that Bob Piland was the spark plug for Apollo at the Space Task Group, and I doubt that he had more than two or three people working with him on future programs out of the total people assigned to the Space Task Group.

In Washington, we had a very small group in Manned Space Flight. The only one in Washington who really spent any time on advanced programs was John Disher, and he probably didn't spend more than ten percent of his time on that because he was also involved with the Mercury program.

So this was strictly an extracurricular activity which we fit into whatever time we could spare from the Mercury program. This was true of Bob Gilruth and his top people and of all the people here in Washington, I'm sure.

Dr. Emme: That brings us, roughly, through September 1960. Were the future programs or goals of NASA discussed at the Williamsburg Conference?

Mr. Low: I was not at the Williamsburg Conference. I noticed in your History that there is a mention of that.

Dr. Emme: Dr. Dryden recalls this conference.

Mr. Low: I believe others can speak on that much better than I can. While the studies for the circumlunar flight were going on, we became concerned again as to whether we were going far enough with the circumlunar flight or whether we should really focus our attention on a lunar landing.

I had forgotten about a memo which my secretary (Mrs. Lillian Stutz) dug out for me this morning, which I will read to you. This is a memo dated October 17, 1960, for the Director of Space Flight Programs, Dr. Abe Silverstein, on the subject of the manned lunar landing program.

Paragraph 1 states, "It has become increasingly apparent that a preliminary program for manned lunar landings should be formulated. This is necessary in order to provide a proper justification for Apollo, and to place Apollo schedules and technical plans on a firmer foundation."

The memo went on to say in paragraph 2, "In order to prepare such a program, I have formed a small working group consisting of Eldon Hall, Oran Nicks, John Disher, and myself. This group will endeavor to establish ground rules for manned lunar landing missions, to determine reasonable spacecraft weights, to specify launch vehicle requirements, and to prepare an integrated development plan including the spacecraft, lunar landing and take-off systems, and launch vehicles. This plan should include a time phasing and funding picture and should identify areas requiring early studies by field organizations."

Paragraph 3..."At the completion of this work we plan to brief you and General Ostrander on the results. No action

on your part is required at this time. Hall will inform General Ostrander that he is participating in the study." Signed by George M. Low, Program Chief, Manned Space Flight. And there is a notation under it in pencil, "Low, O.K.," signed "Abe."

Dr. Emme: What was your motivation for this particular memo? What triggered it?

Mr. Low: I knew you would ask that question, and I don't know.

Dr. Emme: It was just a sense of timing?

Mr. Low: This was the time, of course, that we were beginning to discuss with industry what the Apollo program was. We were also quite concerned, of course, that in the subsequent year's budget, which was being prepared at that time, there were insufficient funds for any major lunar program. And we felt it would be most important to have something in the files, to be prepared to move out with a bigger program should there be a sudden change of heart within Government, within the administration, as to what should happen. This memo (I was just looking at the date) was written during the Eisenhower Administration and before Election Day.

Dr. Emme: We really have two main historical paths from here on out. One is the President's Scientific Advisory Committee and its role with regard to Mercury, which becomes more prominent with the new administration, and the other is the whole process of the lunar landing decision and how that came about in May. Do you think we can develop these two themes chronologically, or should we take one story and then do the other?

Mr. Low: It would be easiest for me to discuss what happened within NASA in the lunar program and then go back to discuss what happened with Mercury at the same time, because PSAC was involved in that.

Mr. Rothrock: Now, one reaction before I forget. The people we talked to have said there was a general uncertainty existing in NASA in the December-January-February period.

Mr. Low: Yes, and I think we all felt this quite keenly. As you know, the last Eisenhower budget carried a paragraph which said we'll complete Mercury and then future studies will be needed before we could decide what else we could do in manned space flight.

Dr. Emme: Was Dr. Glennan the only one carrying to the Bureau of the Budget and the White House the thought that had gone into future manned mission? How was the Eisenhower budget determined? Dr. Glennan did give you the planning go-ahead right from the start in July, didn't he?

Mr. Low: In July we had the planning go-ahead. I believe Dr. Glennan, Dr. Dryden, and Dr. Seamans, who had joined the organization in the summer or fall of 1960, carried the story forward to the Bureau of the Budget.

The next major step in the planning within NASA was essentially an outgrowth of the Task Group that I formed on October 17, 1960. We put together a preliminary story during November and December, 1960, and on January 5, 1961, presented the program for manned lunar landing to the Space Exploration Council of NASA. This Council, I believe, consisted of the Directors of the major Centers and Dr. Glennan and his immediate staff in Headquarters.

Dr. Emme: This was a full day of briefings?

