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**THE DECISION TO SEND
HUMANS BACK TO THE MOON
AND ON TO MARS**

**Howard E. McCurdy
American University**

**NASA History Division
Code ADA-2
NASA Headquarters
Washington, DC 20546**

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**Space Exploration Initiative
History Project**

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Preface

This folder contains working papers collected to date on a NASA-sponsored history project to document the events leading up to the July 20, 1989, speech setting forth the objectives of the Space Exploration Initiative.

Included in the folder are a chronology of events, briefing papers produced by the NASA Working Group laying out proposal, briefing charts used to present the proposal, a copy of the President's speech, and an essay summarizing the events that led up to the announcement. Additionally, two of the interviews conducted as part of the project are enclosed.

As of this date (February, 1992), the project continues with additional interviews and refinement of the history. Until all interviews have been conducted and integrated into the history, this folder and accompanying materials should be treated as work-in-progress and not distributed or promulgated in such a way as to suggest that they constitute a definitive history of the initiative.

Additional interviews, briefing papers, and documents collected as part of this project but not contained in this folder have been placed in the NASA History Office.

All interviews have been edited by the principal investigator so as to remove obvious grammatical errors and redundant phrases.

Any views or conclusions expressed herein are solely those of the principal investigator and do not represent the official policy of the National Aeronautics and Space Administration.

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Introduction

Back to the Moon and on to Mars

On July 20, 1989, President George Bush proposed that the United States undertake as the long range objective of its civil space program an initiative that would lead to the establishment of a permanent base on the moon and a human expedition to Mars. His speech, delivered from the steps of the National Air and Space Museum in Washington, D.C., on the 20th anniversary of the first landing on the moon, gave official blessing to what had long been the unapproved purpose of the American civilian space.

In 1961, it took a crises -- the space race -- to speed things up. Today we don't have a crises. We have an opportunity. To seize this opportunity, I'm not proposing a 10-year plan like Apollo. I'm proposing a long-range, continuing commitment. First, for the coming decade -- for the 1990's -- Space Station Freedom -- our critical next step in all our space endeavors. And next -- for the new century -- back to the Moon. Back to the future. And this time, back to stay. And then -- a journey into tomorrow -- a journey to another planet -- a manned mission to Mars.¹

¹White House Office of the Press Secretary, "Remarks by the President at 20th Anniversary of Apollo Moon Landing," the steps of the Air and Space Museum, Washington, D.C., July 20, 1989.

While the President and his staff chose the time for setting out this policy, career employees of the National Aeronautics and Space Administration strongly influenced the shape of the Space Exploration Initiative. During the two years prior to the President's speech, NASA civil servants conducted detailed studies that provided a technical foundation and a rationale for the proposed initiative. NASA civil servants significantly altered the original thrust of the White House policy. The focus of the Space Exploration Initiative changed considerably as the issue moved from conception to decision within the White House. Although NASA officials were obliged by presidential advisers to consider options, the NASA preference for a moon/Mars focus emerged relatively unscathed from White House review. This was made possible in large part by the decision to not subject the initiative to a full, formal White House review by the various presidential offices and councils.

Like most major space flight initiatives before it, the Space Exploration Initiative (SEI) decision was preceded by a multi-year process of data collection and analysis within NASA. The ability of NASA civil servants to conduct studies on behalf of a yet-unapproved policy was encouraged by NASA executives anxious to define the purpose and direction of U.S. space efforts, by White House officials who in 1988 embraced the general goal "to expand human presence and activity beyond Earth orbit into the solar system," and by members of Congress supportive of the overall desire for long-range objectives in space.²

Responding to these developments, as well as to the agency's own exploration culture, NASA officials fully two years prior to President Bush's speech established an Office of

²The White House, Office of the Press Secretary, "Fact Sheet: Presidential Directive on National Space Policy," February 11, 1988.

Exploration at NASA headquarters to coordinate the effort that would lead to an approved program. They also assigned officials at the NASA field centers the task of conducting basic engineering studies. As a result of these activities, when the White House staff brought up the issue in the Spring of 1989, NASA officials had already assembled a large data base from which they could draw technical estimates and cost analysis. In less than two weeks during the first half of June, 1989, a Working Group made up of NASA career civil servants pulled that information together and prepared the briefing material that provided the technical foundation for the White House decision.

There was a huge base of data on moon/Mars that went back not just to John Aaron [head of NASA's Office of Exploration from 1987 to 1988], but to Sally Ride and the National Commission on Space....It turned out that all the engineering data from all of the trade studies that had been going on...were all due and available the first week in June.³

Having previously assembled a large data base on moon/Mars exploration, NASA officials found themselves in a much better position to influence the outcome of the decision than if they had been obliged to create such material as the White House reviewed the initiative.

The thrust of the exploration emphasis that White House officials suggested to NASA as the review process began differed significantly from the objective that President Bush eventually embraced. Officials in the Office of the Vice President initially requested that NASA formulate a relatively simple objective that would lead to a major accomplishment by the year 2000 and take advantage of Space Station Freedom. The most likely program to meet these criteria was

³Franklin D. Martin interview, March 15, 1991, NASA History Office.

a return to the moon; a quick sprint to Phobos also qualified. NASA officials implored White House officials to look beyond the year 2000 and endorse a comprehensive program that incorporated practically all of NASA's long range goals, including Mission to Planet Earth, a lunar base, robotic missions to Mars, and the eventual human exploration of Mars. What thus began as a search for a relative short-range objective within the White House became a more comprehensive undertaking involving humans and robots, earth, moon, and Mars. The earth emphasis was later subsumed under the larger undertaking so that the focus became a lunar base at an unspecified date in the 21st century, which in turn would pave the way for human exploration of Mars.

From the start, NASA officials single-mindedly advocated their long-held dream of lunar and planetary exploration by humans. The original briefing papers that the Working Group prepared for NASA Administrator Richard Truly to deliver at the White House proposed "a permanent research facility on the Moon...[and] robotic exploration of Mars to support human exploration early in the next century.⁴ It did not contain options. White House officials asked NASA to add options. NASA officials did this by presenting a scenario that would send humans (preceded by robots) directly to Mars early in the 21st century, bypassing the moon. A second option provided for a planetary exploration program using robots only, with a focus on Mars. The options were presented to White House officials and to four outside groups called in by Vice President Dan Quayle to hear the NASA proposal and react to it. Additionally, Quayle and Truly presented the proposal to members of Congress with space policy responsibilities.

⁴"The Objective," from Mark Craig, "A Scenario for Human Exploration of the Moon and Mars," June 13, 1989.

NASA officials won approval for their preferred option in large measure because they were not obliged to subject the Space Exploration Initiative to a full White House policy review. Although a large number of White House officials participated in the events that led up to the President's speech -- including Vice President Quayle and his staff, second echelon presidential assistants and speech writers, and the President's principal advisers -- the decision did not wind its way through the official White House staff system. The National Space Council, established earlier in 1989 for the purpose of reviewing national space policy, did not formally take up the initiative before the President's speech, nor were the members officially briefed on it prior to that event. The preference for an extramural decision was enhanced by the desire of White House officials to prevent premature exposure of the initiative prior to the President's July 20 speech, and by the absence of any strong center of opposition within the Executive Office of the President to the initiative.

The Space Exploration Initiative, as a result, moved rapidly from conception to decision. NASA received the White House request that it begin formulating a proposal on May 31, 1989. President Bush announced the new policy less than two months later, on July 20, 1989. Unlike the decisions to approve the Space Transportation System in 1971-72 and the space station Freedom in 1983-84, NASA officials were not obliged to compromise their vision or bargain extensively with White House interests as a prerequisite for presidential approval. The decision, however, did not emerge in the President's speech with as much specificity as was contained in the NASA-prepared briefing documents.

Space Exploration Initiative

Chronology

I. BEGINNINGS

- 12/16/59 NASA's Long-Range Plan calls for "manned exploration of the moon and the nearer planets."¹
- 5/25/61 President John F. Kennedy commits the U.S. "to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."²
- 9/69 The Space Task Group urges President Richard Nixon to set as a goal "a manned Mars landing before the end of this century."³
- 12/19/80 The NASA Transition Team (George M. Low, chairman) urges President-elect Ronald Reagan to define "the purpose and direction of the U.S. space effort."⁴

- 1986 The Report of the National Commission on Space (Paine Report) recommends a long range space plan that would include human settlements on the Moon and Mars.⁵
- 6/87 NASA Administrator James Fletcher establishes a NASA Office of Exploration to "coordinate agency activities that would 'expand the human presence beyond Earth,' particularly to the Moon and Mars."⁶
- 8/87 A NASA Report by Dr. Sally K. Ride identifies a lunar outpost and humans to Mars as two of the four "leadership initiatives" that might form the basis for the future U.S. civilian space program.⁷
- 2/11/88 President Ronald Reagan approves a National Space Policy that includes the overall goal "to expand human presence and activity beyond Earth orbit into the solar system."⁸
- 11/88 The NASA Office of Exploration (headed by John Aaron) issues a report setting out three pathways for the exploration of the Moon and Mars.⁹
- 12/1/88 Dr. Franklin D. Martin replaces John Aaron as Assistant Administrator for the Office of Exploration.¹⁰

II. THE INITIATIVE

- 1/20/89 George Bush is inaugurated as President of the United States.
- 3/1/89 President Bush transmits to Congress a message announcing the composition and functions of the National Space Council, to be chaired by Vice President Quayle.¹¹
- 3/1/89 Dr. Mark Albrecht is appointed Director of the Staff of the National Space Council.¹²
- As a result of interviews preceding his nomination as NASA Administrator, Admiral Richard Truly submits a one-page white paper to White House Chief of Staff John Sununu raising President Bush's opportunity to set national space goals; Bush replies.¹³
- 3/16/89 President Bush states at a Forum Club luncheon in Houston that he has "not reached a conclusion on whether the next major mission should be a manned mission to Mars," but has asked the National Space Council "to come forward with its recommendations."¹⁴

- 4/89 Vice President Quayle raises the exploration initiative with President Bush, receives a go-ahead to pursue the issue. Periodic conversations between the two follow.¹⁵
- 4/5/89 Vice President Quayle announces that the National Space Council will study the possibility of a lunar base or expedition to Mars in time for the president's fiscal year 1991 budget proposal, but warns that budget constraints may preclude any grand initiatives.¹⁶
- 4/12/89 President Bush announces his intention to nominate Admiral Richard H. Truly as the eighth NASA Administrator.¹⁷
- 4/20/89 President Bush signs Executive Order 12675 establishing the National Space Council.¹⁸
- 5/11/89 Mark Albrecht asks Philip Culbertson to recommend an exploration program that NASA could accomplish by the end of the century that would make use of the space station.¹⁹
- 5/25/89 Mark Albrecht calls Admiral Truly to ask whether NASA could return to the Moon by the year 2000; Truly confirms the White House request with Vice-President Quayle.²⁰

- 5/26/89 Culbertson reports to Albrecht that NASA could accomplish a lunar landing or a sprint to Phobos by the end of the century given an Apollo-scale activity.²¹
- 5/31/89 At the Office of Exploration sponsored "Pathways to the Planets" Conference, Mark Albrecht meets with Admiral Truly, Frank Martin, J. R. Thompson, and Philip Culbertson to solicit NASA's proposals for a new space exploration initiative. This leads to a request by Vice President Quayle, dated May 31, that NASA prepare options and recommendations "for [a] Presidential decision to take advantage of unique opportunity of July 20 [and] to achieve significant milestones in [the year] 2000."²²

III. THE STUDY

- 5/31/89 Admiral Truly establishes a working group to meet at the Johnson Space Center and pull together the details for a Moon/Mars exploration initiative proposal. Participants include Frank Martin, John Aaron, Mark Craig, Charles Darwin, Mike Duke, Darrell Branscome, and Aaron Cohen.²³
- 6/4/89 The working group assembles at the Johnson Space Center and begins its work.²⁴

- 6/13/89 Mark Craig and other members of the working group present their work to Admiral Truly and other NASA officials at the Holiday Inn in Washington, D.C. They propose "a permanent research facility on the Moon in the year 2000 [and] robotic exploration of Mars to support human exploration early in the next century." See "A Scenario for Human Exploration of the Moon and Mars," Mark Craig, June 13, 1989. (The charts used for this briefing provided background material for the charts that eventually went to the White House.)²⁵
- 6/15/89 Admiral Truly, Frank Martin, and Mark Craig present NASA's proposal to Mark Albrecht at the Holiday Inn, who suggests changes. See NASA, "Draft Briefing Package," June 15, 1989.²⁶
- 6/15/89 Admiral Truly and Frank Martin present NASA's proposal to Vice President Quayle. They recommend a lunar outpost by the year 2000 and a human outpost on Mars in the 21st century, to be preceded by robots. Also attending were Mark Craig, J. R. Thompson, Mark Albrecht, and two White House aides. See NASA, "Civil Space Exploration Initiative."²⁷
- 6/16/89 The Senate Commerce, Science, and Transportation Committee holds confirmation hearings on Admiral Richard Truly.²⁸

- 6/16/89 Admiral Truly meets with John Sununu to explain NASA's proposal. Sununu asks that Truly remove funding requests for FY 1990, that he allow others to review the program, and that he present the president with options.²⁹
- 6/21/89 Members of the Working Group (including Frank Martin, Mark Craig, and
-7/5/89 Darrell Branscome), working with Admiral Truly, refine the NASA proposal. They create three options: a lunar outpost, then to Mars; direct to Mars; and robots only. They also slip the deadlines one year (so that the moon landing, for example, would occur in 2001).³⁰

IV. BRIEFINGS

- 7/5/89 Admiral Truly briefs Vice President Quayle on the revised NASA proposal.³¹
- 7/5/89 The White House undertakes a series of briefings to explain the Civil Space Exploration Initiative proposal to four groups from outside the administration. All three options are presented, with NASA recommending the moon/Mars approach. "Space Advocates" receive the first briefing. Admiral Truly and Vice President Quayle lead the presentation and discussion.³²

- 7/6/89 Admiral Truly and Vice President Quayle brief representatives from the science community.
- 7/6/89 Chief executive officers of major U.S. corporations receive the White House briefing.³³
- 7/7/89 Congressional staff members from committees that oversee NASA receive the White House briefing.³⁴
- 7/7/89 The White House ceremony swearing in Admiral Richard Truly as the eighth NASA Administrator takes place with Vice President Quayle and President Bush in attendance.³⁵

V. THE SPEECH

--- White House officials draft the president's speech.

- 7/11/89- Reports appear in the Washington Post and Washington Times suggesting that
7/12/89 President Bush might unveil a new space initiative.³⁶
- 7/13/89 Admiral Truly, with the Vice President in attendance, briefs members of the Congress with responsibilities for space policy.³⁷

- 7/17/89 Admiral Truly, with J. R. Thompson and Frank Martin, brief Senator Barbara Mikulski on the Space Exploration Initiative proposal. A similar briefing with Senator Ernest Hollings follows.³⁸
- 7/18/89 President Bush returns to the White House from a 10 day trip to Europe.
- 7/20/89 President George Bush, in a speech on the 20th anniversary of the first Apollo moon landing, from the steps of the Air and Space Museum in Washington, D.C., proposes "a long-range, continuing commitment...for the 1990's -- Space Station Freedom...for the new century -- back to the Moon...and then...a manned mission to Mars."³⁹

Notes to the Chronology

1. NASA Office of Program Planning and Evaluation, "The Long Range Plan of the National Aeronautics and Space Administration," December 16, 1959, p. 28; NASA History Office.
2. John F. Kennedy, Special Address to Congress on Urgent National Needs, from Theodore C. Sorensen, ed., "Let the Word Go Forth: the Speeches, Statements, and Writings of John F. Kennedy" (New York: Delacorte Press, 1988), p. 174.
3. Space Task Group, "The Post-Apollo Space Program: Directions for the Future," September, 1969, p. 11; NASA History Office.
4. NASA Transition Team, "Report of the Transition Team: National Aeronautics and Space Administration," December 19, 1980, p. 7. See also option C, calling for a lunar base and human exploration of Mars, p. 6.
5. National Commission on Space, Pioneering the Space Frontier (New York: Bantam Books, 1986).
6. NASA, NASA News, "NASA Establishes Office of Exploration," release 87-87, June 1, 1987; Mark K. Craig interview, March 15, 1991.
7. Sally K. Ride, Leadership and America's Future in Space: A Report to the Administrator (Washington: NASA, 1987).
8. The White House, Office of the Press Secretary, "Fact Sheet: Presidential Directive on National Space Policy," February 11, 1988. See also Ronald Reagan, "1988 Legislative and Administrative Message: A Union of Individuals," Weekly Compilation of Presidential

Documents, January 25, 1988, p. 119.

9. NASA Office of Exploration, "Beyond Earth's Boundaries: Human Exploration of the Solar System in the 21st Century," Annual Report to the Administrator, November, 1988.

10. NASA, "Key Personnel Change," Appointment of Assistant Administrator for Office of Exploration, November 14, 1988.

11. George Bush, "Message to the Congress Transmitting a Report on the Establishment of the National Space Council," Weekly Compilation of Presidential Documents, March 1, 1989, p. 271.

12. Appointment of Mark Albrecht as Director of the National Space Council, Weekly Compilation of Presidential Documents, March 1, 1989, p. 272.

13. Franklin Martin interview, March 15, 1991.

14. Remarks at a Luncheon Hosted by the Forum Club in Houston, Texas, Weekly Compilation of Presidential Documents, March 16, 1989, p. 362.

15. Frank J. Murray, "Putting Man on Mars May Be Bush's Goal," Washington Times, July 20, 1989, p. A1. (When did the idea start?)

16. "Quayle Puts Damper on Manned Mars/Moon Mission Prospects," Defense Daily, April 5, 1989, pp. 22-23.

17. Remarks Announcing the Nomination of Richard H. Truly to be Administrator of the National Aeronautics and Space Administration, Weekly Compilation of Presidential Documents, April 12, 1989, p. 524.

18. Executive Order 12675 -- Establishing the National Space Council, Weekly Compilation of Presidential Documents, April 20, 1989, pp. 589-591.

19. Philip E. Culbertson interview, November 15, 1991.

20. Franklin Martin interview, March 15, 1991. The telephone conversation probably occurred between the May 23-24 Senior Management Assessment meeting and the May 26 meeting that Martin had with Truly.
21. Philip Culbertson interview, November 15, 1991.
22. Frank Martin, "The Briefing: 1989 New Initiatives," chart titled "Policy Options;" Philip Culbertson interview, November 15, 1991.
23. Franklin Martin interview, March 15, 1991; Mark Craig interview, March 15, 1991.
24. Mark K. Craig interview, March 15, 1991.
25. "The Objective," from Mark Craig, "A Scenario for Human Exploration of the Moon and Mars," June 13, 1989. Franklin Martin interview, March 15, 1991. Mark Craig interview, March 15, 1991. Martin states that J.R. Thompson, William Lenoir, and Lynn Fisk also attended this meeting.
26. Franklin Martin interview, March 15, 1991; Mark Craig interview, March 15, 1991.
27. Franklin Martin interview, March 15, 1991; NASA, "Civil Space Exploration Initiative," undated. According to Mark Craig interview, March 15, 1991, this meeting took place on June 20.
28. U. S. Senate Committee on Commerce, Science, and Transportation, Nominations--May-June, 101st cong., 1st sess., 1989, pp. 247-281.
29. Franklin Martin interview, March 15, 1991.
30. NASA, "Civil Space Exploration Initiative;" Franklin Martin interview, March 15, 1991; Darrell Branscome interview, April 25, 1991; Mark Craig interview, March 15, 1991.
31. Franklin Martin interview, March 15, 1991.
32. Martin interview, March 15, 1991; Mark Craig interview, March 15, 1991; NASA, "Civil

Space Exploration Initiative."

33. Mark Craig interview, March 15, 1991.

34. Franklin Martin interview, March 15, 1991; Mark Craig interview, March 15, 1991.

35. Admiral Truly was officially sworn in on July 1, 1989, at NASA headquarters.

36. Clarence A. Robinson, "Space Council Urges Manned Lunar Base," Washington Times, July 11, 1989, p. A1+; Rowland Evans and Robert Novak, "Quayle's Ambitious Space Program," Washington Post, July 12, 1989, p. A23; Kathy Sawyer, "Space Initiative May be Grounded," Washington Post, July 13, 1989, p. A21; Bernard Weinraub, "President Is Said to Back Moon and Mars Projects," New York Times, July 20, 1989, p. A21; Frank J. Murray, "Putting Man on Mars May Be Bush's Goal," Washington Times, July 20, 1989, p. A1+.

37. Franklin Martin interview, March 15, 1991.

38. Franklin Martin interview, March 15, 1991.

39. White House Office of the Press Secretary, "Remarks by the President at 20th Anniversary of Apollo Moon Landing," the steps of the Air and Space Museum, Washington, D.C., July 20, 1989, p. 3.

Transcript of Interview

Franklin D. Martin

By Howard E. McCurdy

March 15, 1991

Washington, D.C.

I. PERSONAL BACKGROUND

DR. McCURDY: First of all, we have your birth date as [REDACTED]

DR. MARTIN: That is correct.

DR. McCURDY: Your home town is China Grove, North Carolina?

DR. MARTIN: That's right.

DR. McCURDY: Where is that?

DR. MARTIN: Well, I was born in [REDACTED], which is the same place Elizabeth Dole is from. So you can get that in perspective. China Grove is a little cotton mill town. It is about 30 miles north of Charlotte, North Carolina, just off of Interstate 85.

DR. McCURDY: What was your father's occupation?

DR. MARTIN: He was a truck driver for Armour Meat Packing Company.

DR. McCURDY: Was your mother professionally employed?

DR. MARTIN: She was a cotton mill worker.

DR. McCURDY: Do you have brothers and sisters?

DR. MARTIN: Yes. I have got -- I was just thinking about my mother and father, who both passed away. My dad went to the eighth grade and my mother went through the fourth grade. I think she was 14 years old when they got married. So it was a different time. My wife and I got married when we were 18, and our kids talk about getting married when they are 30. So it is an interesting progression as society changes.

But you asked about brothers and sisters. Yes. I have a brother who is 13

years younger than me and I have two sisters in between. They all live in North Carolina.

DR. McCURDY: Did they go to college?

DR. MARTIN: My brother did. He is an accountant. The other two did not.

DR. McCURDY: You went to school and majored in physics and math.

DR. MARTIN: Yes.

DR. McCURDY: And eventually you got a doctorate in physics?

DR. MARTIN: That is correct.

DR. McCURDY: When did you first get interested in space exploration?

Was it during your college years?

DR. MARTIN: I never was. I backed into it. I went to college because I wanted to be a high school teacher. When I got into college, I wanted to be a college professor.

I went off to graduate school. My career kind of mapped the build-up in the Apollo program. I got my PhD in physics in 1971, which was the year that the country gave the most PhD's in various programs and I benefitted from a lot of money that the federal government was putting into science and technology.

I came from a family that wasn't -- let me put it politely -- wasn't affluent. So there were programs like the National Defense Education Act that were targeted specifically for people like myself who were good students, but couldn't necessarily afford to do some of these things. So my wife and I both went through school on scholarship programs that were subsidized by the government.

Subsequently, the National Defense Education Act paid for three years of my

schooling at the University of Tennessee at Knoxville. The last two years were done under a research grant to the Naval Research Lab.

I went to Knoxville to the University of Tennessee because Oak Ridge National Lab was close by and I wanted to be a nuclear physicist. But as we got into this whole business, the whole business of high energy physics on the ground was falling out of vogue and they were closing down reactors.

Research groups were folding in high energy physics. It was because they felt that there were just no new frontiers. Look at what has happened since then. Most of the Nobel prizes have come about because of people with strange particles and quarks and all of those kinds of things that have happened since then. But at that time, money was getting tight and areas were being cut back.

So what I did is I got involved in underwater acoustics because I thought it was practical. My wife and I had a child; therefore, we were beginning to think about building a nest that was more substantial and trying to find something that I could do with this degree.

In the process, I found myself graduated from the University of Tennessee in August of 1971, which had to be the worst year on record to try to find a job with a PhD. Someone walked in the door with a contract at Lockheed Corporation in Houston, which had a support contract there and still does. It is the same outfit that does the support here. They have a large support contract where they provide technical support. NASA had added to the last couple of Apollo missions orbital science. They needed to have scientists to interface with scientists in the research community. They could not hire government employees to do

that, so they went to the low bidder. They went to Lockheed. Lockheed went out to the university community to find some generalists to come in and do those jobs. I got hired right out of graduate school and got a job offer to work in Houston with no other real offer, other than post-doc.

My wife thought I ought to go to work. So I went down there really to get the experience, but my whole hope was that I could go out and help pay some of my bills and debts from being in school and eventually become a school teacher. I got interested in the program that way from the firsthand working on those couple of Apollo missions.

DR. McCURDY: By school teacher, you mean college professor?

DR. MARTIN: College professor, high school, both those things continued to interest me. So I kind of backed into it. It was quite an experience.

DR. McCURDY: You then came to NASA headquarters in 1974; is that right? That was your first job with NASA?

DR. MARTIN: The Houston work was with Lockheed, at the Manned Space Flight Center, on Apollo. Then I came to Washington to work for the Navy. I had this degree in underwater acoustics. So I got involved in that. That went on for about a year.

I think because our daughter was born while I was out on a research ship, my wife made a call to some NASA friends and I suddenly had an invitation to come over to NASA headquarters. I came into the lunar program office working on Lunar Polar Orbiter, which is still around. I was kind of a program scientist, mission definition type out of NASA headquarters on that.

I got involved in advance mission planning. This was the beginning of 1974.

Then I became a part of the physics and astronomy advanced programs and all the explorer satellites and the great observatories and a lot of the solar terrestrial physics programs. Eventually, I wound up as the Director of the Astrophysics and the Solar Terrestrial Divisions. They had about three or four different names during that period.

It was during that time when Tim Mutch passed away. He was the associate administrator killed in a mountain climbing accident. So there was a lot of personnel as well as budgetary turmoil. Programs were being cut back. The U.S. portion of the international solar terrestrial project was canceled during that period. I was in one of the divisions that was affected by that kind of thing.

Then after that, I went on out to Goddard as the Director of Space, and eventually Space and Earth Sciences. I came back to NASA after the Challenger incident to work for Andy Stofan who I had worked with before on the space station program. We were busy during that period getting the contracts awarded for the space station hardware work and associated activities. I spent, I guess, about two and a half years on the space station.

It was at that point in time that I made a decision that it was time for me to move on. The new administration was coming in. Basically, it was Jim Fletcher and Noel Hinners who asked me if I would consider taking the exploration job. This was in December of 1988 or the November-December time frame of 1988. [They asked] if I would consider doing that, because I was very much concerned about staying around for another space station change. I had agreed to come work for Stofan and I agreed to stay on and help Jim Odom get settled in. I just felt like two of those was enough for any one person to do. I

really was looking for something else to do.

So they gave me that [the exploration office] as sort of something to keep me occupied for a while and a nice, quiet place to rest. The space station was kind of a busy place. So I kind of viewed the exploration office as a nice, quiet interesting place to work and did not expect that much of anything was going to happen for a couple of years.

DR. McCURDY: Now the exploration office had been in business since the Sally Ride report.

DR. MARTIN: Sally Ride had started the office. Then John Aaron had come in. At the time I got there, John Aaron had just put out his report, "Beyond Earth's Boundaries." One of the first things that John and I did, I believe, literally the first week I was there, the first week in December of 1988, was to have a press conference and to go around and brief the various people around town that needed to know about the "Beyond Earth's Boundaries" report.

So there was a huge base of data on Moon/Mars that went back not just to John Aaron, but to Sally Ride and the National Commission on Space. You could go on back a couple of decades and you find Wernher Von Braun saying many of the same things. There had been a long history of work both at low level and highly visible ways.

In particular, I think the National Commission on Space report came out right about the time the Challenger accident occurred, and therefore, kind of got set aside in a way. The only response to that was the Sally Ride report.

But the agency, NASA, had at least internally been in support of the National Commission on Space. Sally Ride and John Aaron had been working away and looking at

what it might take to do a Moon/Mars mission in today's terms.

DR. McCURDY: And the White House had been, in 1988, developing a space policy, which Reagan put out toward the end of his term.

DR. MARTIN: Reagan put out a space policy toward the end which included a statement on expanding the human presence and activity beyond Earth's orbit in the solar system. You can talk to the people who were closer to that. Ken Pederson, for example, might be a good person to talk to, and some of the people around the White House.

There was a lot of struggle about whether that really meant sending humans or whether it meant sending robots. As you can imagine, that discussion was there. It [the policy] came out in a way that those that were interested in human exploration with humans actually doing it found it acceptable.

DR. McCURDY: When you came into the Office of Exploration, did you have the impression that NASA was aggressively pursuing the Mars/Moon initiative?

DR. MARTIN: I came in at the end of Fletcher's second term recognizing that there was going to be a new administrator. In my own personal sense, I recognized that and I was thinking along the lines of changing my own career. So in a sense, personally, it wasn't something that I was worried about -- whether it was aggressive or not.

I had been through the last 15 or 20 years where, after Apollo, I could not characterize the support in this town or in the White House as being strong on a space program that was good. I mean we got money to build shuttles. We did science programs and we did things, but there were always constraints. Money wasn't lavished on the programs.

So coming from that particular environment and recognizing there was a transition, I recognized that Jim Fletcher was not going to go across the street and make a proposal -- at least I didn't believe so -- that would be acceptable to the then-Reagan administration to announce a bold, new program to go to the Moon and Mars. That was going to be the subject for the next administration for the next administrator, if at all. So that was my mind-set when the transition came.

DR. McCURDY: You were speaking of this job as a transition: a transition to what? To industry?

DR. MARTIN: Well, I really wasn't quite sure. I had hoped in my own mind that it was going to be a transition to a university to teach school, which is what I wanted to do. During my years here at NASA and particularly within the last few years with the space station and exploration, I spent quite a bit of time with the NASA education office and at the universities and the school systems doing those kinds of things.

First of all, because I believed in it and secondly, because it was good therapy to see people really get excited about these things as opposed to the kind of staff inspections that you see proliferated here in Washington. So I did quite a bit of that.

II. THE INITIATIVE

DR. McCURDY: When did you first learn that NASA was going to aggressively pursue the Mars/Moon initiative?

DR. MARTIN: I can tell you very specifically -- in fact, it would probably be easier if I went through my calendar and told you that because it happened over a short

period of time. Would you like to do that?

DR. McCURDY: I would like to hold on that just a minute. It occurred when: in the spring or the winter?

DR. MARTIN: Let me tell you what: Jim Fletcher was very much interested and everybody -- Noel Hinners and all those kinds of people were supportive, but it wasn't something that you went around and talked a lot about.

You had to be very careful because the Office of Management and Budget, for very good reasons having to do with expectations of Congress and the public and others, was very careful about things like the John Aaron report -- whether or not there were schedules and dates and all that kind of stuff in it. Those things had to be taken out because they implied commitments of the administration. So you had that going on.

I think probably the first time I realized that the new NASA administrator, Admiral Truly, was interested [was during the events that led up to his confirmation hearings]. I did get to know him because of the connection between space station and the shuttle program prior to that, but not as personal friends, not as comrades and compatriots.

I was told by a lot of people a lot of things that you sometimes read in the paper about the man: that is, he is an astronaut, he is too conservative, and the last thing in the world he is going to be interested in is any of this exploration stuff, so keep your head down. That was the advice I got concerning Admiral Truly.

What I found out about the man was exactly the opposite. He and I had a conversation in the hall of the Senate after one of the hearings that he was involved in after he had been announced, but was not confirmed. We spoke in the hall briefly about the

exploration thing. He expressed a keen interest in it. I didn't understand until later why he was as strongly interested in it as he was.

But I found out later on when we got heavily into this that one of the things that he did when he was being interviewed for the administrator's job was that he suggested to John Sununu that it was George Bush who would have the opportunity sometime in his tenure, four-year kind of tenure, that it would be George Bush who would have the opportunity to set the next set of major goals in the civil space program.

Sununu was interested in that, and asked Truly if he would write it down on a white paper. Truly did a one-page white paper. He showed it to me, and of course, copies haven't been thrown around on it. It was a simply worded, non-specific thing that said just what I have said -- that you really do have an opportunity to lay out the next major goals in space. That note was passed on to George Bush and George Bush wrote a note back to John Sununu. If you ask Truly about this, he will probably show it to you.

I have learned that my memory isn't too good because I remember some of these dates as being slightly different than what they turned out to be in this calendar. The note from Bush back to Sununu was that this looks like a good thing, and we should follow up on it. Now whether that note and the response to Sununu was the thing that stimulated the White House or not, I don't know. I'll tell you the rest of that piece of the story.

Having seen that made me understand at that time, which was prior to the contacts from Mark Albrecht and the Vice President on the subject, that Admiral Truly had already thought about the long-range strategy for the future of the civil space program and was most receptive to whatever thoughts that I might have had and others might have had.

In preparing himself for the job of being administrator, he had done quite a bit of reading and studying and consulting with individuals. While he was an astronaut, he was also a carrier pilot. Carrier pilots are used to being hitched up periodically to catapults and being thrown off into oblivion or flying and testing shuttles and planes and so forth.

So here was a man who to me had been responsible for guiding the shuttle into the recovery thing; yet I found the guy privately to be one of a tremendous amount of vision who melded the element of risk with the pragmatism of understanding how tough it is to do things. I find that you find very few people who have had to go through that process.

So here was someone who was willing to encompass the vision of where we ought to go next -- but at the same time, insist that it be done in a responsible and rational manner. Nowhere during this time did Dick Truly ever tell me, "Make it cheaper or do it faster." It was always, "Do it right. Make sure we can do this. Make sure we understand the scope and magnitude of this program."

So we had this conversation in the hall. We talked about a couple of things. There was this resonance and instant communication that was there. He invited me to come by and visit with him later on, which we wound up doing, but other things caught up with us very quickly.

DR. McCURDY: What was your reaction?

DR. MARTIN: It was a very interesting reaction because it happened this way. On May 16th, which was before the contact [with Mark Albrecht and the Vice President], we were in the middle of a GMSR [General Management Status Review]. At lunchtime, we broke. I asked Admiral Truly if I could visit with him for a little bit. What I

told him was that I had given a great deal of thought. (He understood that I was in transition when we had this conversation.) That I had met with my family and we had decided that I was 45 years old and it was time to change. That I wasn't really prepared to make a commitment for another four or five years.

There were all kinds of ethics laws being bandied around about restrictions on employment in the private sector, a few other things of a personal nature. Basically on May 16th, I gave him my verbal resignation. So I had resigned from the agency. This was May 16th of 1989.

Within a week or two, somewhere in that time frame, before the end of the month and probably the week before the end of the month, he called me back. We had talked twice about this during that period. One was to tell him, and then he said, "Would you please come back and think about this a little bit."

Fundamentally what I told him was, "Yes, but I would wait until after his confirmation hearings."

It turned out that his confirmation hearings, you can find in the calendar, were June [16] and this end date for the ethics laws was July 20th or something. So I volunteered -- he never asked for anything -- I volunteered that I really have decided I am going to go, but I'll wait until after your confirmation hearings so you don't have to read in the paper about one more NASA official leaving. But I will be leaving. I'll pick a date, but we'll do it after you have been confirmed and before that law goes into effect.

We had those two conversations. He was very gracious and very supportive. The last thing in the world I ever saw from Dick Truly was the view that if you weren't an

astronaut, if you weren't one of the chosen, that you couldn't be a part of the system -- which you hear people talk about, the articles written by some people who are welcome to their opinions. But I felt nothing but welcome and a very generous and gracious individual.

I found what happened the following year that led to the [President's] speech and it raised my opinions of the man to an even higher level. What he did was -- Mark Albrecht called him, either called him or talked to him. It may have been a phone conversation; but they could have had a meeting. At that time, I had neither heard of Mark Albrecht and had never met him.

Truly called me. I think it was the last week of May. Again, I have no way with the records I have to verify when that was. He sort of began the conversation, he said, "About this resignation and you leaving," he said -- and he kind of make a joke out of it. He said, "Mark Albrecht has called and wants to know if NASA can go back to the Moon by the year 2000." It was basically that simple. It wasn't Moon/Mars. It wasn't anything but can we get back to the Moon by the year 2000?

He said, we had talked a bit about this but we hadn't gotten to answering that specific question because no one had put the urgency on it that this was. So we had the conversation about, you know: Albrecht was new; he was all full of energy. As they say down south, "a little piss and vinegar," a lot of enthusiasm. There was no way to calibrate if this was just a new staff guy who is busy playing "what if" games or was this a serious proposition.

The conversation that Truly and I had was -- I think I was the one that suggested it to him -- that the real way to find out was to call the Vice President himself and

to verify that indeed this is something that the President wants to be done and how it is to be handled so that we don't get caught into some staff trap. I didn't want to do anything that would either embarrass the agency or the Administration or Mark Albrecht for that matter.

So Truly called the Vice President and very shortly called me back. As part of the [preceding] conversation with him (on the subject about my resignation) I had told him, "Well, we could probably do a pretty good job. We had lots and lots of data on this exploration business. We could do a very good job of sort of scoping it out."

We had a lot of fresh data that was coming in very shortly. So we could give them a good answer. We could be responsive. The answer was yes, we could.

What I told him as part of that conversation was that if he needed me to do something given the nature of this, I would certainly be willing to stay around if that was what he needed to have done. When we got through with that process, then we could talk about a date, but that I wasn't going to walk out the door and leave him just sitting there with that.

He called back later, and he said that, indeed, the Vice President was interested in this and indicated that so was George Bush, and could we do something to respond to this activity. So given that, what we did was on May 31st and June 1st, there was a conference that had been scheduled for sometime at, I believe, the Omni Shoreham Hotel. You may want to check on that.

(Let's see the May 31st date in here. It says the Sheraton Squire. Have I got that right now? No, I have got it wrong. For some reason, I thought it was the Omni Shoreham, but I can tell you where you can find out for sure. That is to check with Terry

Finn. I can tell you how to get there, but I can't remember the name of it for some reason.)

DR. McCURDY: Okay. We can check that out.

DR. MARTIN: It was originally intended as kind of a coming out party, after the John Aaron report. It was basically a public meeting. We had put the program together ahead of time. The morning speakers on that program were Mark Albrecht, Dick Truly, J. R. Thompson and myself. That is what was scheduled for that morning. It turned out that during this process, Mark Albrecht, prior to talking to Admiral Truly on the subject, had gone to Phil Culbertson, former NASA assistant administrator. Are you aware of this? And he had asked Phil to take a look at: if NASA were asked the question, could you go back to the Moon by the year 2000, could NASA do it?

It was a very sensible sort of thing: let us see if we can check this out before we find out what NASA thinks. Phil, in addition to whatever other sources he may have used, went to the Langley Research Center and talked to -- you have got to help me with the names now, the guy who is the Director of Science down there now that has been doing trade studies forever on Moon/Mars and space station and all these other things. [The person was Ray Hook.]

DR. McCURDY: How about [Paul] Holloway?

DR. MARTIN: No, it is not Holloway. I am embarrassed now; he is such a good friend. Anyway, he has forgotten more about the whole business of major system trades for large systems and so forth than anybody else.

DR. McCURDY: Was it Brian Pritchard?

DR. MARTIN: No, it was not Brian. Brian works for him. If you pick up

the Langley phone book, you'll see him in there as a Director. It will come back to me, and then I'll tell you who it is.

Anyway, he [Culbertson] went to that group who had done a lot of these trades historically and asked them the question. They came back and said yes. So in addition to that information or whatever else he had, the input back to Mark Albrecht was, "Yes. NASA can respond affirmatively if you ask on that."

Now that was a sensible thing, I think, for Albrecht to do -- given the post-Challenger situation where you pick up a paper and see, "NASA Is Lost In Space," and all these other kinds of things that you would worry about.

Phil Culbertson talked to, in the midst of all of this stuff, prior to the 31st of May, Culbertson talked to me, as well as Admiral Truly, during this period and gave us the background on that. Well, I have given you a long, kind of shaggy dog story about this because it turned out that because Truly and Thompson and Albrecht and myself were all going to be together for this conference here in Washington, we invited Phil Culbertson to come along and participate in what we called a "Speakers' Breakfast."

So that morning of the 31st, I met Admiral Truly. We had had a number of conversations, but I met Admiral Truly early that morning, well before the meeting. I can't remember exactly what time the meeting happened, but it was the hour before that conference started. If you talk with Terry Finn, he probably has a copy of those proceedings buried somewhere in the file. So we had that breakfast. That was what I call a hand-off from Phil Culbertson in the process. Phil was there sort of to say, "Here is what we have got," and answer any questions.

The hour before we got into that meeting, I spent in the lobby of that hotel with Admiral Truly. He spent that time asking a lot of very informed questions: What about robots? What about going to the Moon? What about going to Mars?

The nature of that conversation, without going through the whole thing, but I remember very vividly, the gist of the conversation was that going to the Moon is not the right answer. We have been to the Moon. If we are going to go to the Moon, we need to go back to stay. In the process of doing that, if you announce that you are going to go to the Moon and then go to Mars with humans, you had better be prepared to send robots along in the process.

First of all, you need them to do the precursor work and so on and so forth. But if you are going to build a constituency, to pick between the Moon and Mars is a little like Solomon cutting a baby in half. Really, the policy of the United States as stated by Ronald Reagan and later as restated by George Bush is to expand human presence and activity in the solar system.

One of the lessons from Apollo is if you go racing off to plant a flag on Mars or whatever it is, then you may be able to recreate the brief glory of the Apollo era, but you may have done little to expand human presence and activity in the solar system. So I will use my words and not the words of that meeting: the message was that the real program was men, women and robots, Earth, Moon and Mars.

We talked about Mission to Planet Earth: that really to have a program, you had to have the Earth, Moon and Mars in it since those were the three principle planets that you could really do anything with in the near term that involved humans directly. He

[Truly] listened. He asked lots of questions.

When we went into the meeting with Mark Albrecht that morning, I had no idea what he was going to say.

DR. McCURDY: "He" being Truly?

DR. MARTIN: Truly. I did not know. We had lots of conversations. All I saw was the sparkle in the man's eye and his keen interest in this. We had lots of interchanges, but other than the conversation, I had no idea how he was going to handle this particular situation other than recognizing that the guy was very intelligent and very thoughtful.

We went into the meeting. Albrecht came in. Albrecht is an interesting character. Like me, he has a beard. He wears suspenders. To put it politely, he has a lot of confidence. It was kind of exciting to see him because he was -- here was this guy who says, let's get on with it, we are going to do something. He started to immediately take charge and say -- they had already had a conversation, yes, we'll talk about this at this breakfast meeting. He was, "Let's get back to the Moon," and so on and so forth. So he goes on with his conversation.

Truly listened. When it was over with, Truly said, "That is an important thing to do, but I believe that the real program is Earth, Moon and Mars as a total program strategy and both man and machines working together. It is that program that I think we need to proceed with."

He went through his logic and it was impeccable. Sally Ride or Tom Paine or anybody else including Wernher Von Braun would have been proud of this supposedly

conservative astronaut as he discussed this. I must admit that I was both very proud of him and felt very fortunate to have been a part of whatever part I played in helping to communicate any ideas to him. But I felt I was talking to someone who had already thought a lot about the problem, and in no way believed that he had formulated these things the hour before. He was using me to test his own vision of what the future of the agency should be.

I showed him [Truly] one chart prior to that meeting because at this conference, I had this very long presentation about exploration. I showed him one chart, which I will show you. [Chart: Science and Engineering Doctorates, from NASA, "Civil Space Exploration Initiative."]

As I was flipping through, and I was talking about the impact that the civil space program has on various things, that was the last pixel here in this PhD thing. Everybody has probably seen this chart or some version of this chart. This is how it looked that morning, except it was in black and white. We didn't have the color version of it put together. We didn't have these dates on it. There was a budget chart that went with it.

In fact, it wasn't this exact chart. It was a chart that had the NASA budget which peaked in 1966. It had all this other stuff on it. I had used it because I graduated from high school in 1962 and I graduated from college in 1966 and I got my PhD in 1971. So I used it to talk to kids about education. I showed it to Truly and was telling him this story.

Of all the things we had with us at that meeting with Albrecht, Truly asked for this chart or the other version of this chart. And he takes this chart and puts it in front of Albrecht. Albrecht looked at the chart and very quickly, very bright guy, he says, "This is

really good stuff. This is a winner, but you have got to change the chart. Take the budget off of it. Don't confuse them with the budget. Put the date of Kennedy's speech, the date of the Apollo landing," and you know, anything else.

So this was Albrecht's idea to do this and to remove the budget from it. It is a very strong way of just delivering the message -- not that the space program does these things but the impact that a nation can have on its young people when it takes on challenges and decides to do things, and then the impact of what happens when the people from other nations are basically taking advantage of your educational system and your own children aren't.

So we had that conversation and it was at that point that I realized how much Truly was also interested in education. We had not specifically talked about that at that time, but that version of that chart was something that he took a keen interest in. Like I said, it was put together for me to talk to high school kids, but I used it in our exploration talk just as an example of what a nation can do.

So when we got through with the meeting, Albrecht went all the way from, "Well, okay, maybe going to the Moon is not the right answer. We don't care about the answer. We think investing in this and infrastructure (he called it the highway through the heavens or the skies or whatever it was) was great for the country just like investing in the highway infrastructure here is," and so on. He was very eloquent and energetic about this whole discussion.

He says, "I don't want to tell you what to do." He says, "All we want is for you guys to come forward and give us a plan on what you can do. We need it very soon

because here it is, it is May 31st and the President plans to make a speech on July 20th. We need to review this and how soon can you guys turn it around?"

III. THE WORKING GROUP

I had already agreed with Truly that it turned out that all the engineering data from all of the trade studies that had been going on over the past year, which Sally Ride and then John Aaron had put into place and Mark Craig was then doing in Houston, were all due and available the first week in June. So in a sense we were very fortunate that we had fresh data and as good a [set of] data as we could, to try to scope out what this was all about.

DR. McCURDY: Could you give me an example of what that engineering data might contain?

DR. MARTIN: Well, spacecraft sizes, masses, sizes of launch vehicles. I mean it all exists. It was actually published. Mark Craig could give you copies of it. It was all the kinds of systems trades that allow you to scope these things out and figure out how much it takes in resources to do them.

DR. McCURDY: Was this [May 31] meeting the first extended meeting you had had with Admiral Truly?

DR. MARTIN: No. I have had lots of extended meetings with him, but I had not had a number of extended meetings on the subject of exploration.

DR. McCURDY: That is what I meant.

DR. MARTIN: Yes. We had known each other and dealt on space station.

DR. McCURDY: Was this the first extended meeting on space exploration?

DR. MARTIN: No. There had been some other discussions, brief discussions, half hour or whatever it was in his office prior to this. This morning [May 31] was the time that he had asked me to come. He said, "Basically I want to ask questions and I want you to answer the questions."

DR. McCURDY: Was this the first contact you had with Mark Albrecht?

DR. MARTIN: Very first, yes.

DR. McCURDY: And you hadn't had any contact with the Vice President or anybody else in the White House?

DR. MARTIN: None at all. I had dealt with the White House staff with OMB over the years and OSTP staff. But the space council staff did not exist. In fact, at that time, I don't believe there really was much of a space council staff.

I don't know what the timing was, but it was Albrecht and we never saw the space council staff until a later time, which I can share with you. It was Albrecht and the Vice President through most of this period. There was no space council meeting -- the space council, of course, being all the heads of the various agencies that are involved. They never were involved as a council prior to the speech as near as I could tell.

DR. McCURDY: You never made a presentation to the space council?

DR. MARTIN: Absolutely not. But I can tell you which presentations were made and to whom they were made.

DR. McCURDY: What did they ask you to do as a result of this meeting?

DR. MARTIN: Well, Admiral Truly told them what we could do. They wanted us to get back to them in a couple of weeks. We agreed to do that. But what

Admiral Truly committed to do and he and I had already agreed to was that I would pull a small team together in Houston, Texas, and we would spend the next two weeks basically pouring over the new information that we had. We would come back with a set of charts that scoped out in terms of cost and schedule doing something by the year 2000, that involved the Earth, Moon and Mars and humans and robots -- men, women and robots, I call it -- and that reflected his strategy that he and I had been discussing. So that was the charge I had.

We went off to Houston and I spent most of the next two weeks down there. So when you look at the calendar, you will see there are airlines listed, which are probably the flight numbers. I spent several days of those two weeks down there working with the following individuals.

Aaron Cohen was brought into this. Of course, J. R. Thompson was involved in this and myself. I think at this point, there was no one else at NASA headquarters other than Admiral Truly's secretary who had any idea of what was going on.

I am not sure aside from Mark Albrecht and the Vice President how many people outside were brought into it. Later on, it was clear to me at least that the working staff at OMB was not even [brought in], even though [Richard] Darman knew about what was happening.

Anyway, let me come back to what we did. We took that data we had. The team that was involved with this -- and Mark Craig has probably already told you this, too, but see if my memory is good. It was John Aaron. John had led the previous year's activity on exploration, plus John also had a lot of experience on mission trades and costing the space

station. I had been on space station, of course, and had benefitted from that also. So it was me; it was John Aaron; Mark Craig because Mark was the one who was really tasked with doing the project level analysis. Charlie Darwin from Marshall Space Flight Center. Of course, Mark and John Aaron are from Johnson. Charlie Darwin is a long-term hand at advanced mission work at Marshall.

Then Mike Duke, who is a scientist from the Johnson Space Center and a long-term lunar and planetary science type and very much plugged into the justifications and scientific rationales for these various things, and Darrell Branscome who was in charge of advanced mission planning for code M, the manned space flight guys here at NASA headquarters and had worked with Admiral Truly for some time.

The other individual who supported us and was in and out through this time and helped review what we were doing was Aaron Cohen. Aaron gave us a facility that I called a facility in the "back 40" down at the Johnson Space Center that was away from the main traffic and was a facility that they used for proposal evaluation and those sorts of things.

So it was set up with desks and computer terminals and things of this sort.

DR. McCURDY: Was it on the center?

DR. MARTIN: It was on the center inside the gate. So we spent those two days [weeks] there with those folks basically stopping whatever it was they had to do on everything else as best they could and devoting them completely to trying to put together a set of presentation charts and get a good understanding of what we saw the costs of such a program as being. That is what we did.

DR. McCURDY: Do you remember which two days [weeks] those were?

DR. MARTIN: Let me get the calendar here. (I have gone to the wrong month.) Oh, one other thing you ought to be aware of. In addition to that discussion that we talked about with Truly, you asked me: Was this the first extensive discussion that I had with Truly on the subject of the Moon/Mars stuff? The answer when I look at the calendar here is: May 22nd and 23rd, Admiral Truly had a retreat with all of his senior staff, as well as the center directors. We went away to Turf Valley in Ellicott City. Each one of the program AAs [Associate Administrators] got up and presented their program. Again, I was told that when you get ready to talk about this exploration, he is going to eat you alive. But it was a very pleasant experience. He was very much interested in what was going on whereas when you looked around the table, there were clearly some individuals who saw this business as either frivolous or a threat compared to the current budget thing. I don't mean this as a negative thing relative to them.

It [the phone call from Mark Albrecht] probably happened after that meeting. It may have been before. You would have to ask Admiral Truly whether it was before that meeting or after that meeting, but I do see that on May 26th, I was in Admiral Truly's office at 4:30. It was that meeting where we had quite a discussion on the subject. At that point in time, that had to be after the phone call. So we were in the process of having face to face conversations on what could and could not be done.

June 2nd was a Friday according to this [Frank Martin 1989 appointment calendar]. So it [the gathering of the working group] was the following week. In fact, it shows me going to the Holiday Inn and NASA Road 1 on Sunday. So we were in there

working at least on Monday [June 5] if not over the weekend. We probably started on Sunday if I remember correctly. But we worked through that week for the most part. You'll see, for example, on June 6th, it shows an OAST University Space Engineers program meeting with Steve Hartman.

Do you see that there? It says down below, "DOH."

Chances are that I was not back then, that I was still in Houston. Doug O'Handley probably handled those meetings. In fact, you could probably find out exactly the times if you knew what those [airplane] schedules are -- those are the flights. I just don't remember. I stayed a good part of that week. I came over the weekend and then went back the following week to put the final touches on what we were doing.

DR. McCURDY: Was Mark Craig involved in the exploration conference?

DR. MARTIN: I think so.

DR. McCURDY: I mean was he there? Because you have a meeting with him on Friday morning [June 2]. [Craig did not attend the Pathways conference.]

DR. MARTIN: You would have to ask Mark. My remembrance of that is that he may not have been at the conference because of the work that needed to be done to get ready for the rest of this. I think he had sent somebody to the conference, but I could be wrong. One of the things that I have learned is that my personal remembrances aren't always exactly right on target, but you do oral history kind of work and so you know it for a fact. But you have to ask him. I know he was very much involved, as John Aaron was, in scoping out this process.

DR. McCURDY: Who was the person who was in charge of pulling all this

together?

DR. MARTIN: Me.

DR. McCURDY: Who was the person who was in charge of pulling together materials at Johnson?

DR. MARTIN: Mark Craig was.

DR. McCURDY: Okay.

DR. MARTIN: Mark was the guy who worried about the technical details of it. John Aaron led the cost piece of it. Darrell Branscome looked at it from the standpoint of future plans, transportation issues and so forth. Charlie Darwin's main function was to worry about some of the transportation elements, launch vehicle kinds of considerations. John Aaron and I were both very much involved in what is the impact on space station if we try to use that. Mike Duke was very heavily involved, as I got involved in it from my own background, of what are the scientific rationale and sort of the scientific uses of these things. So we had a team that overlapped in terms of background and experiences.

They were picked not because they came from this center or that center, but they were picked because you had someone there who had a lot of experience in unmanned programs and science programs, myself. You had someone who was a card-carrying, publishing scientist. You had someone who had been involved in space station, two different groups with the space station, transportation, so on and so forth. So it was a small group, but it was a very experienced group. I don't know how many years of experience, but quite extensive years of experience in every element of the kinds of things that you would need to do to do that. Darrell Branscome brought to it his political experience from having worked

on the Hill. So it was a good thing. It was a group of people that if I were going to get a group of folks together to try to make something happen that I believed was feasible, it is those kinds of folks that I would have counted on.

DR. McCURDY: They were physically in Houston.

DR. MARTIN: We all went to Houston. Everybody went to Houston to work on this.

DR. McCURDY: And you were going back and forth?

DR. MARTIN: That's right. In fact, some of the others probably went back and forth during that period, too. I know Darrell did and I am sure Charlie Darwin did. Of course, Mark and John Aaron and Duke and Aaron Cohen were all in Houston anyway. Aaron Cohen was very much involved in reviewing things. Aaron and I spent quite a bit of time worrying about the institutional resources that were needed to do the job too -- the manpower facilities and all those other kinds of things that were there. So we had some interesting discussions on what we thought it would take to do that.

DR. McCURDY: When did you pull together a product?

DR. MARTIN: I brought some things for you. The first run-through of this was, I believe, June 13th in the Holiday Inn. (I told you we were ready.)

DR. McCURDY: That's Holiday Inn in Washington, D.C.?

DR. MARTIN: That's the Holiday Inn right across the street here. It was in the Mercury Room of all places. I have marked it on this calendar here on June 13th, if you look at that calendar. It has Mercury Room written in the middle of it in light [writing]. We got the room, and in a sense, it took me forever to kind of get it straightened out

because I think I used my personal credit card to get the room rather than following the usual procedures. We kept it a secret. That was a review of the draft charts that we pulled together for a briefing, which I think was scheduled for June 15th, which I believe was [for] the Vice President. That is where my calendar breaks down, but I believe it went to the Vice President on June 15th. At least that was the plan when we brought the draft together.

DR. McCURDY: Who do you recall being at the June 13th run-through? Was this just internal NASA?

DR. MARTIN: Because this program impacted the space station the way we had structured it, and transportation issues, Bill Lenoir was at that meeting. I believe J. R. Thompson was at that meeting, but again you would have to check and see. Admiral Truly clearly was at the meeting. The whole team that was involved in it, I remember that they were there -- all the people, including Aaron Cohen. I do not know at that point in time whether or not Len Fisk had actually been brought into the discussion. It was either right at that meeting or very soon around that time. Len Fisk, in all likelihood, was probably there.

DR. McCURDY: Len, L-E-N?

DR. MARTIN: Yes. The head of the space science and applications program. I don't know that there was anybody else in that meeting. And I don't remember -- what I think was that we may have had that meeting and had a subsequent meeting the next day with Mark Albrecht. However, my calendar is completely blank on the 14th. I remember spending quite a bit of time working on charts with Admiral Truly during that period. It could well be that Mark Albrecht was invited to the meeting on the 13th.

But somewhere between then and the time we went to the Vice President, we had a run-through with Mark Albrecht on the program. So in my own mind, this business of these various runs-throughs kind of blurs together into sort of one major event that led up to the meeting with the Vice President.

Do you know what the date was for the meeting with the Vice President? Do you have that somewhere in the chronology?

DR. McCURDY: Only because I got it from your calendar.

DR. MARTIN: Yes, but what did it say?

DR. McCURDY: July 5th.

DR. MARTIN: No. I don't believe that is correct. I'll tell you why it is not correct, because of the sequence of events. Again, we will have to check with some other people on this. The reason I don't believe it was July 5th is because if you look on July 6th and 7th, we were briefing various other organizations on the program. There were a number of changes that were made to the briefing prior to that. So let me lead you through this. I really believe that the day of the first briefing of the Vice President was closer to June 15th.

DR. McCURDY: Before we get there, who gave the presentation?

DR. MARTIN: To the Vice President?

DR. McCURDY: No, at the Holiday Inn.

DR. MARTIN: It was a combination of me and Mark Craig principally. I think John Aaron may have gotten into the space station discussion, but it was a rather extensive, long discussion with lots of questions and lots of --

DR. McCURDY: This is a set of viewgraphs.

DR. MARTIN: These are some of Mark Craig's charts. This is not the whole set-up.

DR. McCURDY: This is not the whole set-up. (What we are referring to is [Mark Craig,] "A Scenario for Human Exploration of the Moon and Mars, [June 13, 1989].)

DR. MARTIN: Yes, these are not the charts that were used in the White House. These are the charts that Mark used as background to explain what went into the charts. This would be architecture type-studies and these sorts of things, but these briefings did not go to [to the White House]. They were used as technical background for that. I have the actual charts with me that we took to the White House. I have some of the charts that were used in the dry runs. You'll appreciate some of the differences, particularly you will appreciate them in light of things like the Augustine report and some of the newspaper articles that came afterwards.

DR. McCURDY: What concerns were raised at the time of the Holiday Inn meeting?

DR. MARTIN: I think the concerns were that -- Bill Lenoir was very much concerned about trying to accelerate the space station too much. We were going to use heavy lift launch vehicles and pull back the assembly sequence. It was the assumption that money would come along to do that if you proceeded with these things. After all, we were working under the guideline of "do something by the year 2000." It wasn't an open-ended request. That is sort of the way it came in. So there was that question.

Admiral Truly wanted to make sure that we were comfortable and that we had margins and that the resources were there. Like I said, in no way was there ever any effort

to make it cheap or to do anything other than make sure we applied the proper precautions to it. So there were those kinds of questions about it. But the normal sorts of things that engineers and scientists tend to ask about these kinds of things were there, that kind of thing.

Of course, there was always some discussion about the feasibility of doing this kind of thing and the political environment.