Mr. Low: This was a full day of briefings, following general guidelines which were developed by this initial small task team I had. There were briefings by the Space Task Group; Mr. Faget made a presentation; and Marshall Space Flight Center, as presented by Dr. von Braun.

The presentation showed that there was major disagreement within NASA as to how the problem of a lunar landing should

be approached. The people at Space Task Group were primarily interested in the so-called direct approach of going to the moon while the Marshall group felt very strongly that an earth orbit rendezvous approach should be used.

At the same time, of course, John Houbolt of Langley Research Center was developing his lunar orbit rendezvous approach, but I don't think this was described in any detail at the January meeting.

Dr. Emme: But it was mentioned at the January 5 meeting?

Mr. Low: It may have been mentioned. Did Houbolt make a presentation then, do you recall?

Dr. Emme: I don't know.

Mr. Low: I would imagine that the Langley people, Floyd Thompson, most likely, might have said, "Let's not forget about the John Houbolt approach."

Mr. Rothrock: When it was brought before the Fleming Committee, it was sort of a new idea. Members of the Committee apparently had not been...

Mr. Low: It was something we were all aware of. We knew Houbolt was working on it, and occasionally people told us about it, but at first nobody thought it was a worthwhile approach. This, historically, was the case with everybody who looked at it. We were horrified at the lunar rendezvous approach the first time we saw it, and it was only after we studied it in depth, as Houbolt was doing at the time, that we became convinced that this was really the way to go.

Dr. Emme: Were you discussing the lunar orbital mission, or were you really focused on the lunar landing in this January 5 meeting?

Mr. Low: In the January 5 meeting, the title of the presentation was, "A Program for Manned Lunar Landing," so it

was an effort on January 5 to show top NASA management what could be done to extend the then-existing Apollo program to a manned lunar landing program. But it was sort of a diversified...

Mr. Holmes: When you say "then-existing Apollo program," the Apollo program at that time was a proposal, a series of studies being done by industry, wasn't it? And that was what Eisenhower had cut out of the budget just the same month, wasn't it? Or maybe it was just before or after that.

Mr. Low: It was a series of studies proposed to industry. I believe we were supposed to spend no more than a million dollars on those studies, and the goal of the studies was circumlunar flight. This is a point I can't emphasize too strongly, that the studies ended with circumlunar flight and not with a lunar landing.

Dr. Emme: Yes, that's John Disher's summary of the work progressing under the Apollo study approach.

Mr. Low: Company studies had started in November. John Disher's memo mentions that the first reviews were handled early in December and summarizes what approaches were taken by the various contractors. The contractors were the General Electric Company, The Martin Company, and Convair.

Dr. Emme: It is very important to stress that this was a lunar landing program examination at the January 5 meeting as distinct from the Apollo studies, which were circumlunar studies.

Mr. Rothrock: Had you gone over the Air Force studies, the contract studies on lunar landings, to any extent?

Mr. Low: The people on my task force had gone over this. In fact, I think we assigned one of our people to review these studies. I don't remember them in any detail, however. One recollection I have of the meeting is that Dr.

Glennan listened very politely, as he always did, but emphasized at the end of the meeting that we had absolutely no authority to go ahead with any program beyond the Mercury program, except for the studies for the Apollo circumlunar program; that he could not really authorize us to pursue these matters any further. He put a heavy damper on this entire effort. His function then, of course, was to carry out the wishes of the Administration, which had been that there would be no major emphasis on manned space flight following the Mercury program.

Dr. Emme: The minutes of that meeting, which are very terse and general, do show that he placed that on the record.

Mr. Rothrock: Nevertheless, the Saturn program was continuing, but not, at that time, beyond the first stage?

Mr. Low: Yes, but not beyond the Saturn I program.

Mr. Holmes: They were developing the second stage but weren't developing any advanced Saturn hardware. The C-2 was merely in a study phase.

Mr. Low: Since my main association at that time was with the spacecraft end of it, I probably slighted the launch vehicle, and I'm glad you mentioned this. I think one of the most important decisions in the whole lunar landing program was NASA's decision, and I probably should say Abe Silverstein's decision, to base the future launch vehicle programs on hydrogen technology for the upper stages. This, at the time, was a very daring decision.

Dr. Emme: What was that approximate date?

Mr. Low: I would say 1959.

Mr. Rothrock: You'll find that when the decision was made to have the second stage on the Saturn I, the second stage then was hydrogen.

Mr. Holmes: I think it happened in December 1959--that is my recollection of it. It became public knowledge a short time later. When the budget was presented to Congress in early January 1960, they asked for a supplemental appropriation to get the J-2 engine program going.

Mr. Low: But remember, at that time there was no J-2 engine. The RL-10 engine was not working too well. (It has turned out to be an excellent engine now.) And we really knew very little about insulation and bulkheads and all of these problems. Yet the decision was made by a committee chaired by Silverstein to base the whole future launch vehicle program on hydrogen technology. It was really one of the most important decisions in the program, one of the key decisions that allowed us to go ahead with the Apollo lunar landing program in 1961.

Dr. Emme: Well, the dropping of the Vega was tied to going with Centaur at that time.

Mr. Low: I'm not sure that that was connected.

Mr. Holmes: That incidentally happened about the same time but was due to the fact that it became apparent to all that the Agena could do the job and was farther along in development.

Mr. Rothrock: The Vega was dropped because it did essentially the same thing as Centaur did. There was no need for two launch vehicles.

Dr. Emme: The Centaur then was also programmed into the space sciences side of the house, too, wasn't it, as a basis of this fundamental decision?

Mr. Rothrock: The Surveyor program started at that time, yes.

Mr. Low: I don't know whether you've talked to Milton Rosen at all, but Milt was involved in this much more deeply than

I was at the time, and I'm sure he can recall this a lot better than I can.

Dr. Emme: Now is there anything more as a consequence of this January 5 meeting?

Mr. Rothrock: Let me insert one thing. I believe you are correct on the Agena.

Mr. Low: Out of the January 5 meeting Dr. Seamans established the Manned Lunar Program Planning Group. This planning group met for the first time on January 9, 1961. Again I was Chairman of that group. Members were Oran Nicks, E. O. Pearson, Al Mayo, Max Faget, Herman Koelle, and Eldon Hall.

The purpose of this group was to prepare a position paper which would answer the question, "What is NASA's Manned Lunar Landing Program?" This group met almost full time for a week or two and prepared a report which was presented in final form to Dr. Seamans on, I believe, February 7.

Dr. Emme: There was a draft on January 24, and a final report on February 7.

Mr. Low: In this group we had representatives who favored the earth-orbital rendezvous approach; we had others who favored the direct approach to the moon. Again, Houbolt was not represented. We did assign to one of our members, however, the task of studying and looking into Houbolt's approach and studying the lunar orbit rendezvous method.

He came back later and said he had studied it and his basic conclusion was that the lunar orbit rendezvous method would not work. So the conclusion of the...

Dr. Emme: (Interrupting) Shall he remain nameless for this purpose? (Laughter)

Mr. Low: Yes. He had a lot of distinguished company... (Laughter) Maybe he shouldn't remain nameless. It was

Max Faget who did this study, and based on his preliminary look, it did not appear to be an appealing approach. Max, at the time, was strongly in favor of the direct approach to the moon. A year or so later, Max Faget himself became one of the strongest proponents for the lunar orbit rendezvous approach, so it's interesting to see that outstanding technical people do change their minds and their conclusions occasionally.

Dr. Emme: I don't want to scoop what we're going to discuss later, the role of the Wiesner Committee in the Mercury program, but while you were meeting continuously, drafting the full and hard study of lunar landing problems, you had the release of the Wiesner Committee report to the President-elect, which was very critical of NASA and the Mercury program. They even questioned the choice of the booster for Mercury, the Atlas, and also indicated that the military role in space should really be looked at and straightened out with the new Administration. Did this have any impact upon the work of your Committee during January?

Mr. Low: With due apologies to Jerry Wiesner, I don't really think it did, probably because those of us who were working on this effort felt that this group of people really had not been close to the program; they had been working off by themselves; they had been given a task to do and did the best they could do with that task from the outside. I have found that most of our critics of the manned space flight program have been outsiders. Once we've brought them into our fold and told them what we really were doing and why we were doing it, these same people became convinced that what we were doing was probably as good an approach as any, and perhaps the best approach to take.

So at that time we probably looked at the Wiesner Report in that context. At least I don't recall that it made any big difference to what we were doing.

Let me proceed, then, to the report of February 7. At that time it was essentially completed and presented to Dr. Seamans, and for the next few weeks I don't recall that much was done on it.

Dr. Emme: Mr. Webb was selected, in the meantime, as the Administrator.

Mr. Low: Yes, Mr. Webb was selected as Administrator, and I am confident that in some of his initial briefings Dr. Seamans and Dr. Dryden would have told him that we had looked at where we could go, but, of course, at that time we were also very much involved in presenting our story to Congress for that year's budget.

I don't recall any additional mention of the lunar program until a presentation to Congress on about the 14th or 15th of April.

Dr. Emme: But the booster study was still going on, developing the national launch vehicle program concept.

Mr. Low: The studies were going on, the launch vehicles were being developed, but we had not had a major change in the goals of NASA during this time period.

Dr. Emme: Was there any payload for these large boosters? As you recall, the agreement between Mr. Webb and Gilpatric on February 23...