At that time, we were going through a lot of machinations on the Hill about the 1990 budget. They were talking about cutting the 1990 budget, which they subsequently did. So on the one hand, you had the current budget being cut and on the other hand, you had somebody asking you about going back to the Moon by the year 2000. So you had to adjust in your own mind how you merged those two things together. As various individuals got exposed to this that had their own programs -- like Len Fisk and Lenoir and folks that were struggling to try to put together a program and define a program and keep the program sold -- in the door walks this "thing," which has the support of the NASA Administrator and some semblance of support in the White House, though it appears very nebulous and undefined at times. This was a combination of technical and programmatic kind of reviews that went on, I believe, on the 13th and probably spilled over onto the 14th. Again, Admiral Truly's calendar probably will be better.

But we intentionally did not put some of these meetings on calendars because lots of other people see calendars. It was being held very closely within the White House and within NASA.

DR. McCURDY: So your recollection is that you had the Holiday Inn meeting which was then followed by a presentation to Mark Albrecht who came in at some

point.

DR. MARTIN: My guess is that we reviewed it with Mark Albrecht either that day or the next day or the 15th. It could have been on the 15th.

DR. McCURDY: Okay.

DR. MARTIN: But my thought is that we went to the Vice President very soon after that, within a few days, because we were supposed to get back to him within a couple of weeks. So that probably happened. There was either a dry run with Albrecht on the 15th or we went to the Vice President on the 15th and the June 15th date was just put on here because these were the draft charts that we reviewed on the 13th for the 15th, if you follow me, in terms of what we were doing because it says "Draft Briefing Package" or whatever. [A second set of charts, titled NASA, "Draft Briefing Package," June 15, 1989, followed Craig, "A Scenario," June 13, 1989.]

So my initial reaction was gee, we did it here. But then I saw the Mercury Room written [on Martin's calendar] on June 13th, so there is a little work that needs to be done in and around that to verify exactly what those dates were.

DR. McCURDY: Where did the meeting with the Vice President take place?

DR. MARTIN: It occurred in his conference room in the Old Executive Office Building. I don't remember what floor that is on, for some reason. I seem to think it is the second floor, but I am not sure.

DR. McCURDY: I take it that what you took to him at that point was a series of charts.

DR. MARTIN: I'll show you that.

DR. McCURDY: All right.

DR. MARTIN: Let me tell you before that what we brought back and discussed with Admiral Truly on the 13th and/or 15th and ultimately with Mark Albrecht. I'll show you a couple of those. In fact, I will just leave these with you if you would like to have them. [See NASA, "Draft Briefing Package," June 15, 1989.]

DR. McCURDY: Yes, we very much would like to have them.

DR. MARTIN: Like I said, you need to verify those dates. The purpose of the briefing [with Mark Albrecht prior to the meeting with Vice President Quayle] -- there was a stack of charts a little bit thicker than this stack [NASA, "Draft Briefing Package"] that was used as the pitch and then we used Mark Craig's stuff as background. We responded to a request for a long-term civil [space program] to "completing a major accomplishment by the year 2000 (and) taking advantage of Space Station Freedom" which was one of the things that was discussed in the meetings. [NASA, "Draft Briefing Package."]

In fact, that was another thing that came up in that meeting on the morning of the 31st was that long-term exploration goals if done properly could help the space station. So that was the very specific charge that we were working through. The agenda that we looked at -- the draft agenda for the meeting -- was this kind of thing. Goals, science and technology, mission planner, lunar base, Mars exploration, benefits, costs and schedule. We did provide costs and schedule. The Administration chose, for its own reasons, not to use them. Actions required and then a summary. That was the outline. [NASA, "Draft Briefing Package."]

Now you see what we did was we took the approach that Admiral Truly had outlined; that this is really a long-term goal and that the Moon, Mars and all is a piece of a total strategy. So the goals as we had outlined them were here. (We misspelled millennium in this draft.) To strengthen science, technology and education. These were our assessment of Admiral Truly's words in terms of what he wanted to do: increase our understanding of the Earth and the universe. So science comes first. If you have read the Augustine report, you begin to -- so science was one of the top things.

The next thing was to expand our future as a space faring nation, which involved mission to Planet Earth (Earth, Moon and Mars again); a lunar base; robotic exploration of Mars; and then not go to Mars, but commit the nation to the human exploration of Mars. ["National Civil Space Goals," from NASA, "Draft Briefing Package."]

Admiral Truly was very specific -- even though we had data on what it would take to get to Mars -- that he did not want to commit that far out. What he wanted was a program that was sort of within a decade and the lunar thing fit within a decade. So this was some quote from the President that we put in the chart.

Then we had charts backing that up. These never got used but really once or twice in those briefings. This was the science and technology. "Understanding the Universe" was just a restatement of that with some pictures. We had poster boards of these, as well as viewgraphs of them.

Then the mission to Planet Earth -- some descriptions of what that was and why that was important to do. Then space station and some things we have today and what

tomorrow could be like. So it was a kind of integrated view of what all that could look like.

Well, the reaction to that was that Admiral Truly said yes, that captures what we want to do. But when we started talking about Mission to Planet Earth with Mark Albrecht, which was also brought up on the morning of the 31st (Earth, Moon and Mars), it was clear that the Administration was having problems with Mission to Planet Earth at that time.

It was, "We don't want to hear about that. We want to hear about the Moon and we want to hear about Mars."

But even in the paper during that period, Sununu was in the middle of a debate with the environmentalists over some aspects of those kinds of programs. So it was a program that was sold at NASA and sold in Congress, but had not quite sold itself within the Administration, which it subsequently has.

Mark Albrecht made a very astute observation which we had struggled with in our NASA run-through. That was, "If you guys aren't careful, you are going to confuse the situation by taking something as straight-forward as going back to the Moon and fuzzing it up with this whole grand strategy that is on your mind" -- Earth, Moon, Mars; men, women and robots; and working the base.

So Albrecht's request to NASA was: focus on Moon and Mars and treat all this other stuff as just something you would naturally do. Don't talk about Mission to Planet Earth, do it. Don't talk about the technology, do it.

So you'll see that what we ultimately did, it was the same program, but we put these things in in ways within the budget and other places so that the integrated long-term

strategy that Admiral Truly felt needed to be done was all a part of the package that we took to the White House while we talked about the Moon and Mars.

IV. BRIEFING THE VICE PRESIDENT

So the charts that actually went to the Vice President are here. This is a Xerox copy of them. If you want to come here and look, I'll look through them with you. [NASA, "Civil Space Exploration Initiative."]

The program that we talked about was Civil Space Exploration: the Lunar Base by the year 2000, the within-a-decade thing. (Remember, the fiscal year 1990 budget was already on the Hill at the time.) Then humans to Mars. That is what we talked about.

The agenda now became what did the Vice President ask us to do? What is the decision? What is the approach? Why lunar base? Why go to Mars? What is the price tag? What is the effect on America? And a summary.

This [page] says we were asked on May 31st, (many of these charts in one form or another have gone into the public domain after the fact, but they are a little bit different than in this pitch) in 1989, [at] the Vice President's direction, [to] prepare for a Presidential decision on July 20th. Establish NASA exploration goal. Achieve a significant and visible milestone by the year 2000. Maximize the use of present NASA capability -- that gets back to the space station and other things -- and identify what it will take: money, people and facilities. That was the direction that we had.

DR. McCURDY: Who was making this presentation?

DR. MARTIN: Admiral Truly made the front end and I made the rest of it.

He did the introduction to the summary. So it was the two of us. Present at that meeting was Mark Craig and J. R. Thompson. Neither one of them made a presentation nor do I remember the conversations. Truly and I made the presentations. It was as intimate as this kind of discussion [the interview then taking place]. The Vice President was very much involved. Mark Albrecht was there. Then there were two other staff people that were present from the White House. I believe one was off of the President's staff.

The other, I believe, was one of the senior staff people for the Vice President, just in general. There were no security people or anything else. They had come in and checked everybody out ahead of time. Some young man came in and took pictures of everybody for the record, which later got sent out, as they normally do with White House kind of things.

So it was eight people in the room -- four from NASA and four from the White House.

We used viewgraphs and we had books that were put together for this purpose. This is just my own. I xeroxed this for my own remembrances.

So that was the decision. It was to give direction to the civil space program, a permanent lunar base by the year 2000, humans to Mars in the 21st Century, send robots first, humans to follow. That was the message.

Admiral Truly is still talking now. He says, "Look, I want you to understand that we are bringing this forward to you at a time when these are the kinds of things that you read about in the press and people's views."

Here we are on the 20th anniversary of Apollo and Popular Science, July

1989, comes out and says, "Is the U.S. Lost in Space?" [The chart shows the cover of Popular Science, surrounded by news articles.] So you had quite a discussion about that in the current economic situation.

Then he talked about Mars as the long-term goal. It wasn't a program to go to Mars. It was a program to expand human presence, and the activity of which this was the long-term goal. He talked about why it was important to do that.

Then I went into a discussion on the lunar base and the Mars stuff. We had dates with crew sizes. [See Lunar Outpost chart.], By the year 2000, this [the lunar outpost] was a man-tended, 30-day crew sort of thing that was built on kind of space station things, a little [electric] power. By the year 2010, a crew of 12 per year was the kind of data that we had. So he could get some idea -- the Vice President could get some aerial view of what these things looked like.

The kinds of vehicles. You have probably seen this picture before that would be used to do that [lunar transportation]. Again, scaling of it compared to Nina. Then the transportation scenarios and again we had dates on these things: the year 2000.

DR. McCURDY: Was Truly still speaking?

DR. MARTIN: No. I am talking at this point. I got into the discussion about the time this chart came up.

DR. McCURDY: "The Human Exploration of Mars."

DR. MARTIN: Yes, "The Human Exploration of Mars." Truly had made his introduction and I picked up and talked about the lunar scenarios. Then the approach that we used to do this. (These things I think may be out of order. I think somebody has numbered

these things. The decision approach is here. I think that some of these things are out of place and we will just put them in the right place when we get to it.)

The approach described here [Chart: "Lunar Outpost, then to Mars"] was to build on the space station, do the lunar base and then send robots and then humans to Mars when the development fell off. (There is no specific [budget or year] data.) There was a discussion of the lunar outpost stuff and sequence.

Then why do a lunar base? It can be done by the year 2000. [Chart: "Why a Lunar Outpost?"] In addition to other things, we weren't satisfied -- even the zealots -- that you could get to Mars before then given some of the launch windows and some of the other problems even if you were ready to go today. It would be 2001 or 2004, would be your launch window, just a launch. So that was an element in it.

Living and working in space was another argument. It is close by. You can use it as a test bed, so on and so forth, which I think the Stafford committee will probably come out and emphasize even more. Then it was good learning experience.

Then a discussion of the science both from the Moon and of the Moon in terms of work you could do in life sciences as well as other things. Those are here. Then the other message was that as far as international programs, the international space year was coming up in 1992. If we began now, we could start the dialogue that could lead to some agreement. But you had flexibility in an international sense for such a program because others could join you there. You didn't have to do everything on the ground or create a Gordian knot to do these things. Between our capability and the Russian capability, we could actually -- and even in a sensible way -- deliver things to lunar orbit or low earth orbit

or to wherever it might be. So there was a range of management interfaces that you would have.

So we are back to talking about Mars and then why go to Mars. Again, you mated all those things. This [chart] was robots for research, sample return and building some of those international bases.

We didn't show any Mars charts. We had Mars vehicles and we even had pictures and posters of them. But there were no Mars -- you know, Mars was presented as this robotic thing which humans would do later on.

Then when we got into the lunar base. In fact, if you look at the draft charts that were with this, we had Mission to Planet Earth on this schedule. [See, for example, "NASA Milestone Summary," in Mark Craig, "A Scenario for Human Exploration of the Moon and Mars," June 13, 1989.] We took it off here ["Lunar Outpost, then to Mars" in NASA, "Civil Space Exploration Initiative"], but it still shows up on the budget [charts]. So you see milestones along the way. You see the international agreement signed here for the Moon in 1992. The lunar observer which continues to get deferred. I worked on that when I first came here, as I said. So I was still working on it.

Then flight tests in 1999 and a cargo vehicle on the Moon in 1999. Then humans coming in the year 2000, again, to stay. Then the Mars robotic scenarios sent various kinds of robotic missions. Again, we stopped by the year 2010. We didn't show 2020 even though we had the data.

The Space Station Freedom would be accelerated using a heavy lift vehicle. The only one we had that could be done in that time frame was Shuttle C. So we showed

the build-up and the preparation for that activity with a lunar hangar in here to support this kind of a schedule. Then there was the development of the Shuttle C itself and the flights leading up to that. So it was that program in addition to the other things like Mission to Planet Earth that we tossed about.

This was the cost estimate. [The cost chart: "Lunar Outpost, then to Mars."] We took the run out of the NASA budget, the 1990 budget as it was submitted to Congress. We put on top of it a program that had a build-up and then a kind of steady-state billion dollar a year (this was all in 1989 dollars) mission to planet Earth program. The robotic missions to Mars were culled out separately.

Then a budget augmentation that took care of a lot of the institutional problems that needed to be done to allow these kinds of things to happen. Then the lunar science was shown as a separate thing, with stuff [funds] for the lunar base, and then a wedge that could be used to take a look at Mars.

Now the budget wasn't smooth. There were all kinds of humps in it. What we did was we pulled numbers forward so that we could come up with a number that was an approximation of what the scope of this activity would be and what the schedules for these things might be.

So when you look at this, this goes out to 2015. The numbers that were used to build this chart up were subsequently provided to Norine Noonan over at the OMB staff as kind of background. "What did you guys do?" It was: "Have you guys lost your minds? What did you really do?" She is a very capable and very competent analyst. So we sent her the data over there.

I believe it was the OMB staff looking at the data that added up all these numbers and came up with the \$400 billion, because NASA never added those numbers up. We were looking at it as: What is it to do this? And that it is a steady state ongoing program. If we had put a chart together that had another 20 years on it, it would have been another -- you know, you could get any number you wanted.

Then Admiral Truly had an afterward discussion of sort of what was going on with the Moon and Mars. Admiral Truly came back and discussed what the current look at NASA is. What is NASA made of in the 1990 budget submission which was \$13.27 (billion). ["Snapshot of NASA 1990."] He argued that we would need an augmentation in order to do this job and we would need an augmentation in these areas. [The augmentation chart does not appear in the packet.] So it is about a ten percent increase in the budget for space station Freedom, Shuttle C, the modifications for the lunar base thing to make sure of assured shuttle availability. NASA's budget today is there, the lunar base program, mission studies and so on and so forth and precursor kinds of things and then the institutional issues that have to do with making sure that we are in a healthy position and bring people on and start to do this. This was treated as basically a ten percent increase in the fiscal year 1990 budget and go on and proceed to build up to doubling the NASA budget. This is in constant dollars in that time frame.

Then we basically copped this chart ["U.S. Investment in Future"] out of the National Commission on Space report and updated it into 1989 dollars so it matched the previous dollars and took the prior Apollo funding profile and put the future on it. There is a bit of an optical illusion in this chart -- I always have to explain to people that the scale

over here [on the left] is stretched out differently than that [on the right]. This [NASA Budget] is really in terms of billions of dollars. It is \$30 billion. It is the same number as before where as it looks [on the GNP scale] like it is two and something. (That is the future NASA budget and the past NASA budget.)

This over here is the gross national product. So you could see that from 1990 to the year 2000, the exploration program would have cost \$96 billion for the estimate we had. NASA [as a whole] would be spending \$240 billion. The U.S. budget would be about \$11 trillion during that decade. The gross national produce if it continued to grow like it was would be about \$55 trillion.

These are trillions right now. Exploration would be two-tenths and nine-tenths: two-tenths [of one percent] of the GNP and nine-tenths [of one percent] of the U.S. budget. If you look at the NASA total during that period -- and it is an interesting number, because Augustine recommends four-tenths of a percent of the GNP, but that is kind of a steady state number -- you would have spent four-tenths of a percent of the GNP during that period and a little over two or three percent of the federal budget [on all NASA programs].

These are numbers. Other people have come up with some more numbers. There is nothing special about it; it was a way to kind of put it in perspective.

Here is my scribbling on the bottom of this [chart], which means that this may have been a chart that kind of modified [the] exploration [material]. This says if you spent \$96.1 billion, what would you have? You would have a heavy lift vehicle and a space station that could support a lunar base and crew return capability. For a lunar base, you would have that kind of capability. For lunar science, you would do that. You would have

done all these things.

You have probably heard people say, "Gee, you need to have milestones and achievements along the way." Well, the program always did have. It is just that the way the speech came out, it sounded like we were going to take 30 years to go to Mars, and that is because no dates were put on it.

Then we talked about the effect on the country. It was in three areas. There were lots of areas, but we picked education, technology and the economic impact. There is our familiar chart ["Science and Engineering Doctorates"], which later got updated to bring this data all the way back into here. Then the impact on technology, sort of what kind of technologies are required to get to space, to live in space, to work in space, and what the economic impact is on investing in R&D in general. This ["Economic Impact of Investment"] just refers to some reports, which you are probably more familiar with than I am.

This was Admiral Truly's summary. The program could be done ["Impact of Decision"]. It is a major long-term commitment requiring immediate action, and that is that the President's fiscal year 1990 budget needed to be increased by about 10 percent authority for additional personnel and facilities and that while we didn't assume it, we would like to see something done about the procurement system because we could take another year out of the development cycle. The fundamental difference between the old Apollo thing and what we were proposing was driven largely by that, even though there were a lot of other things. But it still could be done within a decade.

Then he said, the NASA we have today can't do the job. Of course, that later

got used against him in a number of places, as though he was saying that NASA was incapable of doing the job. That wasn't his message. The NASA of 1962 could not do the job that John Kennedy laid out, but by the changes and additions that were put into it, you could do that. That was his message here. That this is a major restructuring for the agency and a major thing needs to be done.

It gives a long-range direction and focus to space station Freedom and the heavy lift launch vehicles, and it gives directions to the civil space program.

That was the pitch. That was basically the pitch that was made to the Vice President.

DR. McCURDY: What was his reaction?

DR. MARTIN: We spent almost an hour over there with him. He clearly was not at that time -- subsequently I think he has been exposed to the civil space program enough. But my impression is that he was very interested. He was very friendly. He was wide-eyed and enthusiastic about it. He asked the kinds of questions you might expect to be asked from someone who is a non-technical type. His background is law and things like this. So my impression was that this was the first time he had been exposed in some major way to this kind of presentation from people sort of steeped in the technical culture of doing it.

Later on, I was watching CNN [Cable News Network] after the speech, and the Vice President was on [CNN] talking about water on Mars. I remember discussing just that very thing with him. I found the interesting thing about it was that the press just had a field day with the fact that the Vice President was viewed as not understanding Mars, that he

thought there was water on Mars. I would remind you that there are some scientists who believe there is water on Mars in the form of ice and that there has been water in the past and possibly life. It was that kind of discussion. He got very excited about that.

I found that the message that I came away from that briefing at the White House [with] and what happened subsequently wasn't whether or not the Vice President or the President or anybody else over there fully understood the intricacies of the environmental situation on Mars today or in the past; it was the fact that for the first time in 20 years, somebody in the White House gave a damn about the Moon and Mars. That was what was very profound about it. He was willing to take the time and the effort to try to make something happen.

So I came away from that briefing with a very positive feeling about the Vice President. I came away from that briefing and that period of time with a positive feeling about Mark Albrecht's enthusiasm and the fact that he was a bit of a spark plug and willing to fight some battles to make some things happen. So that briefing was given to the Vice President. After that, Admiral Truly went over probably the next day, if I remember correctly, but if it wasn't the next day, it was within two days.

He went over and had, I think, lunch with John Sununu. I don't know whether the Vice President was in that meeting or not. He may well have been. But at that meeting, instead of viewgraphs, Admiral Truly flipped through the charts in the briefing book.

John Sununu was an engineer and of course, moved fairly quickly through much of the material. When they got down to the end of this -- and this is my understanding

from the conversation I had with Admiral Truly after the meeting -- John Sununu was very supportive, said that investing in these kinds of things was good for the country and that he didn't care who made the content of the program. It was the fact that we were doing it that was important and that he would leave the make up of the program to Admiral Truly.

But this business of needing money in fiscal year 1990, an augmentation to the fiscal year 1990 budget to do these things, given the current budget situation, that just wasn't in the cards. So he gave Admiral Truly two actions. One was to modify the program so that no money was required in fiscal year 1990. And that before the President was to make a speech -- and this gets back to why I believe there was time between the meetings -- that he [Sununu] wanted the benefit of having others outside the government take a look at this as well as some within the government to review the NASA program.

While NASA had recommended men, women and robots, Earth, Moon and Mars or the Moon/Mars scenario, that he wanted the President to have options. The agreement on the options with the Vice President -- I don't know whether Sununu was involved in the discussion of the exact options, but the options that Admiral Truly came back with were the Moon/Mars scenario (go to the Moon and then to Mars). Then bypass the Moon and go directly to Mars. The third option was to keep the humans home and just send robots.

V. REFINING THE PROPOSAL

Then we were asked to invite various groups in. That is where you come to the July 5th date.

Let me take you back to the calendar just a little bit here [Franklin Martin calendar, 1989]. June 15th I thought may have been the [Vice-President's] briefing. It could have been on the 16th because my calendar says "hold" in here. That was oftentimes a code for a meeting with Truly or possibly over in the White House. So it may have been on the 16th.

If you look on the morning of June 21st, I spent quite a bit of time with Truly then. We were probably working on at charts looking at these three options, because we had to bring in these additional two options. We had the data, but going to Mars only and then going to -- [sentence not completed].

Again on the 23rd [there is a meeting with Truly]. Also, when you see Darrell Branscome's name down with me: those meetings all had to do with that, because Darrell was working with me and Admiral Truly on updating the charts, the viewgraphs. So on the 23rd, I was with Truly again according to this.

If you notice my calendar, I was involved in a couple of things during that period that were kind of interesting. I tried to maintain any public commitments that had been made, a few school talks, some conferences. It turned out that one of my employees, of all things, had been arrested and indicted for sexual harassment.

So I wound up with meetings that I had to be involved in on that. So on the one hand, we were dealing with going to the Moon and Mars and on the other hand, we were dealing with this very deeply difficult and troubling situation with one of our employees.

And I had resigned. So for me, this was about as traumatic a period, in a

pleasant way -- some of it was pleasant and some of it wasn't -- that on the one hand, you could dream about this vision of the future and on the other hand, you had to deal with the ugly realities of life here on the planet and how complicated it can get for some individuals.

So back to this. June 21st, I was with Truly then. I was also involved in the SES bonus review process. I was chairing the Senior Executive Review Board during that period. That's the other thing that happens.

DR. McCURDY: You also met with the NASA Advisory Council on that day.

DR. MARTIN: Yes. Which day is that?

DR. McCURDY: The 21st.

DR. MARTIN: The 21st of June? We may have met with the exploration council during that period. In fact, I am sure we did.

DR. McCURDY: The exploration task force.

DR. MARTIN: In fact, that was interesting. That was the very first meeting of that group.

DR. McCURDY: Is this the Boorstin group?

DR. MARTIN: It was the group that Dan Boorstin is on. It is the group that was headed up by Adams from Smithsonian, Bob Adams. He was the chairman of it. We had our very first meeting of that. It was kind of interesting. What date was that meeting on?

DR. McCURDY: I believe it was the 21st.

DR. MARTIN: We had already been to the White House by that time, as I

remember it. Truly and I were very much in the middle of this. Here we were with this very high-powered group that we had scheduled this meeting with and worked their calendars. There wasn't anything we could tell them -- about what we were doing. So it was a very strange kind of thing. I could tell them the same thing that we talked about prior to that and what we were doing, but in no way was I in a position to tell them what was going on.

So we spent some time updating charts and modifying charts for a series of briefings that occurred. You'll see that on the 23rd, I was with Truly in the afternoon.

Those meetings, if you look at his calendar, tended to go on longer than scheduled. On the 26th, Truly and Branscome and I were together again. We were working on charts. On the morning of the 27th we were together.

DR. McCURDY: Does the security briefing mean anything -- earlier on the 26th?

DR. MARTIN: It had nothing at all to do with this. There were several things that I had to do. There were a few people who I let get in, but for the most part, I was dealing with this employee problem, which was a legal problem that I had to do. I was dealing with the SES performance review system, which I was chairing at the time, and I was dealing with the Moon/Mars stuff and whatever else.

The rest of the office was turned over to Doug O'Handley and the guys to do whatever, because they were not at this point directly involved in it. We were using some people in graphics, but in a sense, Admiral Truly asked that we work it with just the names that you have heard at that point since it was viewed as sensitive from the White House.

So you can see virtually every day there that week, the 26th, 27th and 28th, I was with Admiral Truly.

DR. McCURDY: You have an all-day review session on June 28th: 8:00 to 4:30.

DR. MARTIN: Yes. That was a regularly scheduled, all-day review that involved all the people from around the NASA centers that were involved in exploration and probably NASA headquarters. The MACE is Mark Craig's organization and the IAs and the SAAs had to do with other elements of the program.

DR. McCURDY: Were they in on this?

DR. MARTIN: No. This was a review that just happened to come at this time. I don't know how much of my time I spent in that review, but it is clear that in the middle of the day, I came out and spent time with Truly.

DR. McCURDY: Okay.

DR. MARTIN: That is what happened. Now if MACE was there, then that means that Mark Craig was there. That was also a good way for me to get him in town so that no one was particularly suspicious why Mark was around. So he was there for that.

Now my first interaction with the Space Council staff, other than Mark Albrecht, occurred when -- let's see. This says Thursday. So it says, "Metroliner New Carrollton to Penn Station, 9:10 a.m.," and I got in at 11:55. My wife and I went to the Sheraton Squire on June 29th.

DR. McCURDY: In New York City.

DR. MARTIN: In New York City. There was some international conference

up there that the AIAA was sponsoring at the Jacob Javits Center. So we went up there. We got all this work done. We were getting ready to have these further reviews.

Basically I was going to come back. I think I probably came back on -- it shows here that I came back on Saturday, because I saw Truly that Saturday afternoon. But I gave a talk up there at Jacob Javits Center. All that stuff [notes on June 28] has to do with that.

It was while I was there in the hotel room that the phone rang off the hook. I think that was the first time that Mark Albrecht had briefed some of his new staff people -- Space Council staff -- on what was going on. So they were calling basically saying, "Gee. We are excited about this. Is there anything we can do to help you?"

I remember that very vividly because up until that time, they weren't around. I remember it because I was trying to take a nap at the time. It was in the afternoon. There were lots of phone calls back and forth, getting ready for the following week. When I came back from that, I went into the office and spent the afternoon on Saturday with Admiral Truly.

Of course, the holiday, July 4th is in here. Again, the calendar looks fairly clear, when you look at the calendar, but we were busy putting things together and getting things ready. We worked all through the weekend. Then you see "reserved" on July 5th. That was probably a meeting with me and Truly prior to him going over to the White House to talk to the Vice President.

My guess is that that briefing on July 5th was not the first briefing to the Vice President. That is the reason I think that briefing occurred earlier, because I don't remember

the other staff people other than Albrecht [being involved] at that time and I know very well they were involved here.

DR. McCURDY: Is this a briefing you went to?

DR. MARTIN: No, I did not. I don't recall that. It could well be that I did, but I don't remember personally being there at that briefing. I think what that was, was that Admiral Truly went over by himself and sat down with the Vice President and flipped through the charts that showed the other options. I believe that is what that briefing was all about. I don't remember going back over there with viewgraphs and all those kinds of things to do that. I think it was the Vice President wanting to make sure that he took a look at what the new options were before we went into the [briefings]. So we had spent the time prior to that putting those options together.

VI. THE BRIEFINGS

Now if you come over to July 6th [Martin calendar], you see it says "briefing to scientists." Then later, "briefing to CEOs." Then if you look on July 7th, "briefing to Congressional staffers."

Sununu had asked that we brief some senior scientists in the country, Nobel laureate types. The Space Council staff probably has a list of the names of the people that were there. We were also asked to brief the CEOs for various companies. They were all invited in. That is what that was about. We also briefed the Congressional staffers.

Somewhere in here, which I don't see, which may have been on the 5th, but my guess is it was probably -- let's see if it shows up somewhere else -- we also briefed in

that same time frame and before we briefed the Congressional staffers a group of people I classify as space advocates. The Mike Collinses and I think Bruce Murray was in that group, which was separate and distinct. So there were four briefings to these groups of people. They would have filled up a room close to this size, sitting around the table with some staff people around the sides. These briefings all were the three options with NASA's recommendation to do Moon and Mars and why.

Again, the argument had to do with expanding human presence and activity. The Moon is a stepping stone to Mars. You can build along the way. And that sending robots only isn't going to cut it as far as a major -- if the President gets up on July 20th and says we are going to send robots to Mars, so what?

DR. McCURDY: Did you use viewgraphs or did you use those big boards?

[Reproductions of selected charts on poster boards.]

DR. MARTIN: For these briefings with these folks, we had the boards sitting around the wall which were there for people to see as they came in, and we used viewgraphs. Admiral Truly -- we talked about the briefing -- and it was my opinion to him that the most effective presentation NASA could make to these people was for the NASA Administrator to pitch the program; not for someone who might be viewed as a pitchman.

I think Admiral Truly's initial reaction was, "I'll sit at the table with the other wise men and you can make the presentation." While I have made a living making presentations, this wasn't just a presentation. This was his strategy, his view of the future. So we talked about that. He made all of these presentations. What they got was the NASA Administrator telling all of these people very personally and the Vice President participated

in every one of these meetings, I believe, except the one that involved the Congressional staffers.

The Congressional staffers were the ones that were from the committees that are involved in NASA business. You know who that cast of characters was at that time. In fact, one of them that was present at that is now the NASA Congressional Affairs Officer. Help me with his name. He was with the Senate authorizing staff. [Martin Kress]

You can see [on July 7] that there was a meeting with Truly and Thompson in [room] 7002 after that last briefing. It looks like that was probably budget guidelines, and had nothing to do with what was going on at that point in time. This was July 7th.

DR. McCURDY: Tell me about the reactions of the groups?

DR. MARTIN: It was interesting. I was a little bit surprised by it in a way. The Nobel laureate group, I call it, or the general science group, was very supportive. They were enthusiastic about it more so than I would have imagined. They thought it was a great opportunity to do this. The Vice President sat in a room and actually went around and asked each of the individuals to give their opinion.

Jerry Wasserburg was, I believe, in that group -- as opposed to the group that was a space advocate group. Wasserburg was a bit critical, as he has been in some cases of NASA, but I think in a constructive way. The Vice President listened to all of those.

But they were, "Yes, this is the right thing. And doing Moon and then Mars is the right way to do it." It was pretty universal. The space advocate group had a similar reaction. In some cases, their jaws kind of fell down. They were a little surprised.

DR. McCURDY: Did they know why they were coming to the White House?

DR. MARTIN: Some caught on, but I am not sure that some of them -- you know, some of the staff people that contacted them probably told them a bit about it. It was clear that everybody was strongly impacted by what was going on, after the last few years.

The advocate group was very positive. But you could kind of tell that Mike Collins and Bruce Murray were squirming a little bit because they had both come out strongly that we ought to go to Mars and here was this Moon/Mars scenario. So the Vice President listened very carefully to their concerns and what they had to say. But in large part, the rest of the group was Moon/Mars -- this is the right thing. This is the right program to do.

The CEOs were the quietest of all of them. I wonder sometimes -- these captains of industry -- whether they tend to, when they get with their peers and other CEOs, whether or not they tend to be a little hesitant to say things because a number when contacted after the fact were very enthusiastic about it. They were enthusiastic then, but you could tell they weren't quite sure what all this meant to whatever business they might have [inaudible].

The most dynamic group was the Congressional staff. It was very interesting. Of course, you are talking about staff members that are both Democratic staff supported, Republican staff supported. Here they were struggling with the fiscal year 1990 budget and here was this "thing" that we were talking about as though there were no funding problems at all.

In fact, at this point, we had just slipped everything a year. If you look at the charts we presented, it was the Moon 2001. Everything else was the same, with a similar analysis of what it would take in a decade and what you would achieve in a decade and all

that kind of thing. They were very animated.

A couple of them -- Marty Kress was the name I was trying to remember. Marty is the head of Congressional Affairs for NASA now. Marty was -- and Stephen Kohashi was the most animated of all. I don't think Stephen has ever been a huge supporter of space, but he works for Jake Garn, and therefore [conclusion implicit, since Garn supported the space program]. So those two guys were like, "What are you guys smoking? Have you lost your mind? Where is the Administration in supporting the current budget? What is this? Why isn't somebody up there supporting the space station?"

But you could see they were up there walking the halls of Congress trying to deliver a budget for NASA. To them, it seemed like some strange sort of thing to see all this energy going into this huge program without enough attention in it.

Of course, again, [here you had] democrats and republicans and individuals working their own problems. On the other hand, you had staff members like Dick Mallow.

DR. McCURDY: He was there?

DR. MARTIN: Dick Mallow was there. He was very complimentary. He said, "I think this is the right program. Yes, we are going to have problems with funding here in the next couple of years, but this is the right kind of thing that we need to do." So you had the whole spectrum. The ones who you tend to think of as being the most critical were the most supportive and the ones you thought of as being generally supportive turned out to be the bigger critics.

But the issue, in my mind, that was beginning to surface was a certain tension between the Space Council staff and the staffs of the various committees on the Hill, which

after the speech, I saw in spades. In fact, you had quite a dynamic kind of thing that was beginning to take effect, because it was also about that time that I got the call from the OMB staff. In fact, it was on down about a week before the speech that I finally got that phone call. Obviously Darman had been involved in these discussions (not in any of the meetings that I was in). Allen Bromley was in the meeting with the scientists, by the way. So clearly, Bromley and Darman and the Vice President and Sununu were the key players in this along the way.

DR. McCURDY: You hadn't heard from OMB up until this time?

DR. MARTIN: No.

DR. McCURDY: You had a briefing with Tony Woo on May 25th.

DR. MARTIN: It had nothing to do with this. It had to do with the question of -- that was the normal explanation with them sort of laying out what our future budget requirements were. It had nothing to do with this. Woo and those guys were not involved in this at that point. I'll show you later on -- when you can see what happened to my calendar after the speech, you'll see all these empty places and one can come to the conclusion that, "My God, they paid this man and he did nothing during this period."

Where was I, though? We were talking about the briefings.

DR. McCURDY: We are still on the briefings. So the science advisor was there.

DR. MARTIN: He was there for the science briefings. He may have been there for the space advocate part of the thing, too. Again, he was very supportive.

DR. McCURDY: But OMB didn't send anybody?

DR. MARTIN: I don't remember anybody from OMB in those meetings. It could have been one of the staff people. I don't believe so. What had already happened was that there had been quite a struggle apparently when the Space Council staff was formed between the OMB staff and the Space Council staff over budget control. I was told that you would have to verify this from somewhere else.

One of the things that Mark Albrecht attempted to do was to take the funding responsibility away from OMB and have it controlled by the Space Council and that created a lot of tension. So what I saw later and what went on prior to the speech, which I didn't see directly, must have been a lot of pulling and tugging between the various camps and the White House as to what to do with the speech. We were still talking 2001 now; we briefed 2001 with these guys.

So we were busy working off John Sununu's action items which had been reviewed and approved by the Vice President the first week in July.

DR. McCURDY: Just one more thing. On July 7th, [your calendar says] "Truly Thompson AAs." That is not a reaction meeting to the briefings?

DR. MARTIN: I don't believe so. I think if you check his calendar -- this says "budget guidelines" in here and it has all the AAs. He may have briefed everybody into it at that time, but I don't remember.

DR. McCURDY: But this was not a discussion to go over what had occurred at the briefings?

DR. MARTIN: I don't believe so. Now I could be wrong. I have it marked here, but then down below it says budget guidelines. He could have at that time told the

other AAs what was happening. My view was that by then, we still did not know whether the speech was going to be made or not and what was going to be in it. So I am not sure that that was the case.

DR. McCURDY: What were you charged with doing after these briefings?

DR. MARTIN: I remember it was just one constant busy time and getting ready for the next one. But at this point in time, we had worked through Friday of that week. So Saturday and Sunday [July 8 and 9], I took off, I believe, because I don't think we had any others that were intended. If you look at this, you will see that I started to have some normal sorts of things. Steve Devornik came in to talk to me [July 10]. He is a representative of Ball Corporation, an old friend. We had our own staff meeting -- where it says "staff," that is our own exploration office. "WMM" is Truly's staff meeting.

Then Craig Covault came in. He was doing an article on Moon/Mars for Av Week. We had a discussion as though nothing was going on, as I remember.

Then Tommy Newman was a former comptroller of NASA. I think he was working some sort of Congressional action and he needed some help from me on how to respond to that. So this was a day [July 10], for all intents and purposes, it looks like nothing was going on at all on this. It could well be that it was Tommy Newman who contacted me to let me know that the OMB wanted to understand what was going on. That may well have been how that came about.

The next day [July 11], you see "hold" there. That is probably code for Truly again.

You see I've got J.R. [Thompson] on there at 7:30. I don't remember what

that was all about.

Then you see the 12th is a pretty busy sort of day. The "hold" for lunch -- I probably did go have lunch with somebody that day. That looks like it is long enough that I probably actually went out somewhere which was the first time.

DR. McCURDY: It has been reported that during this time that you are referring to here, around July 11th, that the White House space council met and started to discuss Moon/Mars on its own.

DR. MARTIN: No.

DR. McCURDY: That it got wind of what was going on?

DR. MARTIN: No. If they did, I know nothing about that.

DR. McCURDY: Okay.

DR. MARTIN: I know there was no briefing that we went to that I supported. I know Truly would not have gone at that time. There was nobody else in the agency other than the people we talked about, and he worked directly on this. I spent a lot of his own personal time working the charts and working the messages and making sure that it was the message he wanted to give.

If you look at the 13th, it says "VP breakfast" at 7:15 with Congress. On July 13th, there was a breakfast meeting that involved -- and I don't know who the Congressmen and women that were invited. I know two that were not present that we later went up to visit and it will show up in the calendar.

But Truly went over that morning. He had breakfast with the Vice President, and with the various Congressmen, Senators and so forth. We had already briefed their

staff. It was at that point that Admiral Truly briefed them. He may have used viewgraphs for that. I don't recall the details. I was not present at that. He gave them a briefing on what the program was all about.

Later that day on the 13th, there was a press conference. I don't know specifically what that dealt with. His confirmation hearings were somewhere along that time. That had already happened, I guess. I don't know what that press conference was about.

DR. McCURDY: Not Moon/Mars.

DR. MARTIN: It was not Moon/Mars. Then you can see I was tied up with the SES performance review board stuff at that point in time. That is what that was ["SES Awards," July 13]. Then on the 14th, in the afternoon, any time you see a mark like that and there was nothing there, chances are it was a Truly meeting. But again, it was a reasonably quiet time with telephone conversations, several back and forth.

DR. McCURDY: So you basically had prepared all the reports and briefing boards that you were going to prepare?

DR. MARTIN: Yes. Basically that is all done. It is in the hands of the White House. They are busy now internally trying to decide what it is they are going to do. Truly has already briefed the Congressional people. Everybody has had their input and the Vice President has sat and listened to all this. Mark Albrecht has sat and listened to all this.

At those briefings, as I mentioned earlier, those briefings with the CEOs, et cetera, the new Space Council staff members were present, but not the Space Council.

DR. McCURDY: Not the Space Council.

DR. MARTIN: No Space Council that I see. You can see on July 17th:

"Truly and J.R. in Truly's office." Well, the three of us went up to the Hill and briefed Senator Mikulski (who was not present at the breakfast meeting) in her conference room.

DR. McCURDY: Truly, J.R. --

DR. MARTIN: And myself. I don't remember if anyone from the Congressional Affairs office went with us. I just don't remember because again, I recall this as being held very tightly.

DR. McCURDY: Albrecht was not there?

DR. MARTIN: Albrecht was not there. This was NASA talking to Congress.

DR. McCURDY: Did she fall off her chair?

DR. MARTIN: No. She was very supportive.

DR. McCURDY: Did she know it was coming?

DR. MARTIN: Yes, because it turned out that Kevin Kelly had been at the staff meeting. Kevin had been there. So he came in to tell her. What we were doing was accommodating the fact that she wasn't present at the breakfast. She was very supportive. She said basically the same thing that Dick Mallow said. The budgets are going to be tight. It is going to be tough. Space is important for the future. I am glad the Administration is finally taking an interest in space. I hope they will help with making sure that the subcommittee gets a good allocation so we can deal with all the problems that she as the Chairman of that subcommittee had to deal with.

I couldn't have asked for any warmer or better reception from her. Senator Mikulski has always identified very closely with Goddard, and of course, Kevin Kelly started the meeting by introducing me as having come from Goddard, and therefore, I was clean.

She pointed out again that she refers to Goddard as her pearl, and rightly so. So it was a good honest discussion. Admiral Truly led the discussion. He was into this now. It was his.

DR. McCURDY: Was there another Congressional briefing?

DR. MARTIN: Yes, there was. I am going to tell you. It was a briefing and I think it was after that, and I don't know whether it was that same day or whether it happened maybe on the 19th, but we went to Senator [Ernest] Hollings' office. Hollings was incredible. I will never forget that meeting. Again, he was supportive of it. In fact, I remember distinctly Senator Hollings -- some of this I am going to tell you with the tape off, and I'll tell you this story with it on. No, I won't. Turn the tape off.

[A short portion of the interview was not recorded, in which Martin described how Hollings indicated that he would ultimately support the initiative.]

VII. THE SPEECH

DR. McCURDY: We are now up to the point where the President came back from a ten-day European trip. He came back on Tuesday, July 18th. Was there any rush of activity in your office as a result of him being back in town?

DR. MARTIN: No. All the information was in the White House. Whatever was going on at that point in time with NASA was going on principally between Admiral Truly and the Vice President and Mark Albrecht and whoever else was involved in that. There were lots of phone calls continuing with me and the new staff members as they were passing on whatever they felt the latest situation might be and what language might be in the

speech, some of those kinds of things. But it was not -- I don't remember it as a busy time.

DR. McCURDY: Were you asked to prepare any words for the speech?

DR. MARTIN: No. It was purely a matter of -- I think Admiral Truly, as I said, at this time, Admiral Truly had the ball. It was his program and his vision, which is the way it ought to be.

DR. McCURDY: Were you asked to comment on any drafts of the speech?

DR. MARTIN: No, I never saw a draft of the speech.

DR. McCURDY: Did you know it was coming?

DR. MARTIN: I knew that the speech was coming. What we didn't know was whether the dates and the budget would be in it. That is the only thing that was uncertain. We knew that it was going to be the NASA recommended approach to doing it.

The whole question was how do you settle this. I think at this point, all the pulling and tugging was between the various staffs over there. How that worked, I have no idea.

The other thing I don't have any idea about is how the spark -- the Vice President and Mark Albrecht spark -- ignited, whether that was Mark Albrecht deciding or someone recommending to him or the Vice President did or whether it all was a result of Admiral Truly's initial discussions with Sununu. As to just what happened that caused that to precipitate, I don't know. But Albrecht certainly does; the Vice President certainly does. I doubt that Admiral Truly does. He may have, but if he did, he never shared it with me during any of this.

So we are down to that day. You can see that I was busy doing legal things

during that period. I know that because that 9:15 meeting [on July 18], which I won't repeat on the tape, had to do with that. That was the employee I was mentioning earlier.

DR. McCURDY: This is the 18th?

DR. MARTIN: I am on the 18th. You can see that I was reviewing the annual report, the next version of "Beyond Earth's Boundaries," which came out in a slightly different format after I left. This gentleman, Frank Davidson, came in to -- he had worked on the Apollo program and just wanted to -- he was in town for the anniversary and wanted to come by and tell me how to do some things. He was an interesting guy.

I don't know what "1717 deSales, ABC" [is]. Oh, we were doing T.V. interviews about that time. I went over to ABC. I think that is probably the address of ABC, and I did some interviews there with the guy who does their science reporting, Jim -- anyhow, that is what that was. Then the BBC came by and we did a little thing with them. So people were beginning to collect snip-its and bits and pieces of things.

DR. McCURDY: It was pretty predominant in the newspapers, so you were probably getting some pretty pointed questions.

DR. MARTIN: Yes, and I was on CNN as you will see later on. I wound up doing -- I guess it was before that, it was in December -- I did "Good Morning America" during part of it. There were reporters everywhere. Everybody was doing something.

If you come over to the 20th -- [Martin turned back to July 19th] -- then you can see that there was this thing at the Air and Space Museum that night, "For All Mankind." I am sure we came down and went to the thing.

DR. McCURDY: On the 19th.

DR. MARTIN: Yes, on the 19th.

DR. McCURDY: Where were you when the speech was given?

DR. MARTIN: I was at the Smithsonian, sitting there in a chair with all the other NASA folks that got into the meeting.

DR. McCURDY: Did they know it was coming?

DR. MARTIN: No. At that point, the only people who knew it was coming were the people that were on the dais, which were the astronauts and -- and I am not even sure that all of them knew it. [Michael] Collins did because he had been involved. I am sure Buzz [Aldrin] knew completely. I am not sure exactly what Neil Armstrong knew at that point in time.

Clearly, everybody else up there knew what was coming down. But again, at that point, the community of people who knew about it up until the week before had to be no more than a dozen or so at NASA and there couldn't have been that many people in the White House that probably knew about it. So it was something that they felt if you are going to make a decision like this, you better make sure you take the steps along the way. Of course, the people who were brought in, the CEO types and so on and so forth, every time you brought another group of people, there must have been 40 or 50 people, eventually 60 or so, that got exposed to it. But I never got a phone call about it. It wasn't something that was a general hot news kind of a thing. I mean it wasn't something that got around town in any kind of way at all, which is a little surprising.

DR. McCURDY: What was your reaction to the President's speech?

DR. MARTIN: It was kind of funny. There were two things that happened

that day. There was the speech at the Smithsonian and there was a picnic at the White House. I had been invited back to Pfeiffer College, which is where I did my undergraduate work, in May to give the commencement address. I had given a copy of that commencement address to Admiral Truly, just as a kind of here-is-some-stuff. Plagiarize freely if you need some ideas. It had some good snip-its of things that I had actually borrowed from a lot of different places. (When you go back home, you want to make sure you do a good thing.) I had used a quote in that from James Michener about space.

So we were on the lawn of the White House. Who is the country singer that is always singing the song about America? He sort of made a living at it recently. It was Lee Greenwood. He was singing and Helen Hayes was there. Half the astronauts that have ever lived and breathed in the United States were there, a bunch of Congressmen and Senators, about 300 of them, all eating hotdogs with the President and Millie [the President and Mrs. Bush's dog]. It was as hot as hell. Everybody was sweating like pigs.

So I was in the unique situation of -- that speech apparently had gotten over to the Space Council staff. As the story came back to me, someone had decided that they were interested in the quote that was in there, and had taken part of that speech that highlighted the Michener thing and had used it in the President's speech that he gave while we were eating hotdogs and hamburgers. So I was in the kind of unique position of, you know, people fantasizing about putting words in the President's mouth -- and I had succeeded in doing it twice in one day. So in that sense, I felt a little humbled by the whole experience.

Having been in a situation where I knew I was leaving the agency, I just kind of felt privileged that I was even a part of it. So I just sort of smiled and said, "This is kind

of interesting. I have no idea where it is going to go." Because when the speech came out, there were no dates in there and lots of people said, "Gee, 30 years to go to Mars." The articles all started, "Why go to the Moon? Why do this? Why do that?"

In a sense, when you look at what went into it and what was behind the thought process that went into it, it reads very much like the recommendations of the Augustine report without all the criticism. So I found it very interesting as I have watched this process go along, and I knew what Admiral Truly was thinking and what he understood about the problems of the agency and so on and so forth.

But the political process in this town doesn't give you the freedom to work those problems off in a way that one would normally like to work them off. You have to get help. You have to get the criticism. You have to get the broad buy-in, the benefits that you get from Congressional committee reviews, from staff people doing things, from blue ribbon panels reviewing various activities.

VIII. AFTERMATH

So that speech happened that day. I felt, "Well, now I can go." I agreed to stay on until we -- what we had done is we had also talked about what the next steps were. Our view of the next step was that --

DR. McCURDY: By "we," you mean Truly?

DR. MARTIN: Admiral Truly and myself. When I say "we," I am talking about that. We were discussing two things. One was my plans to move on. The other thing was: What do we do next?

We had been discussing with the Space Council staff a set of instructions that would come from the Vice President to NASA that basically said, "Pull together what it is you know now and then do an outreach program."

Somewhere along the way, that letter kept slipping and slipping and slipping. My advice to Truly was that we have this wealth of data that has been worked on for the last five years from the National Commission to Sally Ride to John Aaron and what we have done in the last year. It would be a disgrace if that got lost while we spent our time looking for alternative ideas. So it is very important that we document what we know and give us one more chance to take a look at the cost and the schedules issues.

We had understood when the President made his speech that we weren't going until the year 2000 or 2001, that there were going to be several years of front-end work before that was done. Therefore, when we decided on what options to look at -- in rescoping this whole thing and taking one more look at it -- we relieved all the pressure on the space station schedule. So the new dates then became, instead of 2001, it became 2004.

The position that Admiral Truly took was: let's pull together what we know. We managed to get someone -- we felt it was important to get someone whose background in manned spaceflight was impeccable. That is where Aaron Cohen came into the picture. Aaron had already been involved with us. He had been supportive. He had been instrumental in setting up the exploration work at Houston. So he was very much willing to give up his time and to do this study. I remember the conversation. We talked about it. Again, it was one of those: how long do you think it will take to do this? I said I think it will take about three months.

And Admiral Truly says, "About 90 days." That was the origin of the 90-day report. That in 90 days, we would pull together what we had learned over the last five years. It was not a study that took 90 days to do, so it was probably a terrible name to give it because it had all sorts of misinterpretations. But Aaron Cohen agreed to come in. I agreed that I would stay on and help Aaron with that study. Then when that study was completed, I would come back and sit down with Admiral Truly and we would talk about my departure date. Basically after the study was done, we did manage to get around to that. It just took me another few months to unplug myself completely. But that is what we ultimately did.

So the 90-day study was agreed to before that. What happened was Admiral Truly basically took the instructions that we were working and coordinating with the staff of the Space Council and he turned them into a letter from himself back to the Vice President. That letter is on the record. I don't know exactly the date of it, but basically it says, "We would like to pull together the program elements as we understand them now to get a scope on this thing."

Again, it was an enveloping thing. It wasn't a program plan in the sense of a project plan or anything, then we'll do the outreach program. I think some of the subsequent conflict with the Space Council staff and NASA was that some of them came from a background, the SDIO [Strategic Defense Initiative Organization] background in particular, and they didn't want NASA writing down anything because their view of the world was that you start with a clean sheet of paper.

Our view was that we had been to the Moon and Mars. It would be a shame

to throw away -- not only that, but a lot of independent thinking had already gone into things through the National Commission. That group of folks had gone around and asked virtually everybody who was interested in the country to give their opinions at that time.

So from our perspective, it wasn't NASA doing a "not invented here" thing; it was NASA making sure that the Administration understood what we thought the cost and schedule was, and what we thought the range of possibilities were within our understanding of how it could be done. Then we would look at ways to do it better, faster and cheaper. Admiral Truly wrote the letter and sent it over and said that is what we are going to do.

I guess probably the last thing I did here on the exploration, other than help Arnie Aldrich -- because ultimately we folded the Exploration Office into the OAET [Office of Aeronautics, Exploration, and Technology] thing. Principally, I don't think there was an obvious person to take over the job at the time, at least not someone who Admiral Truly was prepared to put in that job. We tried very hard to get Aaron Cohen to take it. In fact, that was my intention. To give him the brush and let him really enjoy the thing.

Then when it was clear that technology and mission trades were going to be worked on for several years, and I think Admiral Truly was very much interested in seeing if he could make Code R [Office of Aeronautics, Exploration, and Technology] more relevant to the long-term future of the agency, that this looked like a natural marriage for a couple of years until such time as we got to a point where the program started to move again and then we could break it out as a separate program.

Since then, of course, the Augustine committee has recommended that we go ahead and do it now [break it out]. I think they are in the process -- he [Truly] has made a

commitment to do it. But there wasn't anything -- you know, lots of folks said -- there weren't any sinister things about it. It was simply a couple of people, Admiral Truly and myself and a few other people trying to do what they believed was the right thing for the agency given the various skills and the various individuals that we had in place at that time.

Again, all along the way, I was nothing but impressed with him, nothing but treated far more kindly than I would think people normally think of treating individuals who are short-timers. Probably the toughest about leaving the agency after this was leaving Admiral Truly and J.R. Thompson, because I had gained nothing but the highest respect for those people in terms of their professional and technical knowledge and their professional integrity. It was and continues to be absolutely first class.

DR. McCURDY: Can I ask you a couple of questions about your own philosophy of space exploration?

DR. MARTIN: Okay.

DR. McCURDY: Speaking for yourself personally, why do you think we should go to Mars?

DR. MARTIN: I think you could do a long list of things. But I think it is the same sort of reason that you come down to -- the Augustine report captured it a little bit. There is a huge difference between looking at Mt. Everest, sending a rocket with a payload to the top of Mt. Everest, and Hillary and Tenzing actually going there. There is something about the human spirit and the human nature that drives you to explore.

Boorstin's book on discoveries -- if you go back and look at history, there is just something about a society that when you look at it, that makes it vibrant. To me, that

was the thing that always appealed to me about it. Now the fact that pursuing things that are hard to do -- as Kennedy described, he said we are going to go to the Moon and do it within a decade not because it is easy, but because it is hard -- when you take on difficult challenges, you impact your citizens. You inspire your young. You drive technology, which has other benefits and so on and so forth. And, oh, by the way, you actually do achieve things. So it was that level of thing that inspired me.

The other thing was that I was in a bit of a unique position. I probably had as much experience in the manned and unmanned programs from the Apollo work and the science programs and being at Goddard and having worked with Johnson guys in my younger days and working on space station, so that by the time I got to the exploration office, as far as the strategy type of thing across the agency, I probably had as good a view and insight into that as anybody.

So I was in kind of a unique position, to at least answer the Admiral's questions was the way I put it, whereas most people tend to spend most of their career here either doing unmanned programs or manned programs. Very rarely do you wind up with a lot of the cross fertilization that I got into.

Did I answer your question?

DR. McCURDY: Yes. That is very good. Well, we wanted to cover the period up to the speech. I think we have done that pretty much today. We would like the opportunity to come back at some point and talk to you about the period that followed.

DR. MARTIN: I would appreciate it if when we do that, you could tell me exactly what some of those dates were that I couldn't quite ferret out. Like what day we

really did brief the Vice President.

DR. McCURDY: We'll have that by the end of this project.

DR. MARTIN: There are some awfully good people in this system that I knew about before. Mark Craig is a first class systems engineer. Aaron Cohen is a fine, fine gentleman. What the Space Council staff did to him relative to [inaudible] is disgraceful. I will be happy to talk about that at some point in time, because that is a classic example of petty politics and staff infections in the Washington environment. But that was after the fact, not before the speech.

Admiral Truly and J.R. Thompson, they both deserve a hell of a lot better than they have received in the press, particularly this past year with the Shuttle leaks and the telescope issues and some of those kinds of things and this thinking on what he thought about the agency and what he felt about these various programs, as I did. I was in a very unique position to see that and to share some of that insight.

So it is funny. When the speech comes out and it says space station in the 1990s and back to the Moon to stay and then on to Mars, and then somebody puts a number out that is \$400 billion in 30 years, all of the thinking, no matter how good it was that went into that and no matter how visionary the administrator may be, at that point in time he is subjected to all of the Monday morning quarter-backing that goes into, "Well, gee. Why isn't it this?" The answer is that the Administration was provided an opportunity to decide and for very logical reasons, it had to do with resources and whatever else was going on, chose to do it a different way.

But the important thing about that speech -- that just with the Vice President

and the "water on Mars" story -- is that for the first time in 20 years, somebody cared enough to step forward and really lay it out. So now we can debate the details of the how-to and the timing, but there can't be any questions in people's minds as to where we are going and what we are doing.

Now I had a different view of it, which I will just share with you. The question I used to have to deal with when I worked on the space station was: How could you possibly build a space station if you don't know where you are going? In terms of: we don't know whether we're going to the Moon or Mars or whatever. My view of that was: we are not going to the sun. It is too hot. You are not going to Mercury, it is too hot. Venus -- the pressures and the environment are such that you are not going to send humans there. We live on the Earth. We have been on the Moon, and we can go back, and we can go to Mars. You are not going to the asteroid belts and have humans live there for any extended period of time. You may visit.

The question of Jupiter, Saturn and all those sorts of things are well beyond the near-term horizon that we are seriously thinking about. So, therefore, there are only two places you can go. It is not a complicated problem. Therefore, you shouldn't be surprised when people have thought about that in terms of what you need to do in a space station and what you need to do in terms of thinking about evolution and those sorts of things.

There are a lot of -- as Plato describes them in one of his dialogues, he says if you never observe the keen eye of the clever rogue, you can see clearly the way to the end that he wants. He has got a very clear view and narrow focus on what the problem is, but too often, his mischievousness is in proportion to his cleverness.

So what I learned in my tour here in Washington is that Washington is full of clever rogues, some in the service of wisdom and some in the service of evil. It is an interesting mix. That is what politics is all about and that is what high visibility programs are all about. You get to choose whether or not you want to participate in that. So I told someone today -- someone asked about how could you leave NASA? I said I didn't leave NASA, I left Washington. There is a difference. I will probably never leave NASA.

DR. McCURDY: Thank you very much. We really appreciate it.

DR. MARTIN: Thank you.

(Whereupon, the interview was concluded.)

Transcript of Interview

MARK K. CRAIG

By Howard E. McCurdy

March 15, 1991

Washington, D.C.

INTERVIEW OF MARK K. CRAIG

By Howard E. McCurdy

March 15, 1991

Washington, D.C.

MR. McCURDY: Just some personal questions to begin with. We have your birth date as [REDACTED]

MR. CRAIG: Yes.

MR. McCURDY: Do you call St. Louis or Midland, Texas, your hometown?

MR. CRAIG: [REDACTED]

MR. McCURDY: So that is where you grew up?

MR. CRAIG: Yes.

MR. McCURDY: What was your father's occupation?

MR. CRAIG: He was an employee of an oil company.

MR. McCURDY: Was he a laborer or worker?

MR. CRAIG: He was in marketing of oil petroleum products, gasoline petroleum derivatives.

MR. McCURDY: In Midland?

MR. CRAIG: In Midland, yes.

MR. McCURDY: Was your mother professionally employed?

MR. CRAIG: No.

MR. McCURDY: Do you have any brothers and sisters?

MR. CRAIG: One brother and one sister.

MR. CRAIG: You went to Purdue and did some graduate work at Rice University.

MR. CRAIG: Yes.

MR. McCURDY: What were your majors?

MR. CRAIG: Aeronautical engineering at Purdue. Rice didn't have a program in aeronautical engineering, but they had related fields in mechanical engineering. So that was technically in the School of Mechanical Engineering.

MR. McCURDY: Were you interested in aeronautics or did you have an interest in space exploration?

MR. CRAIG: Space -- although my expertise in a technical field is in aerodynamics. One of the three or four fields that I have spent a lot of time in is aerodynamics.

MR. McCURDY: When did you first get interested in space exploration?