Mr. Rothrock: No, there were no payloads spelled out.

Dr. Emme: It was just that we obviously would need the large boosters?

Mr. Rothrock: Yes, this is correct. I wouldn't say that we obviously would need them. I think one has to give von Braun considerable credit for pushing the development of Saturn at a time when no specific payloads were in existence. Then the thing did continue, but I don't think it continued with any great enthusiasm.

Mr. Holmes: Except on von Braun's part.

Dr. Emme: The Juno V is the Saturn I. This goes back to 1958.

Mr. Low: I think we were fortunate in a number of areas to have people in the agency with the foresight to start hardware in critical areas. The F-1 engine, the Saturn I booster, and the hydrogen decision were the three things that allowed us to jump in with both feet in May, 1961. Without those we couldn't have done it.

I'll come back to the Mercury program. Gagarin's flight was on April 12. On April 12 there was sudden interest again, in this country, in manned space flight. On April 11, the day before Gagarin's flight, I was in the middle of a presentation to the House Committee on Science and Astronautics, which was chaired by Congressman Overton Brooks at the time, on the manned space flight picture and defense of the budget for manned space flight.

I was about halfway through the presentation when it was time for lunch and Committee adjournment. I had with me a movie of Ham's flight. Ham had flown in January, and this was a short sound film of the first flight using a chimpanzee in a manned space flight capsule that this country had made.

The Chairman said, "Let's start with the movie when you get back tomorrow." That night Gagarin flew. The next day's hearings...

Dr. Emme: The rumors swept Moscow the day before...

Mr. Low: Even during that time the rumors were flying, and the whole country was uneasy because of the rumors. The next day I did not go back to complete my testimony. Mr. Webb, Dr. Dryden, and Dr. Seamans (I'm not sure whether Dr. Seamans was there as a witness or not) presented an overall picture of where we stood in manned space flight, what the Russians had done and what they could be expected to do, and what we had done.

It was probably one of Mr. Webb's first appearances before that Committee, and he did an outstanding job in avoiding

panic in the country by the way he presented the NASA picture on the day after the Gagarin flight. Incidentally, that hearing was not held in the normal Committee room. It was in the Caucus Room, and it was filled completely with interested bystanders.

The following day, we went back to complete my presentation of manned space flight. Dr. Seamans and I were before the Committee, back in the Committee room again. One of the things I remember was that we decided not to show the film, because we thought it would not be in our best interest to show how we had flown a monkey on a suborbital flight when the Soviets had orbited Gagarin. The Chairman did say, "Well, we thought we were going to start with the movie." We looked around and the projectionist wasn't there, and we fumbled and said, "We don't have it with us today."

But we did go on, and during the hearings, Representative King of Utah noted that the Soviets were being quoted as saying they would land on the moon in 1967. He asked whether we could do it. The only background that Seamans really had at that time was the February 7 report, and under pressure he said the goal might well be achievable. This is where the 1967 date first appeared.

Mr. Holmes: King gave him the 1967 date and said that was the 50th anniversary of the Bolshevik Revolution...can you make it? That's the way the words were put in Seamans' mouth.

Mr. Low: Incidentally, I'm just checking the February 7 report. It showed manned flights to the moon in the 1968-1970 time period.

Following this, then, there are a number of items in your History where Vice President Johnson asked the agency for a plan for manned space flight. The Fleming Committee was organized in about this time period. The purpose of the Fleming Committee was to get better schedule information, better cost information, following up on the February 7 report with a much larger effort to come up with more

specific details of what the program should cost, how it should be done, and where it should be done.

Mr. Rothrock: I think it's interesting that the men on your Committee were members of the Fleming Committee.

Mr. Low: That's right. The same people participated and carried on with the work they had done. One way of looking at it is that it went from the small Task Group which I formed on October 17 (1960) to the Low Committee of January 7 (1961) to the Fleming Committee which was then formed in April, one flowing into the other and each one giving more specific details.

Dr. Emme: And you still had not flown the first Mercury astronaut?

Mr. Low: We still had not flown Shepard's flight. Of course, it was immediately after Shepard's flight that these things were available. The Fleming report was by no means complete.

Mr. Rothrock: Webb was briefed on the results around the third week in May.

Mr. Low: But at the same time, NASA management went forward and presented the plan to the Administration (this was all between Shepard's flight, as I recall, on May 5 and the 25th of May) which culminated in President Kennedy's speech on May 25, which then really gave the country and all of us who were working on the program, the real go-ahead and boost that we needed in the program to move out on it. I think the enthusiasm that the President's speech generated was a real boost to the program.

Dr. Emme: That's a very important historical chapter we have just reviewed. It's the internal NASA work contributing to the lunar landing decision of May 1961. Does that cover it fairly well so we can go back now to the Mercury program and the transition from one administration

to the other? What was the impact of the Wiesner Report upon the Mercury program? That might be a way to get this kicked off...and then, of course, you'll want to bring out some of the problems that the program was involved with, the booster, etc.

Mr. Low: First of all, I think I should say that we did have complete and full support during the Eisenhower Administration and under Dr. Glennan for the Mercury program. The thing I may have questioned before was the continuation of future manned space flight beyond Mercury. But there was no time in the Mercury program where we were held back because of funding, because of people telling us to go slowly; in fact, the pressure was always in the other direction. It was, let's get on with Mercury.

I remember Dr. Glennan, on many occasions, driving us very hard and, of course, this feeling permeated throughout the entire Mercury program. So the impact of the change in administration on the Mercury program was a minor one in that sense, if any.

In the late fall or early winter of 1960, the Mercury program was approaching the manned space flight stage. We'd had unmanned flights on the Redstone and on the Atlas; we'd had successes, and we'd had failures. But the program was still moving along as quickly, or more quickly, than any other program had ever moved. We just drew some comparison curves recently, in connection with Gemini and Apollo, and this is a fact; Mercury was moving exceedingly well.

The first Redstone flight with a Mercury capsule was, I believe, on December 19, 1960. There had been a preliminary attempt at this flight in November which was not successful. We then went on with the Redstone flight in December, and the Ham flight was in January.

At about this time period also, and I don't know whether it was January or February, a number of us felt that before

very long we would be ready to tell our management that we were ready to make a manned space flight, the suborbital flight on the Redstone. The flight was scheduled for about April, in that time period. We felt that the Administrator would have to go forward to the President and say, "We're now ready to make a manned flight." Bob Gilruth believed that if the new President were faced with this decision, not knowing the agency and not knowing the people in the agency at that time, he would be hard pressed to say, "Go ahead." He would want to ask questions: Do these guys know what they are doing? Are they really ready? Or do they just want to go ahead?

So we suggested to Dr. Dryden at the time, and this must have been in the interim before Mr. Webb came on board, that we should have a committee appointed by the President to check on the Mercury program. Dr. Dryden went to see Jerry Wiesner, who had already been appointed the President's science advisor, with this idea, and together they appointed a committee which was not really a PSAC committee, although it had some PSAC membership on it. It was chaired by Don Hornig, who is now the President's science advisor and at the time chaired one or two panels.

Dr. Emme: It was called a subcommittee on manned space flight.

Mr. Low: It was a special subcommittee, but it included many members who normally were not on the President's Science Advisory Committee. This Committee met in March and traveled around the country to McDonnell, to the Cape, to Langley, and to NASA Headquarters in examining the Mercury program. There were some very competent people on this committee, some who had been involved in this kind of business before, and others who had not.

I think to me the most gratifying experience was to see a man like Don Hornig, who had contributed to the Wiesner Report, come in with a very open mind about the program. He was an excellent Chairman but also one with a fairly

negative approach to manned space flight as a whole, at least initially. To see him argue, on the last day of that week, with Jerry Wiesner and support the benefits of manned space flight, saying what a wonderful program Mercury was, was very gratifying.

Dr. Emme: He had been on Kistiakowsky's Committee, too.

Mr. Low: He probably had, but it was a major change for a very competent man like Don Hornig, who had been quite against manned space flight without knowing much about it; to really be for it at the end of this week's period.

Dr. Emme: You reported to the NASA senior staff meeting on March 15 that the Hornig Committee, having visited Langley, St. Louis, and AMR, "had a better feeling now for the system as it is."

Mr. Low: The Hornig Committee was the major influence of the Wiesner group on the Mercury program at that time period. Now we were at perhaps the most difficult time in the whole Mercury program. I don't have a flight schedule in front of me now, but in a period of, I think, ten days we got off three or four launches, each one of which had to be successful before we could go on with Shepard's flight.

So we were in a situation where, first of all, there was major Soviet activity leading up to Gagarin's flight. We had had major difficulties with the Atlas between the MA-1 flight and the MA-2 flight, and NASA as an organization stuck its neck out with the MA-2 flight with a temporary fix to do that. We had had two Little Joe failures, and we needed a good Little Joe flight in this time period.

We had to get MR-2 off. We had landing bag difficulties with MR-2 and had to fix that. All of these things had to happen before we could fly Shepard. On top of that, then, we had to support Hornig Committee investigations.

Dr. Emme: And the Russian dog flights, too, were at about this time.