MR. CRAIG: As a kid. I remember -- in fact, I was in Alexandria, Virginia the day Sputnik went up, at my aunt's house. I remember that very vividly and I was intrigued by that. And as the early Gemini and Mercury shots were going off, I was fascinated by those, and decided in seventh or eighth grade that that was really what I wanted to get into.

MR. McCURDY: You joined NASA as a co-op student.

MR. CRAIG: Right.

MR. McCURDY: What year were you in college?

MR. CRAIG: I was at the end of my freshman year. So in the summer of 1967, I went down to, at that time, the Manned Spacecraft Center, and worked there that summer and then rotated semesters until I finished in January of 1971.

MR. McCURDY: Where did you start work as a co-op student?

MR. CRAIG: I started, somewhat to my chagrin, in the facilities engineering division, which at that time was involved in -- the specific thing I worked on was designing some equipment for one of the emersion tanks, the weightless simulators. In fact, the first thing I designed, I think, was a ladder that was about eight feet wide, so if one of the astronauts were disabled, two divers could be one on each side and carry this guy up this very wide ladder. I just worked there in the summer and then wasn't particularly interested in working in the facilities area, so I found another job in basically a group that was doing mission work: aerodynamics, trajectory, kind of system engineering across disciplines. That was also the group from which many of the people were drawn that started the initial studies on Shuttle at the Manned Spacecraft Center. During that period of time, that was my first introduction to planetary work. The Soviet Venera spacecraft had just gone to Venus, and we were beginning to get some data about the atmosphere of Venus. So one of the first studies I did was looking at how that new knowledge of the atmosphere affected entry and capture trajectories of Venus for both unmanned and manned missions.

MR. McCURDY: Was this still as a co-op student?

MR. CRAIG: Yes. That's right.

MR. McCURDY: That was a big responsibility.

MR. CRAIG: That was in 1968 basically.

MR. McCURDY: And in 1971, you came to work at the Johnson Space Center as a full-time employee.

MR. CRAIG: Full-time, yes.

MR. McCURDY: One of the few people that NASA hired that year, I'll bet you.

MR. CRAIG: That's right. In fact, I was almost rified. I was almost fired within about a year of that because the Apollo program, of course, was winding down. The way the government employment system works, it is last in, first out. I was clearly literally the last in. But I ended up being retained because I spoke Russian. At that time, ASTP [Apollo-Soyuz Test Project] was just on the horizon. So they managed to find a way to retain me. It put me in a rather odd position of being -- and I still am, I guess, at kind of the bucket of a double-bell curve. There just aren't very many people my age in NASA as a result of that.

MR. McCURDY: Did you look at other opportunities or did you always want to go to work for NASA?

MR. CRAIG: I really wanted to work for NASA. I wasn't interested in the defense side of things. I really wasn't -- although I had interviewed with a number of companies -- I wasn't interested in working particularly on the corporate side. NASA is what I wanted to do. So that is where I went.

MR. McCURDY: After about 17 years, you got involved in the space exploration initiative, I think, in 1987.

MR. CRAIG: 1987 is about right. The history of my career in NASA was --

I actually did start working on the Shuttle in 1969. In fact, the summer we landed on the Moon, I was part of a team that Max Faget had set up in a back building at JSC that was working the Shuttle designs, and continued doing trajectory work and vehicle sizing work. I had written a program that combined the trajectory calculations with the sizing of the vehicle. That was kind of a first. It turned out to be a very useful tool.

So as the shuttle moved along in the early 1970s, I was responsible for continuing to develop and maintain that tool and do studies with it: the external tank, internal tank, drop tanks, stage and a half, all of that was modeled and developed on that program.

Then in 1973 or 1974, I was given a chance to move out of that in this same division which I had co-opped in. I had picked up the responsibility for the staging systems on Shuttle, because it is very interdisciplinary and cross-cutting. So I worked in that area and ended up, as a result of that, being the subsystem manager for the booster staging system, which meant that I worked basically at what we call level two.

I was a level two subsystem manager. I didn't specifically have any hardware that was directly my responsibility or software because they were all in the various vehicles - - the booster, the orbiter or the tank. But I was responsible for integrating all of those and writing requirements, making sure that they worked and functioned, then doing all the wind tunnel tests, the proximity aerodynamics -- that turned out to be very complicated wind tunnel tests.

MR. McCURDY: Where did you do the wind tunnel tests?

MR. CRAIG: We did some of the early tests at Ames, but the bulk of the tests that really provided the data base were at ADC -- Arnold -- in Tennessee.

MR. McCURDY: What was that again?

MR. CRAIG: It is Arnold Engineering and Development Center, which is the big Air Force wind tunnel facility in central Tennessee. The tests were fascinating. They were very complicated because with the boosters separating, it is done in a region where the dynamic pressure is still fairly high. You are still in a fairly dense part of the atmosphere, and it is supersonic, hypersonic actually, about mach 4.5. The dynamic pressures can be as high as 75 or 80 PSFs. So it is still a fair amount of air.

It is complicated because as the vehicles move off, their aerodynamics influence the aerodynamics of the other vehicles. So the aerodynamics isn't just a function of orientation. It is a function of the relative positions of these three vehicles -- the two boosters and the orbiter tank. And if that isn't complicated enough, it is additionally complicated by the fact that there are solid rocket motors on the boosters that blow them away from the orbiter. The giant plumes from those things really act like bodies in the flow that divert the flow around them.

So as they come up and go down in less than a second, they blow the flow off the vehicle. It is a very complicated test. It involves relative motion of the models. It involves simulating these big plumes. We spent a lot of time developing techniques to do that and then getting the data.

It also involved being responsible for the software on the spacecraft that initiated and controlled this whole sequence: determined when it was right to separate, fired the motors, blew the bolts. It involved putting together the integrated testing of all this, deciding what we had to do. So it was a good way to cut your teeth on some real hardware

and not do it from a distance standpoint.

MR. McCURDY: Were you doing this as a contract supervisor or was this hands-on work yourself?

MR. CRAIG: No, it was for the most part hands-on work. Rockwell International, which was the integration contractor, of course had people working in this area. But they really never quite stepped up to it. They ended up essentially being an extension of my staff. So I basically managed the team of people that did that.

MR. McCURDY: In 1983, you moved off the engineering directorate and into space station work here in Washington with the Space Station Task Force.

MR. CRAIG: Let me go back to Shuttle. One other thing that I did that I thought really served me well was -- one of the real concerns we had was that these separation motors on the boosters would damage the tiles, the thermal protection tiles on the Shuttle. So we went through a number of tests to figure out how to design the motor and how to orient it so it wouldn't abrade the tiles off the vehicle. In doing that, I became very knowledgeable about the thermal protection system and what damaged it.

After the first flight, there was a fair amount of damage to that system. So I was asked to head up a team that tried to figure out how the tiles were damaged and to fix them, which involved, as it turned out, damage that was induced by stuff off the launch pad, damage that was induced by pieces of things falling off the external tank. It [the thermal protection system] was damaged by pieces of things falling off the booster. Actually, it was damaged also by things coming off the orbiter as we really got into it and looked at it. So that again really gave me the -- it was a lot of fun, too, because I would go out to the launch

pad literally right before the launch with the astronauts and do a final inspection of the vehicle, look for ice and various things that were damage agents.

Then as the vehicle landed, I was the first person to go out and look at it. So it gave me a lot of working with the Cape and how the vehicle is processed, the quality procedures and inspection procedures. There was still a lot of theory involved, but a lot of good hardware hands-on. And also a very visible and kind of political problem, because when there was damage on the orbiter, it was always "the other guy did it." It couldn't have been the tank; it couldn't have been the boosters. It certainly couldn't have been the orbiter. There was a lot of intense internal political pressure. So it, I thought, stood me a very good stead.

I also worked a lot with the other centers in both those jobs, with Marshall in particular, the other principle center on Shuttle. So I spent a lot of time there and knew a lot of people.

In 1983, I was asked to come up here and work on the Space Station Task Force which was just starting up. The unit was called the Concept Development Group, which was doing all the technical studies and programmatic studies, budgets, to support the policy definition of the station. On that group, I ended up leading the team that did all the configuration work as well as some other areas.

MR. McCURDY: Were you part of Luther Powell's group or were you on the task force?

MR. CRAIG: Yes, I was part of Luther Powell's group, the so-called CDG, Concept Development Group. I was up here from July of 1983 to February or early March

of 1984. Of course, the real technical work was being done by the centers and a number of contractors were involved at that point.

The job up here was really more to decide where the work needed to go to get it from all these different sources, integrate it, figure out what it meant and then put it in the kind of framework that was helpful to establishing a policy base for the program. But it was mainly still technical work. That was the first real exposure, though, I had to policy dimensions. Why are we doing a space station? How are we going to sell it? So it was interesting from that respect.

MR. McCURDY: Then you stayed with the space station program when you went back to the Johnson Center?

MR. CRAIG: Right. At the end of the task force here, the so-called Skunk Works was put together at Johnson which is where we brought people from all the different centers to take basically the rudimentary base that had been developed up here, flush it out and start the program, essentially to get in a position to do Phase B. I continued basically leading the configuration work and a lot of the technical work that supported that definition as a part of that team over that period of seven months or however long it lasted.

MR. McCURDY: We've got you still with the space station program office, I think until 1987. Is that right?

MR. CRAIG: That is basically -- I guess that's right. Well, I went from the Skunk Works -- at that point the decision was made that Johnson would be the lead center, and there was a Level Two office established. I was asked to be in that office and wanted to be in it. I decided that program management was really what I enjoyed doing. The office

was broken up into an operations area (this was the Level Two office), system engineering and integration, which was the area I was in, then utilization, and then program control kinds of things.

In the system engineering and integration area, I started out as the assistant head of that office in charge of all engineering. The fellow that was the head of that office retired from NASA. I was then made acting head of system engineering and integration for the program. It was late 1985 or early 1986. So I really spent most of my time running that office and doing the system engineering and integration for the integrated program which was very challenging. The policy framework still wasn't quite firm. Trying to develop a set of requirements that we could work to was extremely challenging because we didn't have that policy framework.

The organization up here [in Washington] had not been able really to define that for a number of reasons. So we were kind of working in the blind. That made it a very complicated job. It was made even more complicated by the fact that there were four work packages and three international partners. So the system was cut up into a large number of pieces to manage, which was a tremendous challenge. It was cut up in such a way that the work assigned to those pieces had very, very complicated interfaces that we were always trying to figure out and still are.

So that was extremely challenging. We had to come up with management structures and approaches to controlling this that were very different than things that had been done in the past. Of course, there again, there was a high degree of political tension in the air because the work packages were still moving around a little bit. The policy definition

hadn't come together up here. So it was very challenging period. I learned a lot from it, mostly about things you should never do being in that environment. I worked a lot with the internationals, which I enjoyed very much. I spent a lot of time in Europe, Japan, and Canada leading the technical negotiations with them. So it was a good experience but not one that I particularly would ever want to repeat.

MR. McCURDY: You stayed with it until they moved the Level B center to Reston?

MR. CRAIG: Yes, and that was the last thing I did basically. The program manager at that point, John Aaron and myself -- we were the last two out the door -- dissolved the program office there as things were being set up here at Reston. I decided I didn't want to move up here and work at Reston. So I was in free-float. The Center Director offered me a position and asked me to go on as the assistant to the Director of Engineering at Johnson, which I did for about six or seven months.

MR. McCURDY: When did you first hear that NASA might be pursuing a Moon/Mars initiative?

MR. CRAIG: Well, the fellow who was the station program manager, John Aaron, and I are very good friends. As I went off in engineering to do some things there, John went off to set up an office for Dr. [Aaron] Cohen dealing with futuristic kinds of things. That was about the time the Ride report was being put together and coming out. So through John, I knew that these things were happening. They sounded exciting. Mars has always been a thing I had wanted to work on, I think, like 99 percent of the people in NASA.

Some of the technical things were being dealt with at that point, which due to my previous experience in entry trajectories and other things, I knew quite a bit about. John would ask me to come down and listen to this or listen to that and give my thoughts to him. So I became aware of what was going on pretty quickly.

Then things sped up from that point. As a result of the Ride report, Dr. Fletcher decided to create the Office of Exploration here at headquarters. John was asked to head that up. That left then the position of heading the office in Houston open. Dr. Cohen asked me to take John's place in that.

MR. McCURDY: Was that a new office? It wasn't, because you were taking his place.

MR. CRAIG: That's right. It had been made a new office as we folded in Level B. Aaron [Cohen] had taken John off and created an office -- I don't recall its name; I can get it for you -- that basically had two responsibilities. One was just to kind of figure out what JSC should be doing in these areas. Number two, a very specific thing which had already been worked out between Johnson and JPL [was] that we would help them with their Mars Rover Sampler Return efforts which JPL had been working on very heavily. There were pieces of that in which they had really not much experience.

We did make aerodynamic entries and things. It was Dr. Cohen's, I think, very, very wise plan to get JSC involved more in these robotic missions and learn to work together with JPL, looking ahead to the longer term that we really needed to find a way to marry the two ugly sisters, manned and unmanned kinds of things, if we were ever going to undertake these longer-term human missions.

MR. McCURDY: So you were, if I have got the title right, the JSC manager for Lunar and Mars Exploration Office?

MR. CRAIG: That is basically it. I think that was the name of it at that point -- just the Lunar and Mars Exploration Office.

MR. McCURDY: And that was through the President's speech?

MR. CRAIG: Well, there was a little blibbit in there. It was always the Lunar and Mars Exploration Office as Aaron [Cohen] set it up and John headed it. Then as I took it over, it was on Aaron's staff. It was basically a staff function to Aaron. It was a fairly small office. Aaron did some other things at the center to create a larger organization to deal with future work called the New Initiatives Offices, which is headed by Bill Huffstetler. As that thing developed, he decided to take this Lunar and Mars office and put it in there, which was the case through the speech. Since then, he has taken the office and pulled it out again. Now it is one of the main line organizations of the center. But up through the speech, it was in the New Initiatives Office.

MR. McCURDY: Speaking for yourself personally, why do you think we should go to Mars?

MR. CRAIG: I think there are several reasons to go to Mars. I think some of them have to do with very, very tangible things when we undertake these kinds of activities. I do think we do get economic return from pushing the edge. I think that history has shown that when people do very, very hard things -- President Kennedy so much as said this when he started the Apollo program: we don't do things because they are easy; we do them because they are hard.

History has shown us that when you do hard things, you reap a lot of rewards. You reap rewards of learning how to do new things. You come to new perspectives and understanding about yourself and about the universe and the world in which you live. You come to understand things and technologies that have repercussions that usually aren't anticipated in life and society, to help people.

Frankly, all of that to me is kind of summed up -- it is just the human imperative to explore. History has shown over and over again that it pays when we do it.

MR. McCURDY: Why does it excite you personally? Thinking back to when you were a young kid.

MR. CRAIG: I think it was something -- and I didn't understand all that when I was a kid in the sixth grade or seventh grade. It was just the excitement of exploration. It was like the Vikings sailing the North Sea. It was going in places no one had ever been and seeing things people had never seen, to my mind at that time. I have never lost that. In fact, I have tried not to lose that as we got caught up in the detailed arguments about cost benefit analysis and things. Never to lose the excitement of the enormity of this endeavor and its significance. There are a lot of ways to say it, I guess.

History. I love history. I love to read history. It is always an interesting thing for me to think about the things that history has recorded and more interesting, the things it hasn't. As one looks back -- and you could use the example of Columbus or others -- and you try to reconstruct what happened in the 15th century. Wars. Cataclysmic events. The reformation. I mean things that we remember today. There aren't many. There are even fewer that most people could tell you that were in the 15th century.

But 1492, they do know that date and they know exactly what happened. I think as we look back with 500 years distance on what happened in this century, few people will know there was a World War I or a World War II even, but they'll know 1969. It is the kind of thing that indelibly imbeds itself on society's conscience.

MR. McCURDY: Do you consider yourself an explorer?

MR. CRAIG: Yes. Absolutely. I mean I have the best job in the world. I get up every morning and think about how to send people to Mars. It is hard for me to imagine a job that is much more interesting than that. There are things that I would like to do that aren't space related that I enjoy very much and find very meaningful. But I guess I was raised to feel like each of us should try to have an impact on the world in our own way. This seems to be the way that my life has taken me to have an impact.

MR. McCURDY: Why send people if you can send robots?

MR. CRAIG: We are people, not robots. To me, one of the beauties of SEI, and there are many in this kind of endeavor, is that it is big enough that it allows us to get away from artificial distinctions. It allows us to get away from the "or" arguments. Should it be humans "or" robotic devices? It says this playing field is big enough that it needs to be both.

Now do we do it in a way that they are complementary? What makes sense to use robots -- in what circumstances? When does it make sense to use humans? That is going to be something that we are going to sort out for a long period of time.

What we have learned, through four years of study, is that we really have looked at that Mars Rover Sample Return and how it is a precursor for human missions. As

you might expect, the relationship is intimate. In fact, we don't even call them precursors any more because that tends to lead to the impression that you do the robots and then you stop them and send the people. The robots will always be the leading way of getting data, providing a relatively low-cost way to get experience without risking human life. They are very, very important.

But ultimately, it's people. I mean we are people and part of the pull and allure of exploration in a vicarious sense is that it is hard for me to identify with a Viking spacecraft on Mars. I mean I can understand what it did intellectually and I can learn from it, but I don't identify with it. But I do identify with scenes of John Young, running around and jumping on the Moon and yelling at the top of his lungs like a little kid. I identify with that perfectly. I think other people do, too.

MR. McCURDY: Where do you think this will lead in the long run?

MR. CRAIG: Well, in the very long run -- of course, we get trapped within our detailed technical community here and the detailed policy community of this city. But many people, as we talk about this, think in terms of colonies and of a much larger scale of things. Of course, there have been people like Jerry O'Neill and others that have done fairly detailed studies of putting large numbers of people in earth orbit or on the moon or on Mars.

There are studies of terra-forming Mars and creating a habitable world there. There is no doubt in my mind that all of those things will happen; probably not in the way that any of us would envision today, but our species will move out from Earth. That is not going to happen, in my opinion, on the scale that people have been talking about it for hundreds of years, but we are taking the first steps in that direction. I don't think that is the

justification for doing it. But I think that ultimately is where it will lead us.

MR. McCURDY: Let me ask you some questions now about the President's speech. When did you first learn that the White House might be planning a commitment for Moon/Mars?

MR. CRAIG: Friday, June 2nd at about 10:30.

MR. McCURDY: How did that come to you?

MR. CRAIG: In the form of a jovial fellow named Frank Martin. I was up here for a set of meetings. Frank called me into his office on the 2nd. As I noted here in my calendar, "Frank tells the tale."

MR. McCURDY: What did he tell you? What did you remember?

MR. CRAIG: Well, there had been a conference up here -- in fact, I guess it was still going on (I had to go to a meeting at Marshall and I did not go) -- called "Pathway to the Planets," which the office up here had set up, basically, as a very top level kind of a presentation of opportunities and where things might be going. A lot of industry people were invited. Mark Albrecht at that time had just come on board. The Space Council was invited. Of course, Dick Truly who had been named Administrator but not yet confirmed, and J. R. Thompson.

The tale that Frank wove for me was that -- again, I hadn't been there the day before -- just at that meeting (it almost rang of happenstance, but I am sure it wasn't), Albrecht and Truly and J.R. and Frank kind of had a cup of coffee.

Albrecht said, "Well, where is all this going? We'd like to do something. I think the Administration wants to do something here."

That began a discussion that basically led to our setting up a team to lay out some possibilities for consideration for the White House.

As it was reported to me by Frank, the initial approach had been, "We think we would like to build a Moon base as the next step." Both Frank and Dick had ratified that as a very, very good thing to do and consistent with all the things that we had learned in our planning, but that maybe that was a little too close a horizon. There really needed to be an even longer term objective and that was sending people to Mars. Whether at that initial discussion or not long thereafter, it was bought off that, yeah, it probably does need to be more than just establishing a moon base. It does need to involve a real horizon kind of a thing of sending people to Mars.

MR. McCURDY: What was your reaction when you met with Frank Martin and he told you this?

MR. CRAIG: Great.

MR. McCURDY: You had been working on this project now for two years.

MR. CRAIG: Yes. Well, it was ironic. I remember thinking as Dr. Fletcher had given us our marching orders as this thing was set up. He said, "I want to start these studies. I want to understand the technical parameters. I want to begin to use these studies to shape the agency's investments. At some point, we probably ought to plan on really putting the hard sell on the White House. Just as a planning date, why don't we think in terms of 1992."

I think his thought was, you know, the Columbus celebration. That might be a good time for not him -- because he knew he wasn't going to be Administrator -- but an

Administrator to go forward. So we geared all our studies to go through a cycle of several years and really hone down and produce several very specific recommendations in 1992.

My first thought was, "Well, damn. The man beat us to the punch. That's great." I obviously thought this was right. I mean this is the way it should happen: that the President has a vision of what can be done and gets the government moving down the path of deciding how to make it happen: Rather than the government, as is often the case -- and it works -- but you know, fighting a vision up. Visions don't seem to travel uphill very well, but boy, they sure travel downhill. So I was very excited obviously.

MR. McCURDY: We have a report that right around this time, Vice President Quayle went to President Bush and proposed that he, Quayle, undertake a study that might lead to this sort of initiative. Do you know whether or not that occurred?

MR. CRAIG: I don't know. I have heard the same thing, but I don't know. I don't know where I heard it, to tell you the truth, probably from Frank or from Admiral Truly.

MR. McCURDY: What were you asked to do as a result of this meeting?

MR. CRAIG: Basically, what Frank said was that Admiral Truly wanted to keep this extremely secret, for obvious reasons. And that what he and the Admiral had discussed was getting a very small group of people together to begin laying some things out that we could take back to the White House. By "things," I mean a very top level description of what we thought could be done, a time table, and some level of budget.

To that end, the people that were told about this and that formed this team were -- I have got it written down here, but it was Frank, myself, Aaron Cohen, John

Aaron, Mike Duke (I don't know if you know Mike, but he is a very senior scientist at Johnson, an expert on the moon), Darrell Branscome, and Charlie Darwin from Marshall.

Frank informed me that Truly was in the process of contacting those people, and we needed to get going. What he [Frank Martin] said was that he wanted me to collect my thoughts. Then he and I -- that was a Friday, the 2nd of June -- he and I had a meeting the next morning with Admiral Truly.

We were going to talk through how we could get this thing going and what needed to be done. So that is basically what we did. Admiral Truly notified these various people. The next morning Frank and I met with him and laid out a plan of attack.

MR. McCURDY: Did you stay in Washington or did you go back to Houston?

MR. CRAIG: I stayed in Washington for the meeting Saturday morning, the 3rd, and then went back to Houston that evening to start getting things rolling down there.

MR. McCURDY: Now was this group located in Houston or was it located in Washington?

MR. CRAIG: The decision was made that we needed to have one place to work out of. Aaron Cohen found a building in the back lot of JSC that we would often use for SEBs [Source Evaluation Boards] and various procurement things that was secure. So we set up headquarters back there. It already had computers in it. It was ready to move in. It was locked. So we basically set that up as our center of operation.

We did not just stay there as this group of whatever it was -- five or seven people. We met on June 4th (which is what Mike and I had written down earlier), which was Sunday, in that building, and basically kind of mapped out what needed to be done. The

way in which we worked was that we each had teams of people off doing stuff or I did certainly and Charlie did at Marshall. The others really didn't.

We kind of talked through what needed to be done, and we would go back and guys like John Aaron -- who was manager of the space station -- would go back and do space station stuff. I would get the team off working on this or that or Charlie and his people working off on this or that. We would meet back together and look at it and shape it.

It ended up that the group primarily met as kind of a consulting body. Most of the technical work was done by the agency team that I was in charge of, as you would expect. I would bring it back in. We would talk about it and shape it and decide how we wanted to present it and work on the pitch that we had to give back up here. That was the product we were aiming at.

Here it was kind of the general thought, I think -- it was pretty well understood early on that the President was probably shooting toward the July 20th time frame. He wanted to say something on the anniversary. So we understood we had -- it wasn't just "you have to have something and here is the schedule to get you to a speech," but it was kind of understood that was where we were headed. So we were working on a pretty short turn-around.

MR. McCURDY: What did you physically produce and when was the first time you presented it?

MR. CRAIG: What we physically produced -- the first thing we produced was a presentation which was that. [Mark Craig, "A Scenario for Human Exploration of the Moon and Mars," June 13, 1989.] It was given on June 13th to Dick Truly and Bill Lenoir.

We came up here and gave this presentation. We gave it to Dick on the 13th. The real first milestone we were shooting for was a meeting with Mark Albrecht, which this thing says was June 15th. I think that is probably right.

At that time, I basically gave this presentation. I gave it on the 13th to Dick and Bill. I thought they were kind of impressed. Of course, they hadn't quite realized that there had been a team out looking at this for quite a while.

There is a fair amount of technical detail in there. I mean there are vehicles and weights. There is a pretty detailed sequence. You know it talks about science, the basic strategy of laying the thing out in terms of what you do on the Moon and Mars. I think they were impressed and kind of overwhelmed by the fact that just in two weeks or less, we had been able to produce something in this kind of detail. We spent a lot of time talking about it. Of course, when engineers get together, they tend to start drilling oil wells then [get] into technical details.

MR. McCURDY: Did you present options as part of this?

MR. CRAIG: Options came to be a word that had a lot of different meanings. This really didn't have any options in it. At this point, we weren't talking about options. It was basically, "What are we going to do and what is it going to take to do it," as you'll see.

There is the approach we were trying to work ["The Approach," in Craig, "A Scenario"] where you would start out with lunar activity and robotic missions: all the precursors to go to Mars. You would tail that activity off and then with the wedge that opened up, you would go to Mars with people. So that was the basic strategy. Everything that is in there is an elaboration of how one might do that. So at that point, there really

were no "options."

MR. McCURDY: So you weren't proposing case studies or scenarios or any of the other kinds of things.

MR. CRAIG: We were working -- the team was off -- the case study was kind of the medium we used to study things before the speech. We kind of broke the problem up into pieces. We use the word "architectures" today. They were kind of mini architectures. We do them to just kind of explore the limits of what could be done and what it meant. They weren't ever portrayed and we tried to make sure they were never seen as actual. This is something that would end up as a proposal. They were really framed just to help us get a data base of understanding.

So the team in NASA, of course, that didn't know about all this, was off working case studies. We had broken up all the work between all the centers. My staff in Houston, which was responsible for integrating that, was continuing to run that process. I pulled a couple of people off and didn't tell them what was going on, but said, "I've got to work a special thing here. Admiral Truly is just coming on board. He is really interested in this and he has asked me to pull together some special things for him. So you are not going to see me for a while." That was the cover we used to pull technical people into this and get this work done.

MR. McCURDY: Which centers were involved?

MR. CRAIG: Well, and that was under the Office of Exploration up here, all of the centers were involved. It was our very clear intent as we set up the Office of Exploration to get all of the centers involved. Number one, this needed to be something that

all of NASA did. It was bigger than any center. Number two, the expertise that is involved in an endeavor of this breadth -- you need the entire agency to get the various forms of expertise. So we literally had every center involved.

MR. McCURDY: So you would call out the people at a center and ask them to perform a specific task and do it in an obviously fairly short period of time?

MR. CRAIG: Well, at the level this thing [Craig, "A Scenario"] was put together, there were only two centers involved, because as you'll see, it was fairly high level. The data that was used to put this together was developed by all the centers. The actual work that coalesced this particular pitch was done primarily by Johnson and Marshall.

MR. McCURDY: So on June 13th, this was presented to the Administrator?

MR. CRAIG: Yes. And to Bill Lenoir over here at the Holiday Inn. They didn't want it done over in the headquarters building because that would look too visible.

MR. McCURDY: That's the Mercury Room of the Holiday Inn?

MR. CRAIG: Yes, I think so. I don't have it written here, but I think that is probably right. In fact, we had a note written down here, we had to delay the meeting because there was a fire in the hotel on the roof. I forgot about that.

MR. McCURDY: After that presentation, a day or two later, you went up to the White House, to the Executive Office Building.

MR. CRAIG: No. Actually, Mark [Albrecht] came down here.

MR. McCURDY: Okay.

MR. CRAIG: So we had another presentation at the Holiday Inn just for Mark. That was Dick and Frank and myself and Mark.

MR. McCURDY: And that was about two days later?

MR. CRAIG: I think the 15th.

MR. McCURDY: How was that different than the first one?

MR. CRAIG: Well, this was the first time Albrecht had seen any of this.

The first meeting with Truly and Lenoir again tended to be an engineer's meeting, an engineer's discussion about how you go to Mars. It lasted a long time. I mean it lasted hours -- a lot of detailed discussions and questions to my presentation. The meeting with Mark was much shorter in time. We actually cut out some of the charts. We didn't present all this stuff and shouldn't have.

I was very, very impressed at Mark. As I recall, the meeting kind of opened up with a monologue on why this was important and the problems that civilian space had had and was having, and that this was a way to fix them. I thought he was right on the money, having just come from [space] station which was suffering from a lack of definition of a strategic horizon.

In fact, frankly, that is why I was so anxious to get into this, independent of liking to work on planetary things. I saw this as a way for the agency and the government to really figure out where it was going and then start to shape its investments against that. So I was just pleased as punch to hear this guy that I had never heard of before, never met before, just lay out the problems that the agency was having in what I thought was right on the money.

He very clearly saw this as a way to do the same things that I had seen in this, too. So I felt very good about that. I am not sure that we had -- we had some interaction in

that meeting, but I don't recall it as being particularly detailed or even substantive. I think Mark was just seeing this stuff and sorting it out in his own mind.

MR. McCURDY: Did he ask you to do anything?

MR. CRAIG: I don't remember that he did. I don't remember that he did. We were all kind of -- at that point, I think, Mark was working with, "How do we get this up through the system in the White House?" As I recall, there was some discussion of that. It wasn't like, "Okay. That is the pitch," or, "With these changes, this will be the pitch we'll make to somebody." As I recall, it wasn't that.

MR. McCURDY: Did you go back to Houston at that point?

MR. CRAIG: Yes.

MR. McCURDY: What did you do for the next couple of weeks?

MR. CRAIG: We continued to refine this. It was clear at that point -- let me look back in my notes here. As we got into this, we did start talking about options. I don't recall exactly where that came from, but it was really options like all robotic, don't send people. Just go to Mars, don't go to the Moon. That kind of thing. That, according to my notes here, emerged not long after that, the week after that.

So we were starting to flesh that kind of stuff out. One of the things that took us a fair amount of time was costing all of this stuff.

MR. McCURDY: Did you put a number on it?

MR. CRAIG: Yes. Well, I mean we defined the content of this thing with this particular approach and did do the costing data just to try to understand, you know, what were we talking about here. We were very concerned, as one always is when you do that

very early, (a) you don't really know what you are doing; and (b) numbers tend to take on a life of their own. Once one number comes out, you'll hear it for 50 years, like the \$8 billion [space] station, which was an experience I never wanted to repeat. So we did that with a lot of trepidation, but decided it was worth it at least for our own knowledge to try to understand it and frankly, to see if this concept made sense that you really could open up a wedge to go to Mars.

I mean that is a nice concept, but can you really lay out a coherent program which is developing hardware that does that -- developing and operating hardware?

I guess one of the things I felt I got out of the cost work we did was to validate at least to a "zeroth" order that that made sense, that you really could do something like that. That turned out to be rather laborious. John Aaron and I really ended up doing that by hand because we didn't bring the cost people in, certainly, with their spreadsheets and their ability to automate all of this stuff. So it was just basically a manual spreadsheet which got rather tedious. That took a lot of time.

MR. McCURDY: So breaking down the components and doing cost estimates and adding them up?

MR. CRAIG: And phasing them, that's right. What is all the research we have to do? The technology development from the front end? What are the vehicles and systems? How can you phase them so that you don't just have every development, you know, one peak added on to the other peak and you get Mt. Everest in terms of cost. You know, how can you really phase these things?

MR. McCURDY: Did you do an annual cost? What it would cost each year

to do it?

MR. CRAIG: We did what it would cost each year. So over a 30-year period, it was a curve.

MR. McCURDY: When did you come back to Washington?

MR. CRAIG: I have here in my notes -- and I don't think I came back for this -- there was a meeting with the Vice-President on the 20th.

MR. McCURDY: Of June?

MR. CRAIG: Yes. That must have been Albrecht and Truly going over to see him. I don't think I -- no, I may have gone to that meeting, actually, now that I think back on it. We had a meeting very early where Admiral Truly and J.R. [Thompson] and myself and maybe one other person went over and we met with the Vice President in his office with his Chief of Staff and one of his other advisors and Mark Albrecht. It was just kind of a general "where are we?" and "where are we going?" meeting.

MR. McCURDY: Was that the first time you had met with the Vice President on this issue?

MR. CRAIG: Myself, yes. It was the first time I had met him, yes.

MR. McCURDY: He had been down to Houston, actually, in April.

MR. CRAIG: Yes.

MR. McCURDY: But that didn't have anything to do with the Moon/Mars initiative?

MR. CRAIG: Not to my knowledge. I have never been told that it did.

MR. McCURDY: So sometime in late June, you think there was a briefing

meeting?

MR. CRAIG: Yes, to him. I was kind of anxious to meet him. I never brought this up, but he used to date my cousin in college. In fact, I met him in college. He went to a school called DePauw right down the road from Purdue. In fact, I think I went on a double date with him.

MR. McCURDY: Did you bring this up?

MR. CRAIG: No. I still haven't. But I mean it is just an odd thing. In fact, there are several odd things. That is one of them -- that he knows my cousin. In fact, his whole family are very good friends with my aunt and uncle and on several generations. The other odd thing is, of course, that President Bush is from Midland, Texas. So there seemed to be some -- I mean, who knows, it doesn't mean anything, but it just struck me as odd as I was getting into this that there seemed to be these connections with my life in kind of odd ways.

MR. McCURDY: Do you recall what happened at that briefing meeting? If there were any instructions to go forward or any directions back to you?

MR. CRAIG: I didn't get any directions out of that that I recall. I mean I didn't come away thinking, "Gee, I have to go off now and do a different set of work." To the best of my recollection, it was basically just a status kind of a meeting.

MR. McCURDY: When was the next briefing to the Vice President?

MR. CRAIG: Well, we got into the next major set of things that happened -- at least to my recollection, it was decided, somewhere in that time frame, the White House wanted to try this out on different groups of people. So they identified actually four groups,

but I think they thought of it as three, that they would invite in at the request of the Vice President. Admiral Truly would review what it was we had in mind, and they would then -- "they" being the Vice President -- would basically poll the group. Does this make sense? Is this what the government should be doing as we look ahead?

Those began early in July. What I had in my calendar was on July 5th, we met with the so-called "space advocates" -- I mean it was the ex-NASA administrators, Mike Collins, and it was the kind of space community. On July 5th.

Then on July 6th, we met with two groups. One was the CEO group and one were the scientists, the Nobel laureates. That basically was Admiral Truly and myself going over. Admiral Truly made the briefings using some -- well, you have seen these big briefing boards.

MR. McCURDY: Yes. The big boards.

MR. CRAIG: Those are the kinds of things that we used.

MR. McCURDY: Please don't throw those out.

MR. CRAIG: No. In fact, we have several sets of them. There is one in Houston. There is one up here. That was the level at which it was discussed. In fact, as we got over there [the Old Executive Office Building], it was done in the Indian Treaty room. We had worked hard to make those compelling in and of themselves and not too-viewgraphy and NASA-laden. We got over there and decided we would just put them up around the room, which we did. Then of course, there was an easel where one could flip through them.

Admiral Truly gave the presentations. I was there if they had more detail or

technical questions that needed to be addressed. There were several, but not many as you might expect. Then after Admiral Truly made his presentation, the Vice President basically started off the discussion. What do you think? He would go around the room and ask people what they thought.

MR. McCURDY: The scientists, whose list of scientists was this?

MR. CRAIG: It was one put together by the White House.

MR. McCURDY: Was Carl Sagan there, for example?

MR. CRAIG: No. He wasn't at that meeting. Later on, there was a so-called "Blue Ribbon" committee put together, which Carl was on.

MR. McCURDY: That was after the speech?

MR. CRAIG: Yes. That was after the speech.

MR. McCURDY: So the first group was like the NASA alumni group.

MR. CRAIG: It was luminaries, space luminaries. Tom Payne, Mike Collins.

MR. McCURDY: Was it all ex-NASA people?

MR. CRAIG: No, not necessary. I can't say for sure that there were non-NASA people there, but it was certainly all people that were in the club.

MR. McCURDY: What was the reaction? There was a fourth meeting. I assume that that is the one with the Congressional people.

MR. CRAIG: Staff. That's right. Well, actually it was just the staffers and that was on the 7th.

MR. McCURDY: Okay.

MR. CRAIG: Now they did -- somewhere in there, and I think it was after the meeting with the staffers, but I am not sure -- go up and talk to people in Congress. But the meeting on the 7th was with the Dick Mallows, Kevin Kelly and Steven Kohashis, those people.

MR. McCURDY: There was a Quayle briefing to Congressional leaders about a week later, on the 13th.

MR. CRAIG: Yes.

MR. McCURDY: Were you at that one?

MR. CRAIG: No, I wasn't.

MR. McCURDY: Okay. Going to these four meetings, what was the reaction of the various groups that you recall? How long did the meetings last, first of all, and what was the reaction?

MR. CRAIG: I think Dick's presentation lasted -- it wasn't meant to last too long -- twenty minutes, half an hour. The discussion usually lasted half an hour to an hour. So they tended to be an hour and a half on average.

MR. McCURDY: Were there meetings outside the meeting with the Vice President or was this the whole thing?

MR. CRAIG: This was it.

MR. McCURDY: What is your recollection of how the people reacted when they were polled?

MR. CRAIG: Varying reactions. Of course, the space group, "Hallelujah brother." I mean, "The skies have opened, and we see God." Now there was in that group,

and in the scientists' group, "Tell me again why we're going to the Moon." I mean there were people, and of course, we knew this would happen, that were Moon zealots. "Why the hell are we going to Mars?" There were Mars zealots. "All we're going to do is stop off at the Moon and bleed off resources and never get the will to go on to Mars."

So there tended to be those kinds of things brought up. People like Tom Payne, who was in that first meeting and of course had written the National Commission on Space report, was extremely supportive -- very strong, but not emotional. Very carefully worded erudite statements about how important it was to have a strategic horizon, to have a goal, to be working. "All of us had gone to work in NASA anyway for this. Thank God now we are finally seeing it. We can come out of the closet and say we are going to Mars." So there tended to be, of course, in that first group of advocates, very strong positive statements. The only things that really came up were Moon/Mars kind of balance questions.

We did present three options, which was the Moon and then Mars, robots only and just Mars. So those three were presented. Then there was some attempt to say, "Well, which of these do you think makes sense?" The Mars direct would usually draw some comment. The robots only never really, even in the scientific group, never really got much comment. Whether it was because people sensed that the Vice President really felt that Moon-and-then-Mars was right or whether they just chose not to say anything or whether they actually thought it was the right thing to do is hard to say.

MR. McCURDY: What about the CEOs? What was their reaction?

MR. CRAIG: Whew. That was the meeting that -- I thought the meeting with the scientists would be the toughest one. Of course, fresh from my experiences in

station, I had seen certain dimensions of how the government does scientific stuff. I had felt that that would be the tough one because they would see that as competition for their dollars. I mean many of them that I worked with tend to view federal expenditures as science and other things that don't spend money on science. So it was seen as a head-on competition. That was my expectation. In point of fact, the meeting I thought that was the worst was the one with the CEOs. It was in my opinion disappointing for reasons I never would have anticipated. They were not not-supportive with one or two minor exceptions, but they did not come across with any kind of vigor as being supportive.

It was, "Well, if this is what the government wants to do, we are good industrial people and we will heave to and we can do it. And (you know) send money."

That was almost, I am overstating it a little bit, the tenor of the reaction. It was not -- no one particularly made speeches about how important it was for the country to do this economically.

In fact, I felt the Vice President was very kind of knocked on his heels, too. He tried to elicit some kind of emotion and response from these people. There was discussion about, "Well, maybe this would help us." There were some philosophical digressions into, "America is in bad shape. The Japanese are beating us up because our managers went to sleep 30 years ago." I couldn't help thinking as I was listening to that, "Yes, and I think they are still asleep."

There were, I thought, some fairly unusual statements. I mean these were not just aerospace CEOs; these were CEOs from other areas. The Vice President would go around the table and talk to each person. He did this in all these meetings to draw out their

feelings. As he was unable to draw these people out, he got some reactions that I thought were -- one fellow said, "Well, I don't know if this is the right thing to do or not. Maybe we need to send off 30 Nobel laureates for a couple of years just to think about the destiny of mankind to decide if we should do this." And we all kind of [Craig leaned back and looked askance]: What does that mean?

I mean it was, in my view, a very strange meeting. I made a point of going up to one of them, who I had met earlier -- who happened to be the CEO of a large aerospace company that I had known -- and said, "Don't you really find this exciting?"

He said, "Oh, yes."

I said, "Why didn't you discuss it?"

He said, "Well, industry shouldn't just be exuberant about things."

I don't know. It was, in my opinion, a very strange meeting.

MR. McCURDY: How were the Congressional staffers? These, I take it, were people from the authorization and appropriations committees?

MR. CRAIG: Yes. The staffers. Of course, they were fresh from, at that point in time, I mean that day, doing battle over \$1 million here and \$1 million there for battlefield monuments and for [other things]. I remember thinking, "What a warp to go four blocks and go from discussion about what you are going to spend tomorrow to a plan to send humans to Mars." So I thought that would be pretty tough.

I was surprised. Their comments generally were, "Well, of course, this is what we're going to do. This is the right thing for the Nation to do, but who knows when we are going to be able to afford to do it."

So there didn't seem to be any real rancor that had been brought up or question that this was not the objective of why we were going into space. It was just, the reality is okay, now, how are we going to pay for it? They actually were supportive.

The scientists got into some Mars discussion, Moon versus Mars kinds of discussions a little bit. But generally, I thought [they] were supportive. There wasn't anyone who just stood up and -- in fact, in any of these meetings, no one just stood up and said it was a bad idea. I guess that is probably because you are talking to the Vice President of the United States who has just said that he thinks by implication it is a pretty good idea. They were much more supportive than I thought they might have been.

MR. McCURDY: Did you ever make a presentation to the Space Council?

MR. CRAIG: To the literal Space Council?

MR. McCURDY: Yes.

MR. CRAIG: No.

MR. McCURDY: Sitting as the Space Council?

MR. CRAIG: No.

MR. McCURDY: I have heard stories that say that while all this was going on, the Space Council was doing its own work, refining the Bush space policy, working on the fiscal year 1991 budget and that it really wasn't until a week or so before the speech that they began to get involved as a Space Council.

MR. CRAIG: I really don't know. I was kind of in and out of Washington a lot at that time. Frank and Dick were really the ones that were working it.

MR. McCURDY: But you didn't make a presentation.

MR. CRAIG: To the Space Council, no. In fact, I have never been to a Space Council meeting.

MR. McCURDY: When was the next time you were in Washington? Excuse me. Did you go home?

MR. CRAIG: Yes. In fact, my daughter's closing weekend at camp was that Saturday. So I flew home late that night and drove to New Braunfels, Texas.

MR. McCURDY: When was the next time you were back in Washington?

MR. CRAIG: I am not sure I came back for the speech.

MR. McCURDY: Were you here for the speech?

MR. CRAIG: No.

MR. McCURDY: Okay.

MR. CRAIG: No, in fact, my notes don't show me as being in Washington.

MR. McCURDY: Did you participate in the writing of the speech?

MR. CRAIG: No.

MR. McCURDY: Were you asked to make any comments or send any suggestions?

MR. CRAIG: No.

MR. McCURDY: What products did you provide them with after the briefing? Any additional materials? Either Frank Martin or the White House group?

MR. CRAIG: I don't think I did. At that point, it was pretty clear -- I don't think anybody thought it was a done deal that there was going to be a speech or what would be in it if there was one. But our assumption was that things looked pretty good from

everything we had seen. So at that point, I was really all figuring out, "Now what do we do the day after the speech?"

MR. McCURDY: So basically your work had culminated in briefings?

MR. CRAIG: That's right. And these more detailed supporting things that we had given first to Admiral Truly and then to Mark Albrecht.

MR. McCURDY: I want to get to those in a second. Let me ask you about the speech, though. You were in Houston for the speech. Were you listening to it?

MR. CRAIG: Yes.

MR. McCURDY: You were quoted in Space News Round-Up as saying that it was bolder than anyone thought it might be. Were you surprised by the speech?

MR. CRAIG: Yes. I was -- well, I am probably shaped, too, somewhat by my experience because in [space] station, we had gone through this kind of speech frenzy which I always used to find amusing. In the State of the Union Address with President Reagan: "Is he going to say something? What is he going to say? How is he going to say it?"

This whole place would just almost shut down in my perception for a day or two while people mused about what Reagan might or might not say in the State of the Union. So I had kind of seen this speech frenzy before and had an aversion to it.

I guess my own feeling was that the President would -- just guessing, you know -- not want to be too specific but would commit himself based on everything we had seen to a general goal. I felt the words that he used were powerful. I felt that in kind of laying out the steps and the time frame -- although people, there was all this, "Well, he

didn't say the year." I thought he had gone further than I thought he would go by giving a time frame and by giving a sequence and giving very powerful statements as to the reason why we were doing this.

One of our problems before the speech and since the speech is that our whole community harked back to the paradigm of Apollo. In fact, it is not even the real paradigm, I don't think; it is their perception of what happened. Simply put, the perception is: the man stands up, he makes a speech, he sets the date, and the money shows up at the door the next day. Now that is not (I don't think) what happened in Apollo and it is certainly not what happened here, but I got a lot of questions like that.

In fact, the reason I made that statement was that I got a lot of questions around the time of the speech -- people who didn't even realize what he had said. They missed it. You know, "just another space speech" was a very common thought even among NASA people. "Well, you know, nice space speech on the 20th anniversary." That was just amazing. Look at what the man said. Look at where we're going. Look at when we are going to go. It is not tomorrow, but it ain't that far off.

So I actually had to do work both inside NASA and with the press to help them to understand how significant it was, and that this really was a commitment on the part of the man and his vision; not just a nice space speech. That I found strange.

MR. McCURDY: It is not atypical.

MR. CRAIG: No. It is not atypical, you're right.

MR. McCURDY: Where were you physically when you heard the speech?

Were you watching it on television?

MR. CRAIG: Yes. As I recall, it was on NASA Select, and I was at JSC.

Good question. Where was I?

MR. McCURDY: Were there other people watching it with you?

MR. CRAIG: Yes.

MR. McCURDY: Were they people from your office?

MR. CRAIG: They were people from my office. Still, we were embargoed from talking about this with anyone and I had not. But I had told people the President is probably going to make a really important speech today and we all need to go over and listen to it.

Of course, at that time, there was a lot of speculation about what all this was up here and down there because I had been spending a lot of time here. At that time, we were over at the Department of Transportation building and had an office. I was doing a lot of the costing stuff by hand and had to back out of some of the big meetings that I should have otherwise been running for the team. So people knew something was up. I think they kind of guessed there would be something around the 20th anniversary that might make some sense.

MR. McCURDY: Tell me about the paper that you produced or reports or other materials that you produced for consideration by the Administrator or by Frank Martin or by the White House, leading up to the speech. We have the viewgraphs themselves [and] the boards. I shouldn't call them viewgraphs.

MR. CRAIG: Please don't do that. (Although they do look like viewgraphs.)

MR. McCURDY: "A Scenario for Human Exploration to the Moon and

Mars," dated June 13th.

MR. CRAIG: One other thing that I did as a result of the decision to have these three options that were shown was to do a Mars only. That came out early in July, which is the same kind of material, but just showing what would happen if you went straight to Mars.

MR. McCURDY: Which is titled, "A Scenario for Human Exploration of Mars," and that's for Mars only.

MR. CRAIG: Yes.

MR. McCURDY: Were there similar scenarios for the other options?

MR. CRAIG: No, actually the robotics option, we developed some data on it basically by drawing on strategic planning material from OSSA. They knew how to do robotic exploration and had laid out a program to do that. We basically drew on their information. They had cost estimates and everything else. So that took care of itself.

MR. McCURDY: So these would be your primary products.

MR. CRAIG: Yes.

MR. McCURDY: Briefing papers.

MR. CRAIG: And then the boards.

MR. McCURDY: And then the boards for presentations.

MR. CRAIG: Right.

MR. McCURDY: Anything written in essay form or reports or decision memoranda?

MR. CRAIG: No, not that I either produced or am aware of. I do have some

material that looks like it might be useful. You may have it. Press announcements, the President's speech, a letter from Admiral Truly to the Vice President. Of course, this was after the speech which you may not be interested in. Then the 90-day study kind of stuff.

MR. McCURDY: All right.

MR. CRAIG: I also had -- we went to special lengths to reward the people that really worked hard on this without knowing what it was, who put in a lot of hours. A list of people and their affiliations that had done a special large amount of work in developing these detailed things. A lot of whom, you will see, are graphics people because it turned out that the production of these boards, we really couldn't do up here. We did them in Houston, using the photographic system down there. There ended up as you can imagine being some changes in things and needs that required very rapid turn-around. So that is a list of people.

MR. McCURDY: Good. Tell me about the DOT office. You had office space here in Washington?

MR. CRAIG: The Office of Exploration, when it was set up by John Aaron in 1987 -- the office space to which it was assigned was actually office space that had been -- the first time I visited it, it was in the Department of Transportation building on the fifth floor. It was office space that had been somehow obtained when Reston was set up or when the space station level B was dissolved. Tom Moser had his office over in that complex. Then of course, when the decision was made to go to Reston, they moved all those people out of DOT and out to Virginia. So that office space was available. Basically, we just moved into Moser's old space.

MR. McCURDY: Now is this Frank Martin's office that you are referring to or is this your office here in Washington?

MR. CRAIG: Well, it is the Office of Exploration office suite. John had it originally, and then Frank took it over from John. Then basically now under my tenure heading up the office, we have moved over here in the Reporter's Building to get more room. We had tripled the size of the staff and done some other things.

MR. McCURDY: Did you have people who were working for you who were physically located in Washington or were they all out in the centers or at the Johnson Center?

MR. CRAIG: At that time, the time frame of the speech, they were all out in the field.

MR. McCURDY: How many people were physically reporting to you at the Johnson center?

MR. CRAIG: At that point, about 30. The way we organized the exploration work -- and again, the medium of work at that time were case studies and trade studies, things like that -- we set up an organization very typical of what we do in programs. We had a level one organization, which was here in Washington at that time, headed up by Frank Martin. We had a level two organization, which I was the head of, which did the integration and the system engineering kinds of things. Then we had level three organizations to break the problem up and look at how you would actually implement it.

The office at Marshall was responsible for all the transportation kinds of things, space transportation. Johnson was responsible for planet surface things, the lunar

outposts, the Mars outposts, were all Johnson's study and responsibility. The robotics missions were JPL.

Then the various codes here supported that, too. Life science and research, in code S; technology development, in code R; deep space net which is now code O. So that was kind of the hierarchy. That is the program hierarchy.

At the Johnson space center, my management responsibility was to have both the level two function which I was the head of and also the planet surface work under me. So in my organization at Johnson, I had both those functions; although in the hierarchy of the program, I had one function and that was the level two, leading the integration effort. So to that extent, I was the lead technical person and was the person that worked with all the technical expertise at the various centers to put the thing together to bring it up here. That was probably a total of 100 and something people, around the agency.

MR. McCURDY: I think that covers the events that I have found, up to the speech. Is there anything that we have missed? Is there any event or briefing or meeting that was key that we haven't talked about? We have a lot of questions about what happened afterwards, but I can hold those.

MR. CRAIG: Nope. I don't see anything else here that would indicate something else to bring to your attention right now.

MR. McCURDY: Good. Well, I thank you for taking the time to assemble this and to recall all of it. We would like very much at some point to come back and talk to you about the events that occurred afterwards.

MR. CRAIG: A lot has happened since.

MR. McCURDY: A lot has happened since. The reaction to the speech, the charge to the agency, and all of that which is a fascinating story. Very good.

MR. CRAIG: Thank you.

(Whereupon, the interview was concluded.)

Mark Craig, "A Scenario for Human Exploration
of the Moon and Mars,"

June 13, 1989

Following a meeting on May 31, 1989, NASA received a request from Vice President Dan Quayle to conduct a study in preparation for a presidential decision on July 20, 1989, that would establish a NASA exploration goal. NASA Administrator Richard Truly set up a Working Group under Frank Martin and Mark Craig, which met at the Johnson Space Center and put together the data necessary to brief the White House on an appropriate plan. The group met from June 4 through June 11 to study the issue and prepare briefing charts. Many of the charts that the group prepared follow. The charts were used to brief Admiral Truly and other high-ranking NASA officials on June 13, 1989.

**A SCENARIO FOR
HUMAN EXPLORATION OF THE
MOON AND MARS**

Mark Craig

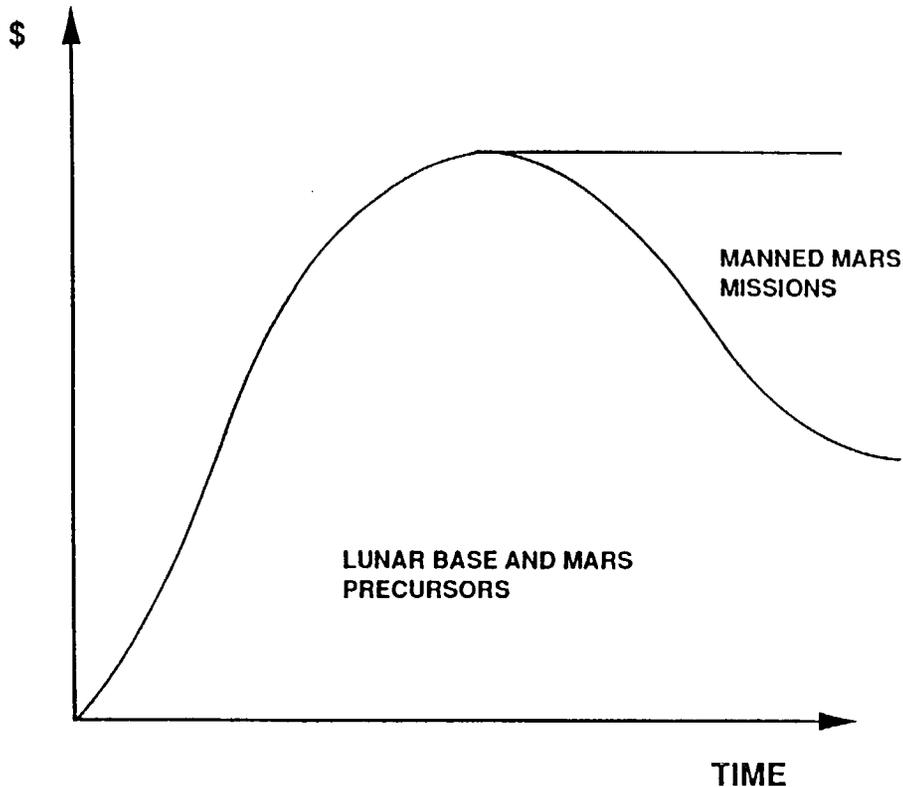
June 13, 1989

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THE OBJECTIVE

- Undertake a program of human expansion beyond low Earth orbit with Mars as the ultimate objective
- Specifically:
 - Establish a permanent research facility on the Moon in the year 2000 to learn how to live, work on, and make use of another planet
 - Undertake robotic exploration of Mars to support human exploration early in the next century
 - Optimize science and research opportunities within exploration activities

THE APPROACH



- CONSTANT ANNUAL INVESTMENT
- LUNAR BASE IS LEARNING CENTER AND TEST BED FOR MARS MISSIONS
 - SURFACE OPERATIONS
 - SYSTEMS DEVELOPMENT
 - G-LEVEL ADAPTATION
 - REMOTE SITE LOGISTICS
 - HUMAN PERFORMANCE
- UNMANNED PRECURSORS TO MARS ENABLE MANNED MISSIONS
 - ENGINEERING DATA ON MARS
 - MAPPING AND SITE LOCATION
 - SAFETY DATA
 - TECHNOLOGY DEMONSTRATIONS
 - INFRASTRUCTURE EMPLACEMENT
- MARS "WEDGE" BUILD-UP
 - LUNAR DDT&E FALL-OFF
 - REUSABLE VEHICLE INTRODUCTION
 - LUNAR LOX USE
 - USE OF LUNAR SYSTEMS ON MARS

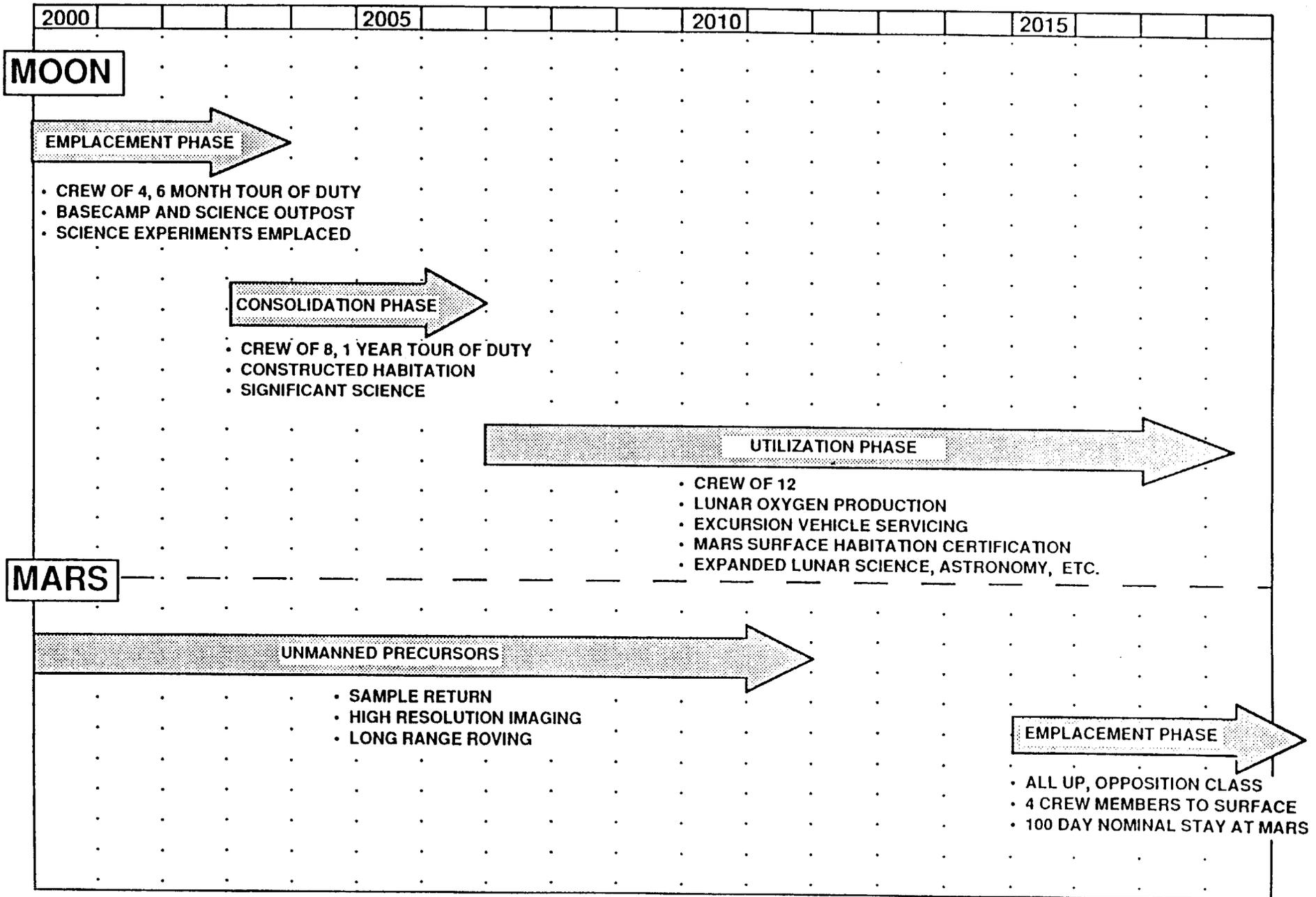
HUMAN EXPLORATION SCENARIO

- Mission Description (2000 and beyond)
 - Lunar Base
 - Mars Precursors

- Enabling Investments (1990-2000)
 - Shuttle-C
 - Space Station Freedom
 - Precursors
 - Advanced Development
 - Technology

- Programmatics
 - Schedule
 - Cost
 - Program Management
 - NASA Institution
 - Risk

MISSION SUMMARY



SCENARIO ASSUMPTIONS

EARTH-TO-ORBIT TRANSPORTATION

- Shuttle-C available by 1999 to support scenario initiation
 - 68 mt to SSF
 - 10 m shroud
 - 6 flights per year max for exploration
- STS capable of transporting 4 mission crew plus 20 mt of mission cargo to SSF (limit 2 per year over and above SSF flights)

SPACE TRANSPORTATION

- Lunar Transfer Vehicle (LTV) and Lunar Excursion Vehicle (LEV) designed to be reusable without major maintenance operations
- LTV reuse initiated in 2004
- Aerobrake used on LTV for crew return to SSF prior to 2004 (vehicles act as reusability test beds)
- LEV reuse initiated in 2006 with lunar LOX production onset
- Reusable vehicles expended after five uses
- Manned Mars mission departs from Earth orbit

SCENARIO ASSUMPTIONS (cont.)