Mr. Low: And the Soviet dog flights at this time. One point I did not mention before is that, although the initial Hornig report appeared to be very good, some of the medical members of the Hornig Committee caucused the night before the report was made, in Washington, and turned in a very, very negative report. They recommended that we could not possibly take the risk of flying a man in a weightless flight, where he would be weightless for five minutes, without many additional tests of monkeys. In fact, they wanted us to fly 50 monkeys. We found out there weren't this many trained monkeys available in this country.

Dr. Emme: Then Bob Gilruth was going to transfer the program to Africa, where they have plenty of chimps. These were centrifuge flights with chimps?

Mr. Low: And they recommended additional space flights. It was an exceedingly difficult period, at that time, to try to make all of the hardware work, and I mentioned some of the things we had to make work, while at the same time we had to satisfy a group of uninformed people as to whether or not we should go ahead.

Dr. Emme: The key was the blood pressure measurement, wasn't it?

Mr. Low: This was one of the keys--the blood pressure measurement. But what really disappointed--I think that is the word to use--many of us who were trying to get on with the program was that this was a group of people who, we were convinced, were not really informed on what they were trying to do. They were not approaching it like Don Hornig had, in a positive manner, and they caused an awful lot of difficulty at a time when we had enough difficulties. This really was the most difficult time in the Mercury program.

Dr. Emme: Until April 12 were you still really working to beat the Russians in a manned flight?

Mr. Low: One of the deepest disappointments to me was when I got a phone call, the night of April 12th, at 2 a.m., that Gagarin was up.

Dr. Emme: Is there anything in particular that should be put on the record with regard to the Redstone and those various problems that wouldn't already be on the record? Did you have more confidence, perhaps, in the Redstone than the Marshall people did? Wasn't it the MR-2 flight that had not followed the exact parameters precisely and yet was within the tolerances?

Mr. Low: Very definitely at that time period there was a conflict between the booster people and the spacecraft people on whether or not an additional booster flight would be needed, and the booster people felt that they could not commit a man to the next flight. We did fly an additional Redstone flight without a spacecraft, and it was successful.

Dr. Emme: Did you have any comments to make on the post-Shepard flight period and the apparent impact that the Shepard flight may have had upon the President and the American people?

Mr. Low: I recently made a comment on this subject in a paper I gave on October 1, 1963, the fifth anniversary of NASA. I just happened to be giving a talk at a technical meeting on the West Coast--a luncheon speech--and I had a comment in there about how surprised we were at the tremendous interest that the people and the press had in Shepard's flight and all subsequent flights. In a press conference following this speech, one of the reporters asked, "How naive could you have been to think that there wouldn't be this interest?" Yet I still don't think we were any more naive than the newspaper people themselves at that time period.

Mr. Holmes: My answer to him would have been, "Well, if we're so naive, why didn't you fellows cover it more?" Because they didn't. It was pretty well restricted to

the trade magazines and so forth. The general press covered such things as the selection of the astronauts, etc., but as far as preparations, details, there was not much in the papers. I think that reporter was out of line.

Mr. Low: I was tremendously elated the day after Shepard's flight. I remember coming back to town that evening. I got into the office just before quitting time (you know, it was a short flight then), and I invited everybody and anybody that I could find to a party at my home that evening. And my wife didn't know I was in town yet. (Laughter) Then I stopped at the liquor store on my way home. It was probably one of the best parties we ever had--in Washington, at least, following any flight.

And I recall also that John Disher and Warren North and I went almost directly from the party to my office, the next morning, and we decided, "Let's put some more finishing touches on what we can do on the lunar landing program." Now what I did not know at the time was that, at the same time, Abe Silverstein was meeting with Webb, Dryden, and Seamans, and some others, and actually spent part of that day with McNamara, being about ten steps ahead of what I was trying to do in my office. So this is the kind of impact that this made on everybody.

The culmination of all of this effort, of course, was President Kennedy's address to Congress on May 25, 1961, committing this nation to the goal of a manned lunar landing in this decade.

Dr. Emme: Could you discuss some of the steps taken after the decision to land an American on the moon was announced by President Kennedy on May 25? Was not the lunar landing made the next major decision?

Mr. Low: The launch vehicle people formulated detailed plans for the facilities they would need and for the configuration of the launch vehicles which would be needed.

On the spacecraft end, during the summer of 1961 we prepared specifications and requests for proposals for the Apollo spacecraft. These were mailed out during the summer. And this, of course, led to the selection of North American for the contract for the command and service modules.

Also during this time period, people here, and particularly at the Space Task Group, were doing more detailed designs of the lunar landing system, and--remember--this was a lunar landing stage, at the time, to go behind the command and service modules. We also started getting more and more interested in the lunar orbit rendezvous approach.