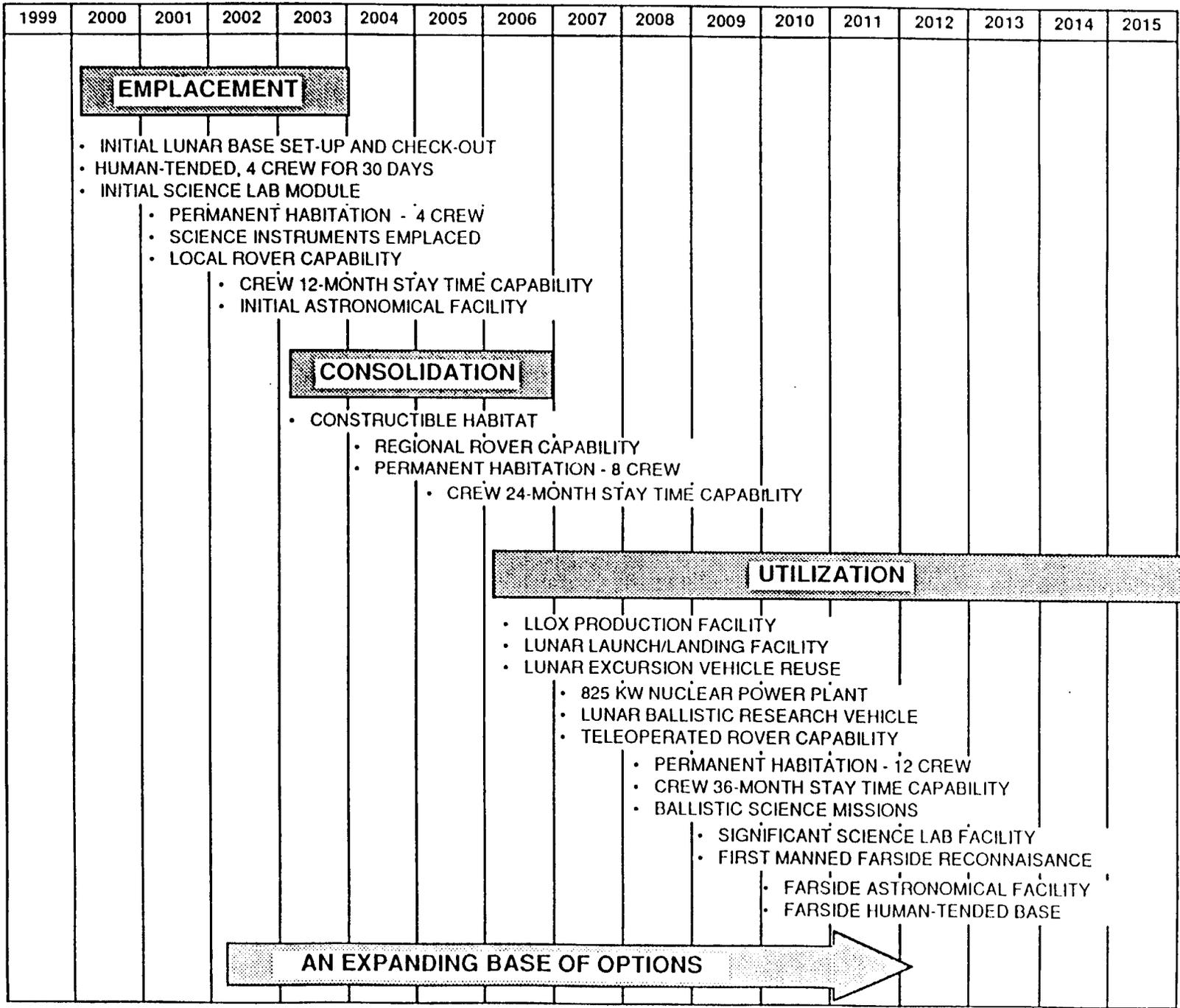
SPACE STATION FREEDOM

- Shuttle-C available by 1995 to expedite assembly sequence
 - 36 mt to 68 mt to SSF
 - 4.6 m x 25-28 m payload bay
- Accommodations for one Lunar Transfer Vehicle (LTV) and cargo until 2004; accommodations for two vehicles and cargo thereafter
- LTV and LEV fueling accomplished at SSF (if on-orbit fueling required)
- SSF crew is not augmented to process lunar vehicles
- Lunar crew return to Earth via "scheduled" STS resupply mission

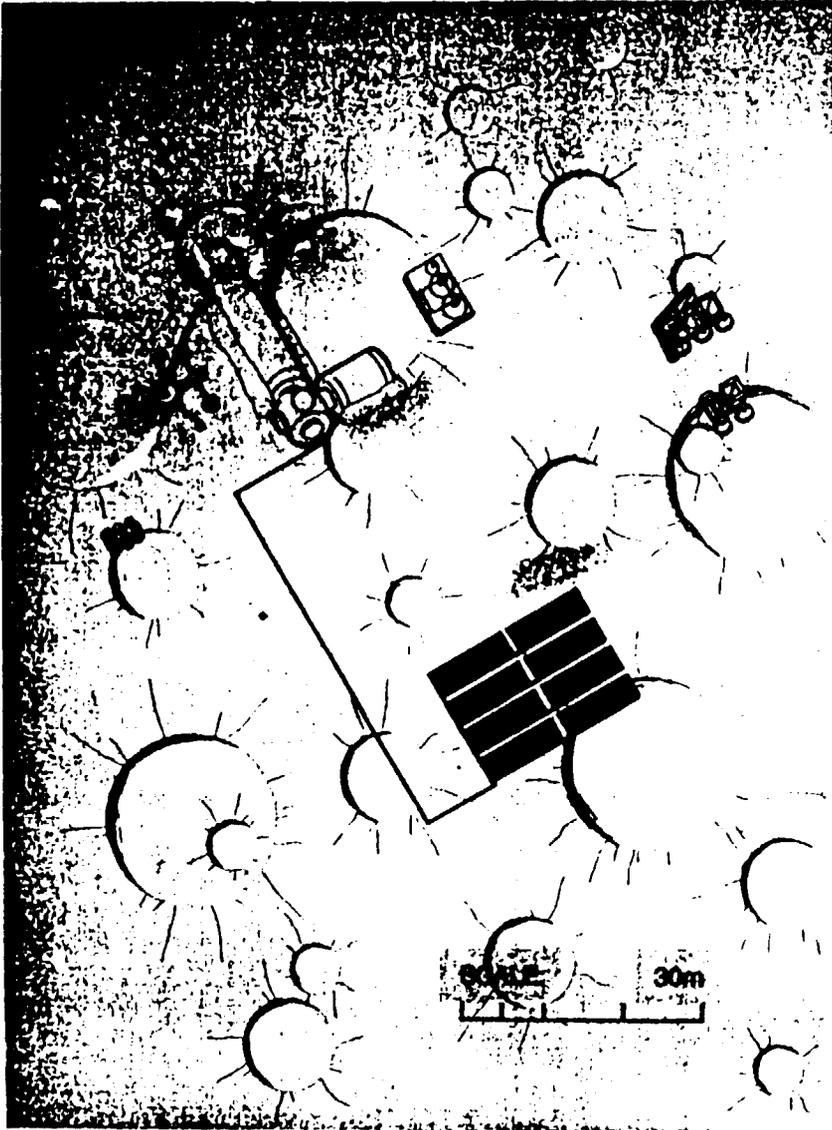
LUNAR BASE

- "Significant" capability can be achieved with 37 mt of equipment on lunar surface (plus 4 crew for 30 days)
- Production of lunar LOX for Lunar Excursion Vehicle (LEV) propulsion and for Lunar Base use opens "Mars wedge" significantly
- Manned Mars mission systems and vehicles will be tested, as appropriate, on the Moon

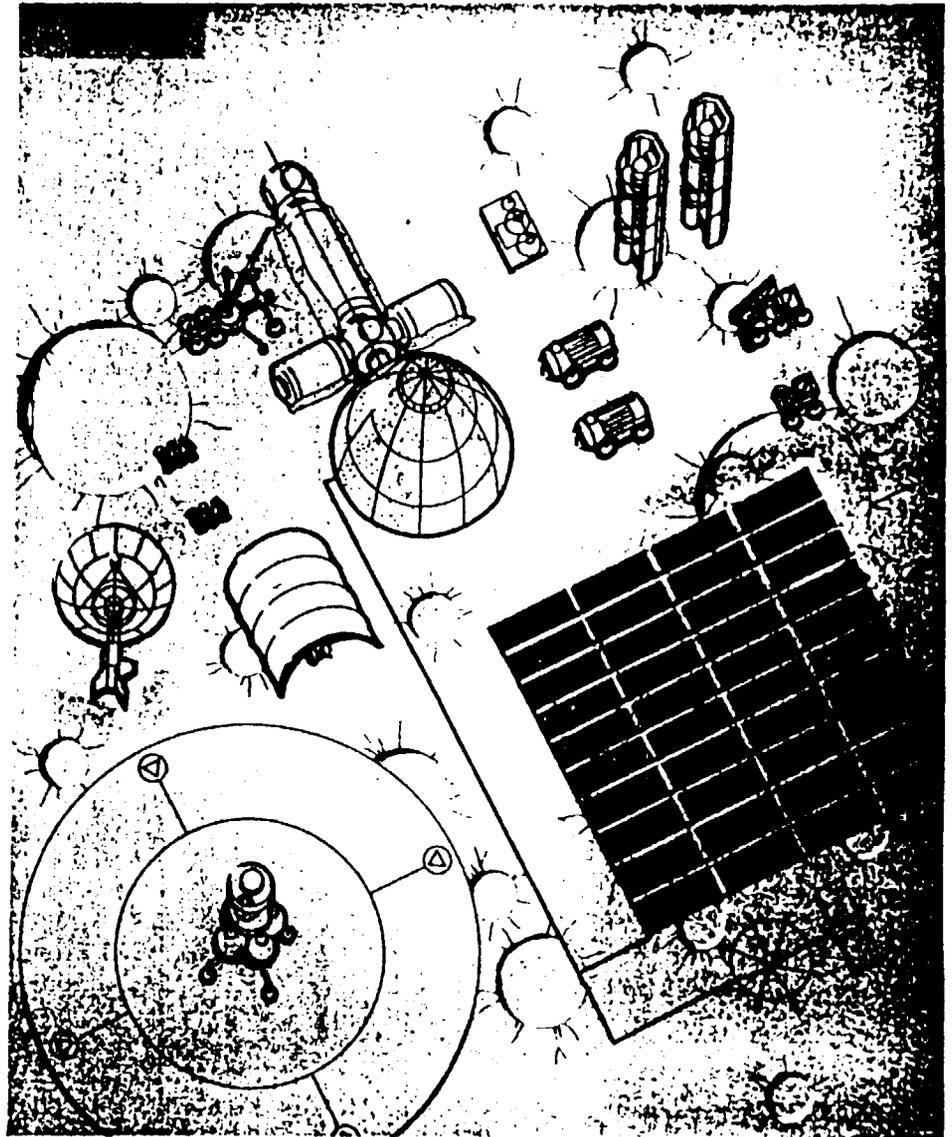
LUNAR BASE CAPABILITY



Lunar Base Evolution



4 Crew/30 days
75 kw



12 Crew/1 year
1 mw

SYSTEMS DERIVED FROM SSF

	<u>SPACE VEHICLES</u>	<u>LUNAR BASE</u>	<u>EXAMPLES</u>
STRUCTURES	✓	✓	NODES, HAB MODULE
AVIONICS	✓	✓	DMS, DISPLAYS/CONTROLS, PMAD
POWER		✓	PV ARRAYS
MECHANISMS	✓		BERTHING
ECLSS	✓	✓	WATER RECYCLE
MAN SYSTEMS	✓	✓	HAB EQUIPMENT, HEALTH MAINTENANCE
AUTOMATION	✓	✓	OFF-LOADERS, AI

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MARS PRECURSOR PROGRAM OBJECTIVES

- Maintain modest level of effort toward stated long term goal - enables Mars mission within 25 years
 - '90's and '00's important to Human Exploration in '10's
 - International opportunities for cooperation can be pursued
- Obtain data on Mars to reduce manned mission cost and risk
 - Atmospheric properties (aerobrake, entry, at surface)
 - Surface materials (hazards, operations)
 - Resource distribution (water)
 - Contamination hazard (quarantine)
- Obtain data on Mars to enable "smart" science content of manned mission
- Perform technology and mission demonstrations to reduce manned mission cost and risk
 - Aerobraking
 - Hazard avoidance
 - Landing accuracy
 - Surface mobility

MARS PRECURSOR SCENARIO

CONSIDERATIONS

- Information from sample return has greatest probability to influence design of manned Mars landers
- Sample return has high science content
- "Local" samples are sufficient if several sites are visited
- Long range autonomous rover enhances sample return by collecting broader range of material for return by robotic or manned mission - can reconnoiter potential base sites

MISSION SET

- Early sample return with "local" rover - 2001
- Sample returns from dispersed sites - 2003-2005
- High resolution imaging orbiter - 2005
- Long-range, autonomous rover - 2009-2011

HUMAN EXPLORATION SCENARIO

- Mission Description (2000 and beyond)
 - Lunar Base
 - Mars Precursors
- Enabling Investments (1990-2000)
 - Shuttle-C
 - Space Station Freedom
 - Precursors
 - Advanced Development
 - Technology
- Programmatics
 - Schedule
 - Cost
 - Program Management
 - NASA Institution
 - Risk

LAUNCH VEHICLE OPTIONS

1994 TO 2000

- Shuttle-C
 - 4.6 m x 25-28 m payload bay
 - 10 m x 30 m payload bay (by 1999)
 - 68 mt payload capability to SSF

2000 TO 2010 - Two systems, assured heavy lift

- Shuttle-C (lower flight rates)
- Advanced Launch System (for increasing traffic)
 - 6-10 m diameter by 25-30 m length
 - Payload capability of 45-100 mt

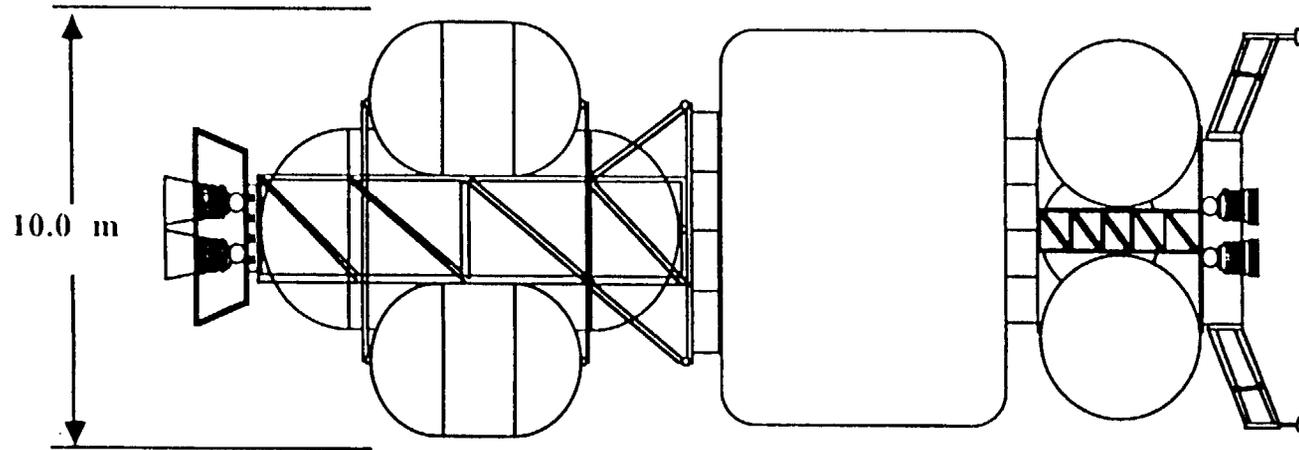
2010 TO 2020

- Shuttle-C growth to 90-115 mt payload capability
- ALS Modularized elements divided by 135-180 mt payloads
- New vehicle using Shuttle-C and/or ALS elements: 135-180 mt
- NASP for crew transfer

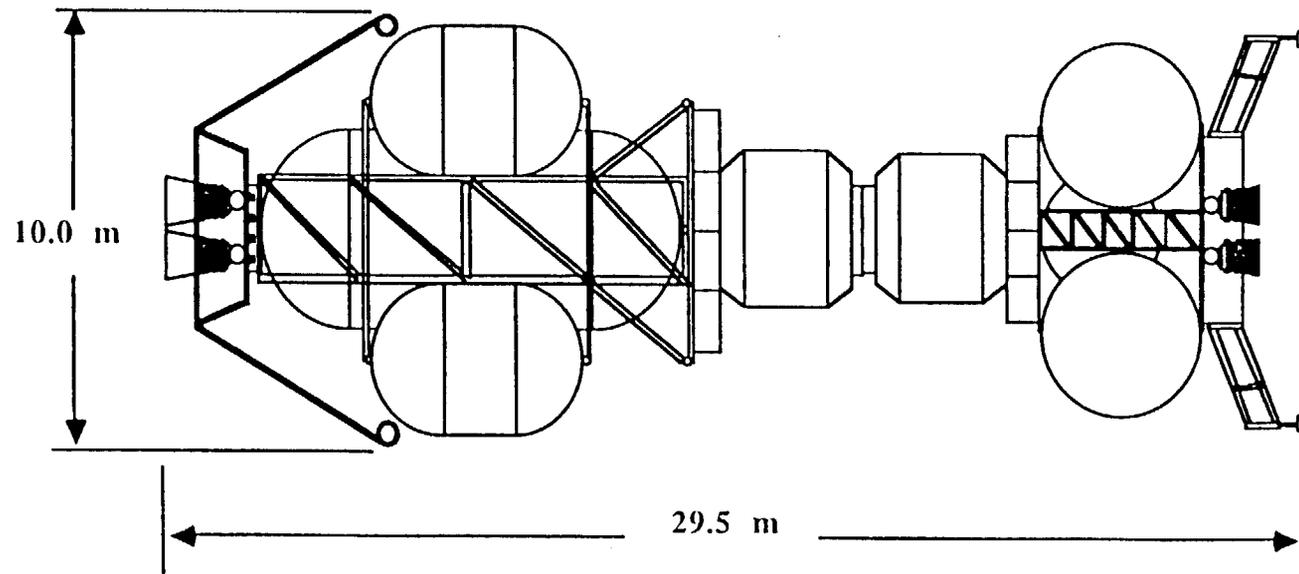
SHUTTLE-C ASSESSMENT

- 68 mt lift capability and 30 m payload length are required
- Shroud diameter variations (nominal = 4.6 m)
 - Studied at 6.7 - 10 m diameters
 - Basic wind tunnel data for 6.7 m and 10m available
 - Considered practical
- Impacts of 10 m shroud (~ \$200 m)
 - Payload decrease of 6 mt due to shroud weight (offset by 3 engines, 109%, ASRM, and trajectory shaping)
 - Development cost of larger shroud (50 - \$100 m)
 - ET and attachment load impacts (25 - \$100 m)
 - KSC facility impacts (cargo element transporter, VAB platforms, pad) (50 - \$100 m)
- Launch facility mods to support 4-6 flights/year cost \$200 m

SHUTTLE-C LAUNCH CONFIGURATION

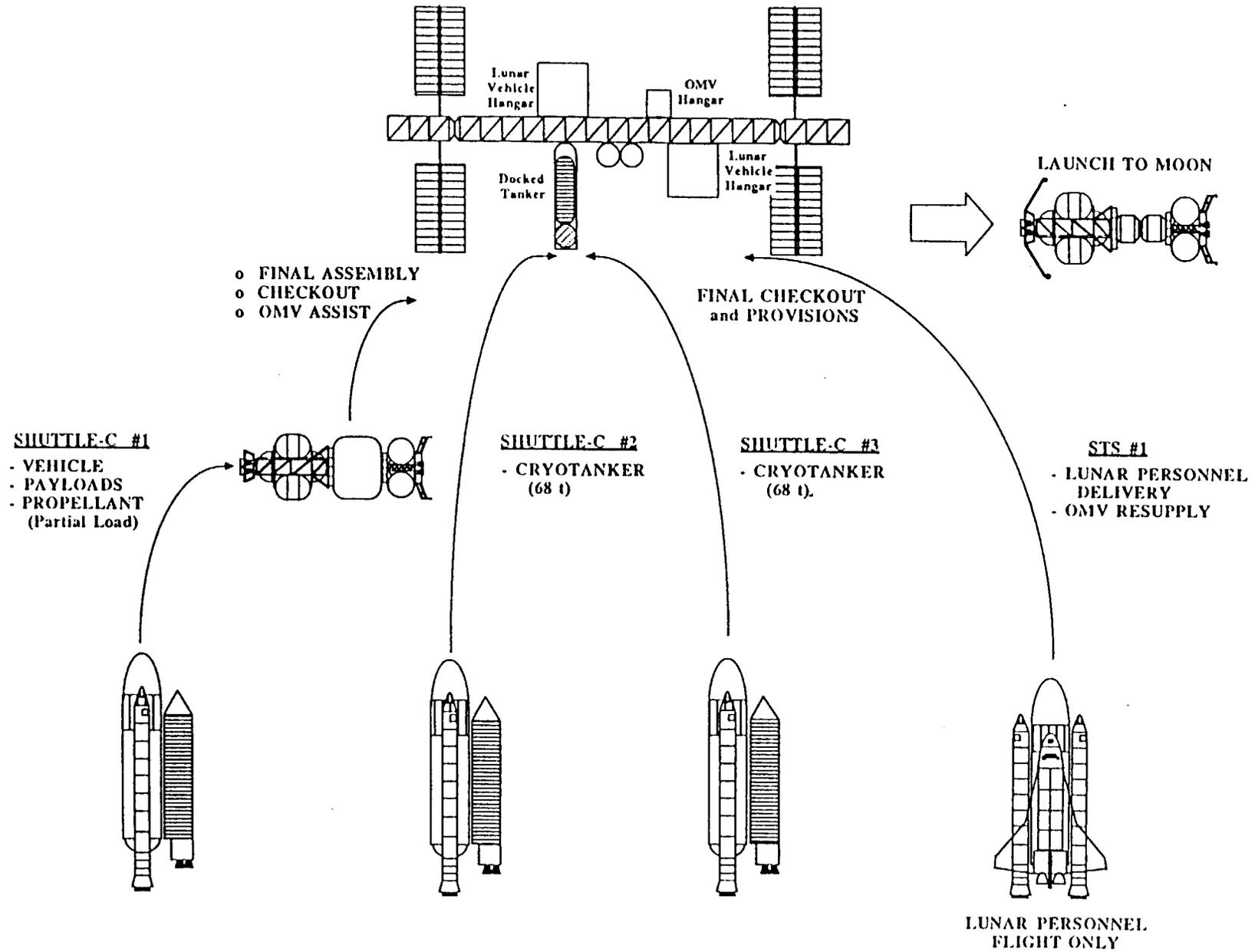


Cargo
Configuration

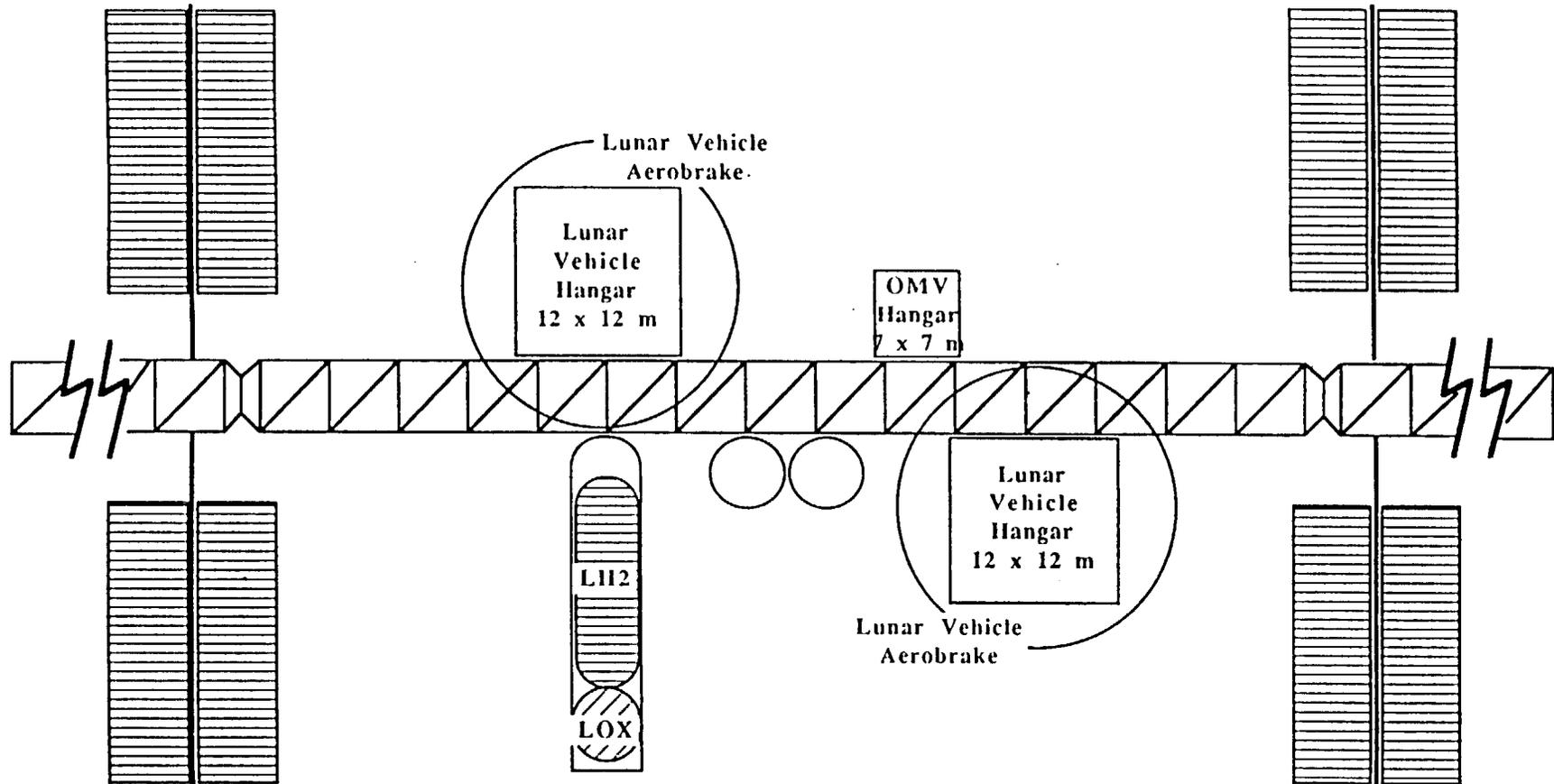


Piloted
Configuration

EARTH ORBIT OPERATIONS SCENARIO



Space Station FREEDOM
Lunar Base Support
Configuration



LUNAR PRECURSOR DATA REQUIREMENTS

SITE SELECTION

- Global geochemical maps; identification of accessible resources influences strategy and optimizes site characteristics

SITE CERTIFICATION

- High resolution images (1-5 m) at sun angles < 30 degrees for landing hazard and trafficability assessment
- Local geophysical mapping to determine engineering properties, construction strategy

SURFACE NAVIGATION

- Cartographic quality images to allow creation of surface cartographic net to support surface-to-surface transport

LUNAR SCENARIO PRECURSORS

<u>MISSION</u>	<u>DATE</u>
Lunar geochemical mapper (Lunar Observor)	1997
Site certification rover* (On test flight of Lunar Excursion Vehicle)	1999
Cartographic mapping mission	2004

* Not required if an Apollo landing site chosen

1990's MARS EXPLORATION PROGRAM

1992	U.S.A - Observer	Global geochemistry
1994	U.S.S.R - Rover - balloon	Local physiography, meteorology
1996	U.S.A - Observer & penetrators	Aeronomy, local surface imaging, network geophysical
1998 (?)	U.S.S.R - Sample return	Detailed composition of local regolith