I'm trying to think of the timing here, and I believe John Disher could help you much more than I can about the detailed effort during this period of time. Brainerd Holmes came on board in September--really not until October 1961. We discussed with him during the rest of the year various designs for the lunar landing stage, for the "direct approach" to the lunar landing. We were not really talking to him yet about the possibility of a different method of approach, because none of us had yet become convinced that the lunar orbit rendezvous method was the way to go.

I remember taking Joe Shea, who had come aboard in December 1961, to Space Task Group to introduce him to the people there. We spent a good part of the day being briefed by the various people from Space Task Group and from Langley Research Center on the lunar orbit rendezvous approach. It was about in that time period, about January 1962, that Dr. Gilruth and his key people became convinced that lunar orbit rendezvous was the way to go.

Dr. Emme: Gemini was coming along at about the same time?

Mr. Low: Gemini was coming along as an almost separate program at about the same time period with studies during the summer of 1961, the development plan prepared in about November 1961, and the program being approved in December 1961, I believe.

Dr. Emme: And the booster studies were under way in the Golovin Committee during the summer of 1961?

Mr. Low: That's right. It wasn't until December 1961, when we had the first meeting of Brainerd Holmes' Management Council, that we decided that the Saturn V should have five engines in the first and second stages. Until that time we had four engines.

I remember also, in this December meeting, Bob Gilruth's saying, "Well, even if we don't go ahead with the approach we presently have planned (namely, the direct approach), we could use that extra booster power with any other approach that we would take," so he went along with it on that basis.

Mr. Holmes: Gilruth had become convinced in favor of lunar orbit rendezvous?

Mr. Low: He was beginning to be in the December 1961-January 1962 time period.

Mr. Holmes: So he had LOR in mind when he was supporting the five-engine advanced Saturn?

Mr. Low: He definitely did. I recall, at the first meeting of the Management Council, Gilruth said he was not convinced we had the proper approach to the moon, but no matter which approach, he would like to see that fifth engine in there.

Dr. Emme: Was the major pacing item the boosters? You recall that in 1961 you had the decisions on selection of AMR as the launching facility; you had Michoud and Mississippi static test area. These decisions were all announced late in December 1961.

Mr. Low: During 1961 all of the major decisions in the program were made, except the LOR decision. We committed the land and the facilities. We committed to the contractors for, I think, all of our stages except for the lunar landing or LEM stage. So the only hole that was left in

the program by the end of 1961 was the way to go to the moon and that particular stage and its modules.

Dr. Emme: I didn't appreciate until just now that actually our first Saturn launch in October 1961 preceded the first orbital flight of Glenn (February 20, 1962). You have the Saturn launch on October 27, 1961, and then, of course, Glenn.

I think you might want to put on the record that we really wanted to try to orbit a Mercury astronaut in the calendar year 1961, as against doing it the same year as the Russians had done it. Was there any thought like that in NASA Headquarters?

Mr. Low: From our point of view, and I speak of both Space Task Group and my office at NASA Headquarters, we were always very schedule conscious in Mercury, and we had set ourselves a goal of getting a manned flight off in 1961. We had made these commitments and we just wanted to maintain and keep these commitments.

Unless you establish a goal for yourself in any program, whether it's going to the moon or orbiting a man, you will never make any schedules. So once we had established these goals, and once we had told the public and our management that this was what we were going to do, we were making every effort to do this. I think it was more that kind of a personal commitment we had all made as opposed to getting it off in the same year as the Russians did.

As you know, we came very close to getting Glenn's flight off in 1961. It slipped into January 1962, and we had the weather problems in January that put it into February. But, again, I don't think I ought to apologize for any of the wonderful people working on Mercury for not making it until February, because it was still a tight schedule all the way through.

Dr. Emme: I guess the other major area we would like to cover before we conclude would be the mode decision of 1962.

I presume there may have been arguments or... (laughter)... at what point did the arguments begin to break down and coalesce into pretty much a unanimous...

Mr. Low: Gene, there were arguments at every step of the way. As I said earlier, there was a time when Max Faget was very much against this, early in 1961. By late 1961, he was convinced this was the only way to go, and so was Bob Gilruth. Coming into Washington, I was probably starting to support this and believe in this kind of a decision early in 1962, after I had spent some time at Langley.

At that time, we had organized our systems engineering organization under Dr. Shea, whose task it really was to decide what mode to take to the moon, or how to go to the moon, and to synthesize the entire program. I don't know specifically when Joe himself, and his people, became convinced that LOR was the way to go.

Mr. Rothrock: How about the Huntsville people?

Mr. Low: They were probably next in line. I do recall Joe Shea's becoming convinced fairly early and then setting out to study this mode in real depth, and Brainerd Holmes' beginning to lean toward LOR in the spring of 1962. And then Brainerd, through the Management Council, and through a series of technical briefings from Joe Shea's people, convinced the Huntsville people that LOR was the way to go. In the end the Management Council unanimously recommended the lunar orbit rendezvous approach.

Shortly thereafter, this was presented to general management by the Management Council. Following the briefing of general management in NASA, the next step was to convince Jerry Wiesner's people that this was the way to go. It took all of that summer to get everybody convinced that this was the approach we should take. In the meantime, of course, we had prepared our contractual work statements so that we could move very quickly with a contractor selection in this area.

We'd had industry studies, we'd had in-house studies, and one by one, as people looked into this more and more thoroughly, they became convinced as we had that LOR was the proper approach.

Dr. Emme: It's been said, and I'm not sure it's true, that Houbolt almost had to publish this LOR concept in the Astronautics and Aeronautics Journal (I think it was February or March 1962 that it appeared) to really begin to catch thinking on the lunar orbital mode. Is this true?

Mr. Low: Well, Houbolt did write a number of letters to Seamans and to Brainerd Holmes. In fact, as I recall, one of the first days that Brainerd Holmes was on board, he was handed a very long letter that Houbolt had written to Seamans, saying that we really didn't know what we were doing up here. John Houbolt deserves a lot of credit for being as persistent as he was in pushing this forward, because I'm convinced now that he was right.

Dr. Emme: In your office were you becoming increasingly involved with the Apollo lunar program and, of course, Gemini also? What was the relative concern you still had with Mercury in the 1962 period? Or was that largely under the Space Task Group?

Mr. Low: It became less and less of a concern, of course. Perhaps I can best describe this in terms of organization. I had a very small office at Headquarters initially, and by the summer of 1961 I had about ten people. Now this did not include the launch vehicles. As you recall, there was a separate arm, reporting directly to the Associate Administrator at the time, for launch vehicles. But it did include the whole Mercury program and what is now Gemini and the Apollo spacecraft, as well as the mission planning for Mercury, Gemini, and Apollo.

Out of those ten people, which included three or four secretaries, only one, John Disher, was spending almost full time on future programs.

After Brainerd Holmes came on board, my responsibility became that of directing the spacecraft and the flight missions. I organized in four separate elements, one of which was entirely for Apollo, under John Disher, and this became the largest element of the group. Another element was on Mercury and Gemini, under Colonel Dan McKee, and he might have had two or three men on Mercury, but the rest of the people were working on Gemini. There was an operations group, under Captain Van Ness, which was mostly involved with Mercury in that period of time. So during the summer of 1961, the fall of 1961, and leading into 1962, more and more of my group were devoting their attention to Gemini and Apollo, but we kept essentially the same number of people we had always had on Mercury, which was always only two or three people in Headquarters. I would say I probably spent less and less of my own time on Mercury.

Dr. Emme: Did the Wiesner group again raise questions before the first orbital flight, the Glenn flight?

Mr. Low: No.

Dr. Emme: George, thank you very much for this superb oral history interview, which will be invaluable to the future historians.

Interviewee:

George M. Low
George M. Low

Interviewers:

Addison M. Rothrock
Addison M. Rothrock

Eugene M. Emme
Eugene M. Emme

Jay Holmes
Jay Holmes



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Prior to his present appointment in February 1964, Low was Deputy Associate Administrator for Manned Space Flight at NASA Headquarters, Washington D.C., and has been associated with NASA and its predecessor, NACA (National Advisory Committee for Aeronautics) for 15 years.

Low was born in Vienna, Austria, in 1926. He earned a bachelor of aeronautical engineering degree in 1948, and a master of science in aeronautical engineering degree in 1950, both from Rensselaer Polytechnic Institute.

Low joined NACA at the Lewis Research Center in Cleveland, Ohio, in 1949. There he specialized in research in the fields of aerodynamic heating, boundary layer theory and transition, and internal flow in supersonic and hypersonic aircraft. During his years at the Lewis facility, he was head of the Fluid Mechanics Section, and later Chief of Special Projects Branch.

In October 1958, when NASA was established, he was assigned to the headquarters office as Assistant Director for Manned Space Flight Programs. Early in 1961, Low was chairman of the select committee which performed the original studies leading to the Manned Lunar Landing Program. His most recent assignment in Washington was Deputy Associate Administrator for Manned Space Flight. He was responsible

to the Associate Administrator for Manned Space Flight for the overall management and direction of the Manned Space Flight programs (Gemini, Apollo and advanced missions) and the field centers directly associated with these programs.

The author of numerous technical papers and articles, Low is an Associate Fellow of the American Institute of Aeronautics and Astronautics. He was awarded NASA's Outstanding Leadership Medal and the Arthur S. Fleming Award, for his contributions to Project Mercury.

Low is married to the former Mary R. McNamara. Mr. and Mrs. Low and their five children live in Friendswood, Texas.

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