SCENARIO ADVANCED DEVELOPMENT NEEDS

LUNAR BASE

- Utility Vehicles
- Launch Vehicle Support
- Life Support System
- EVA Suits
- Construction/Mining
- Lunar Material Use
- Nuclear Power

SPACE VEHICLES

- Space-based Propulsion
- Aerobraking
- Cryo Storage and Transfer
- In-space Assembly/Checkout

SCENARIO TECHNOLOGY NEEDS

MARS BASE

Life Support System
EVA Suits
Mars Material Use

SPACE VEHICLES

Nuclear Propulsion
Aerobraking
In-space Assembly/Checkout
Systems Lifetime

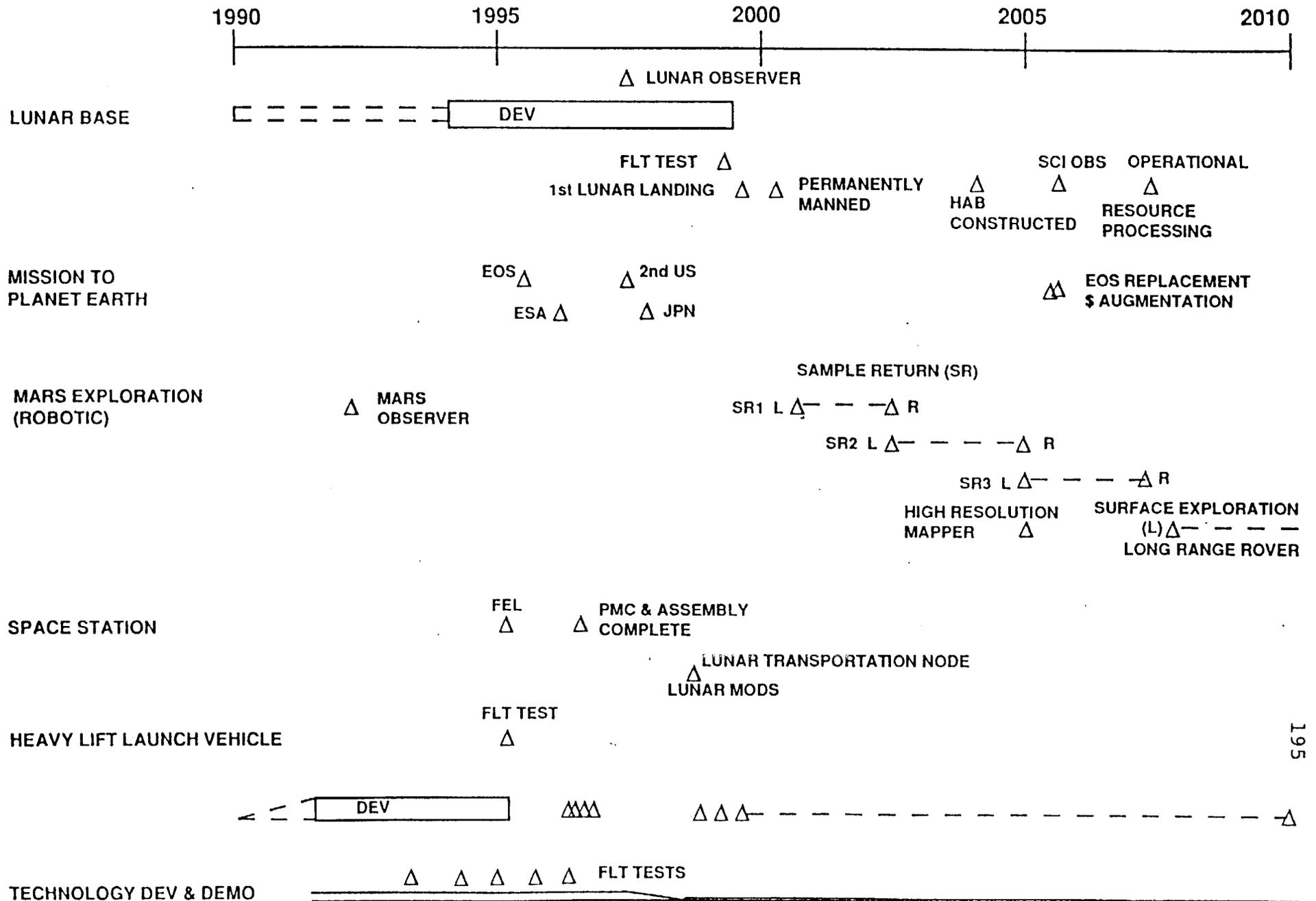
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 - Mars Precursors

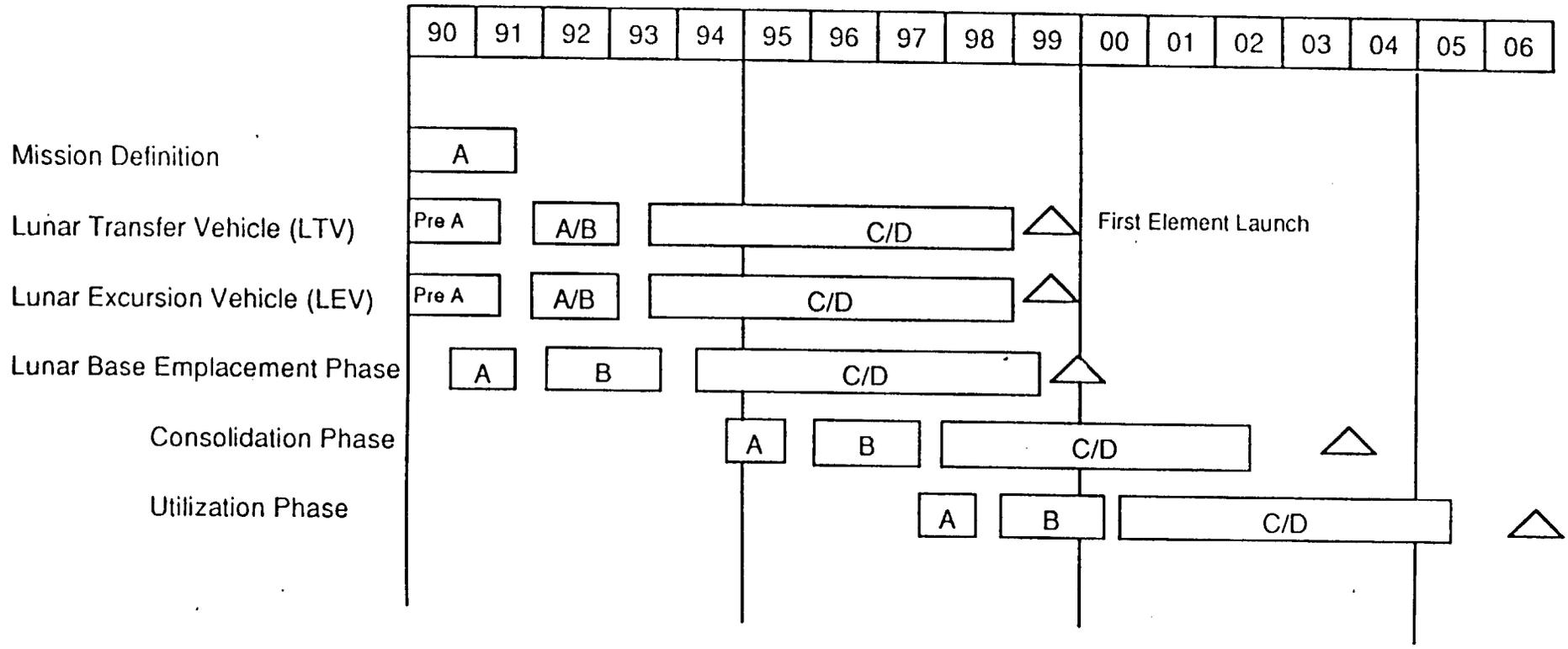
- Enabling Investments (1990-2000)
 - Shuttle-C
 - Space Station Freedom
 - Precursors
 - Advanced Development
 - Technology

- Programmatics
 - Schedule
 - Cost
 - Program Management
 - NASA Institution
 - Risk

NASA MILESTONE SUMMARY



DEVELOPMENT PROGRAM STRUCTURE



NASA, "Civil Space Exploration Initiative,"

undated

On or about June 15, 1989, Admiral Truly and Frank Martin presented NASA's conceptual plan for an exploration program to Vice-President Dan Quayle. Presentations by Truly and Quayle to a variety of groups outside the administration ensued. These officials drew upon the following charts for their presentations. The charts, based on the technical material supplied by the NASA Working Group, were updated and rearranged as the presentations transpired. For a description of the briefings, see Franklin Martin interview, March 15, 1991.

NASA

Civil Space Exploration Initiative

Agenda

- ❑ Introduction
- ❑ Direction from Vice President
- ❑ Effect on America
- ❑ Lunar Outpost, then to Mars
- ❑ Direct to Mars
- ❑ Robots Only
- ❑ Rationale for Lunar Outpost, then to Mars
- ❑ Impact of Decision

May 31, 1989 — Vice President Direction

**Prepare for a Presidential decision —
July 20, 1989**

Establish NASA exploration goal

**Achieve significant and visible milestones
early in 21st century**

Maximize use of "present" NASA capability

Identify what it will take

- Money**
- People**
- Facilities**

National Space Policy — February 11, 1988

Long-term goal: “Expanding human presence and activity beyond Earth orbit into the solar system”

President Bush — State of Union, February 9, 1989

“The space program should always go ‘Full Throttle Up.’ That’s not just our ambition, it’s our destiny.”

President Bush is seeking advice in setting the civil space exploration goal

Los Angeles Times - Sept. 30, 1988

Liftoff to Where?

Americans watched a wounded friend get up and run again Thursday, this time aware that bumps and bruises can go wrong in the crucial liftoff of a space shuttle, this time missing their cheers with sighs of relief.
This time, too, people watching the launch on

The Evening Bulletin - Providence, R.I. - September 30,

We're flying again, but flying to where?

America is back in space.
With yesterday's successful launching of the Discovery shuttle, the nation's space program is once again in orbit, and nearly three years after the loss of the Challenger, flying and soaring

astrophysics and yesterday the Soviet Union the ahead. We are all and engineering programs are just as for military purposes

Where, in space, is U.S.

Apollo began its blundering withdrawal from space leadership at the very moment of its crowning achievement. Just as the Apollo program was succeeding, the Nixon administration cut the program's budget, forcing it to cancel its last scheduled moon flights

Scientists that station as NASA display it. More gobble up programs earn, so

STATE, Columbia, S.C. - Sept. 30, 1988

Shuttle flies, but space goals still in limbo

DISCOVERY, the extensively redesigned shuttle, lofted into orbit Jan. 28, the design and set back this country's space program for years. Indeed, the 32-month delay between the Challenger explosion and Thursday's successful flight created a very serious problem

ington Banner, Bennington, VT - Oct. 4, 1988

Is NASA Stuck in Orbit?

act that the space shuttle launched National Aeronautics and Space Administration from the get the space next president now in time NASA to Mrs. a long term mandate more ever was one. But for now at least the agency will probably have to settle for less. One temptation Congress prob

is NASA Headed?

NASA is caught in another bind. The new shuttle cost \$2.4 billion to make later and is more expensive than ever to operate. With 10 or more launches a year, each flight costs around \$100 million. Unmanned rockets, depending on size, cost \$30 million to \$200 million. Yet if the shuttle's flight rate is in

Popular Science

JULY 1989

20 YEARS AFTER APOLLO



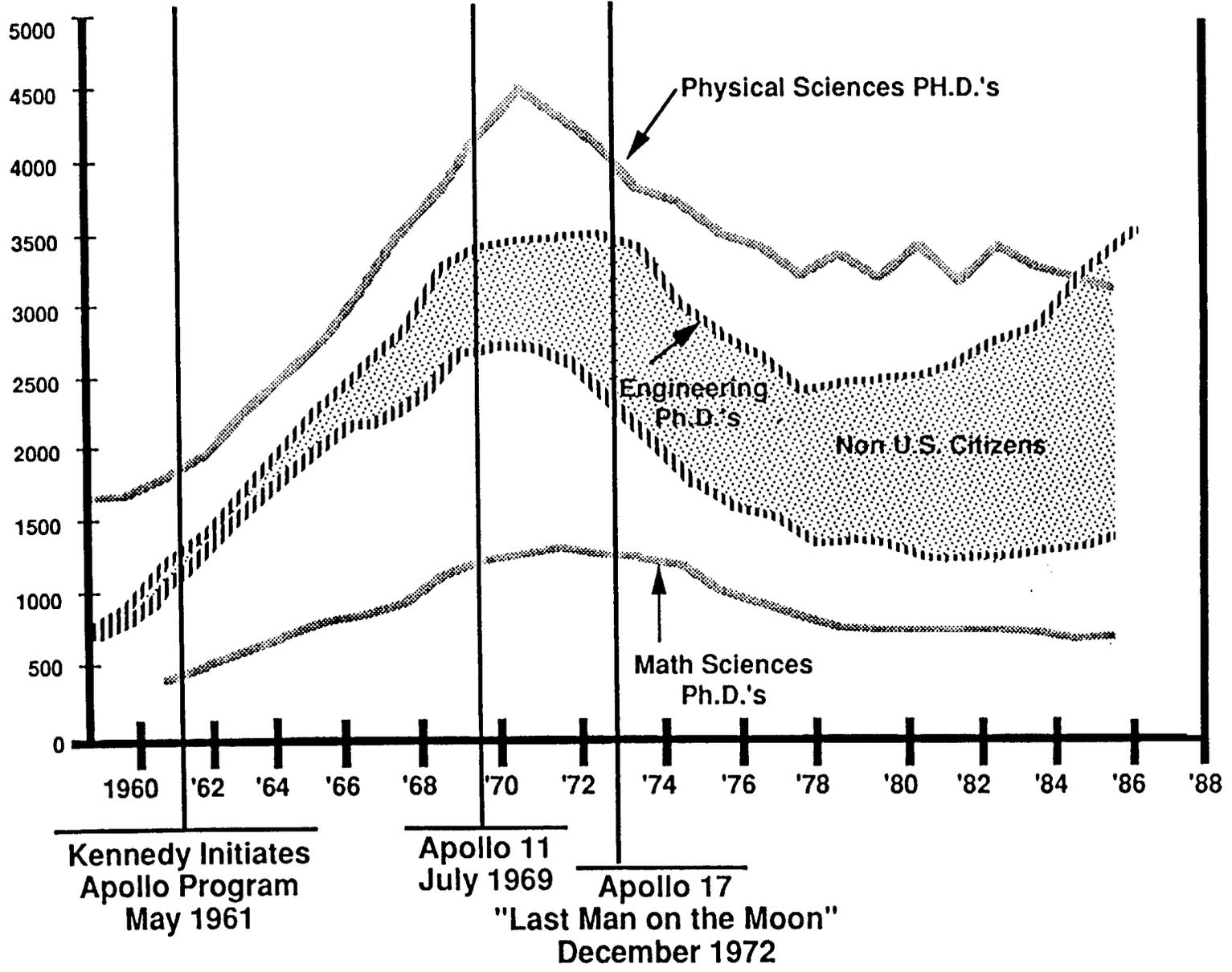
IS THE U.S. LOST IN SPACE?

Effect on America

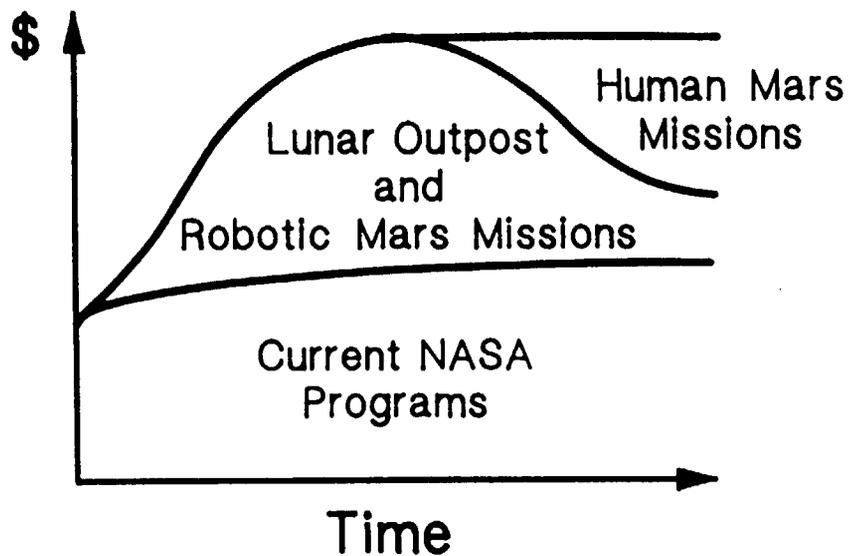
- **Education**
- **Technology Stimulus**
- **Economic Impact**

Science and Engineering Doctorates

Number of Degrees



Lunar Outpost, then to Mars



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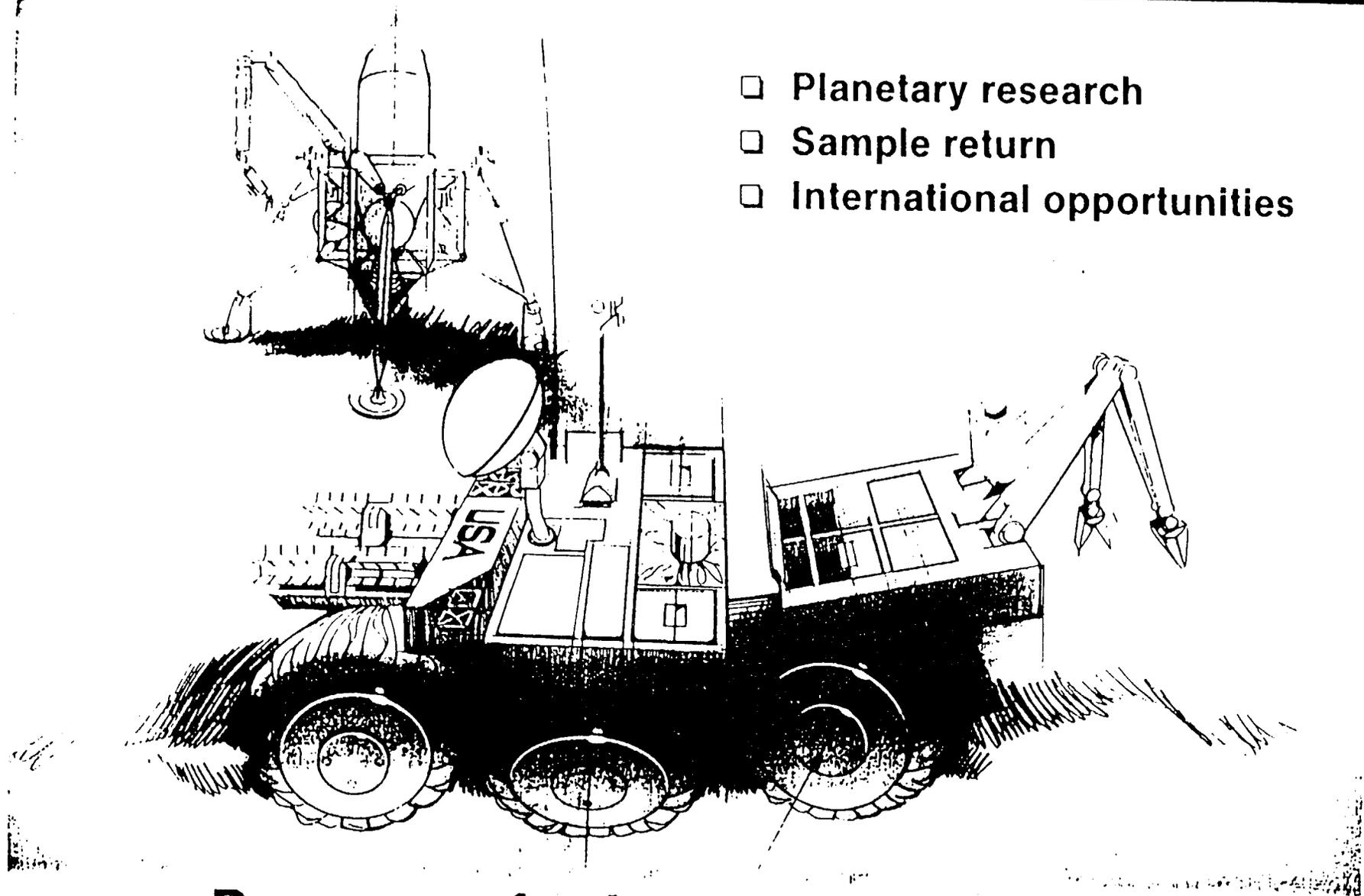
- National investment in space transportation and Space Station *Freedom* provides pathway
- Lunar Outpost: research base test bed for humans to Mars
- Robotic Mars missions pave way for humans
- Humans to Mars when lunar development falls off

Human Exploration of Mars

The long range goal

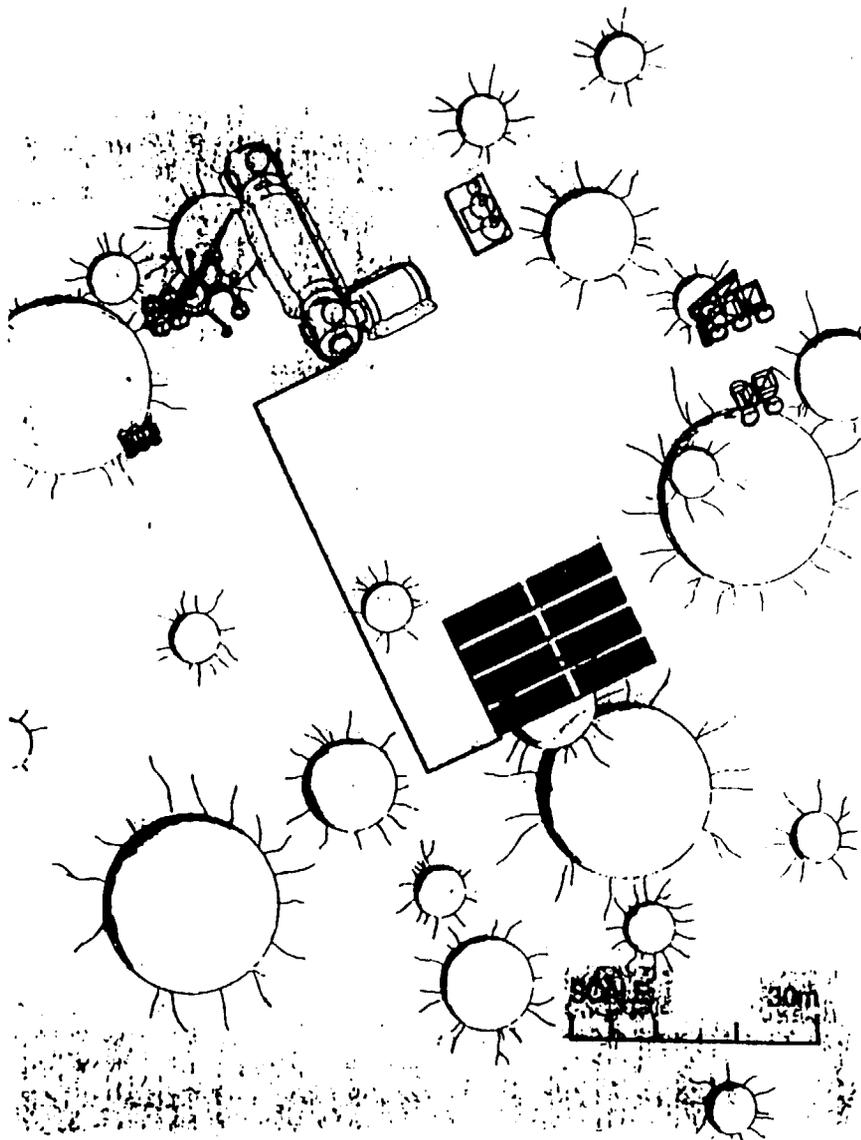
Mars Robotic Exploration

- ❑ Planetary research
- ❑ Sample return
- ❑ International opportunities

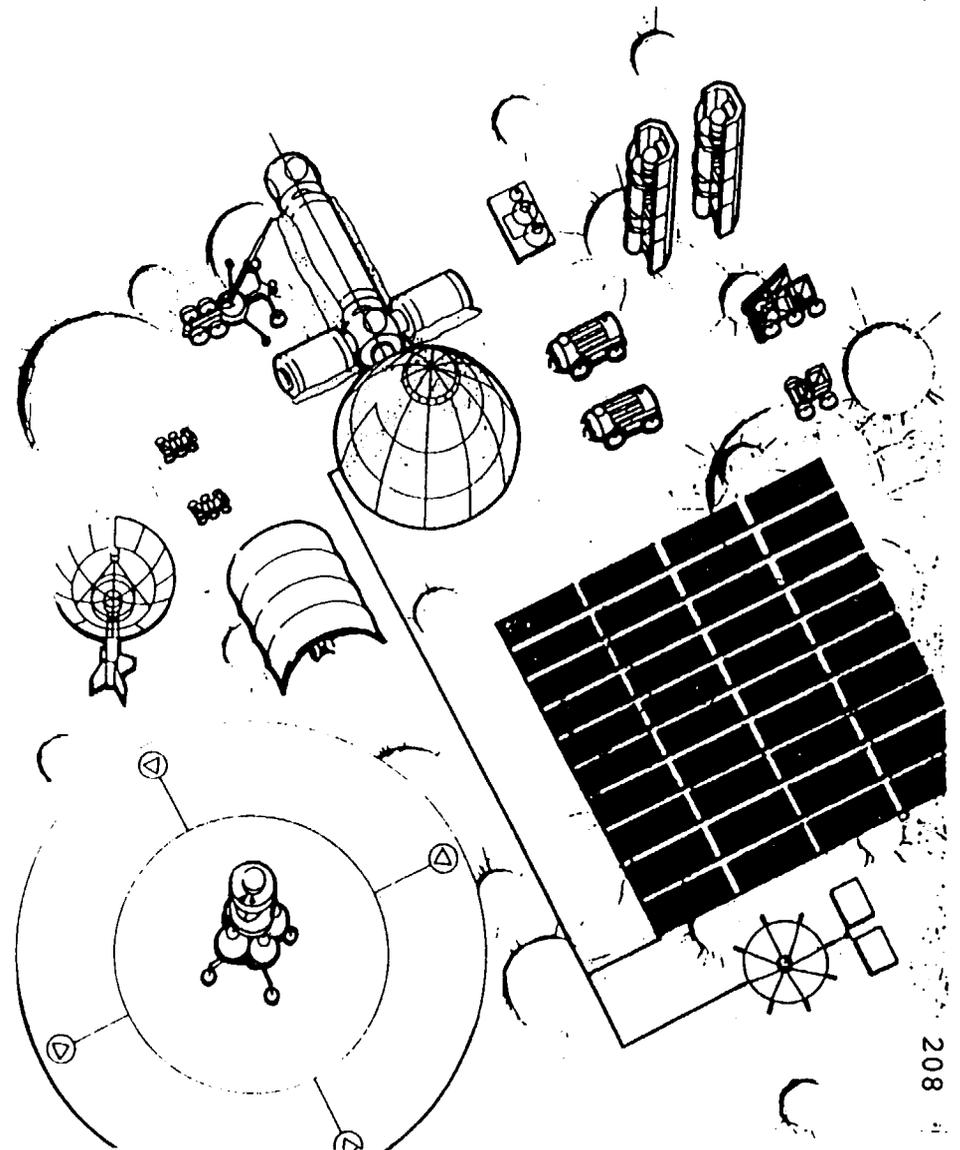


Precursor for human exploration

Lunar Outpost



2001
4 Crew/30 days

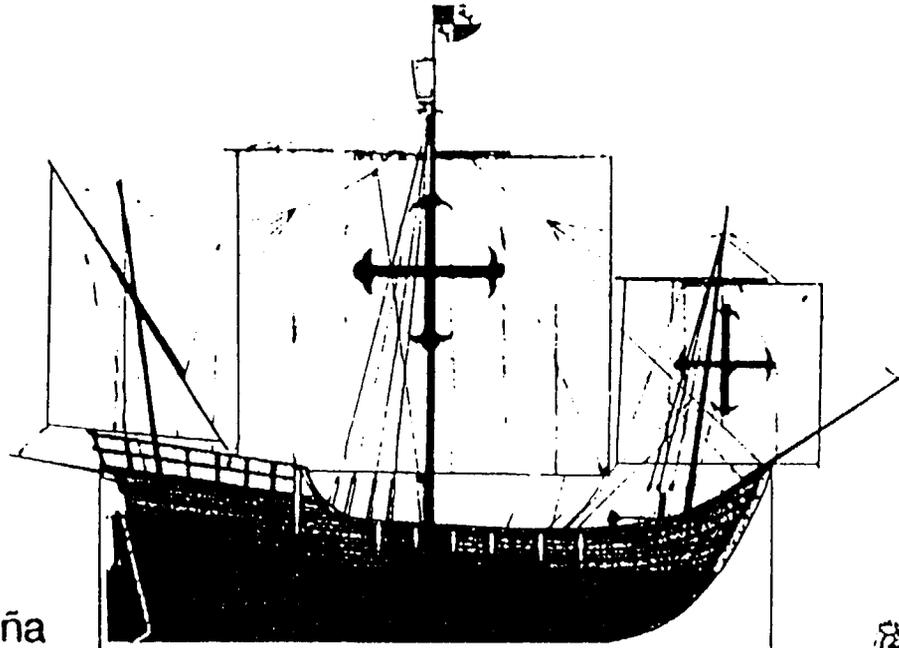


2010
12 Crew/1 year

Ships of Exploration

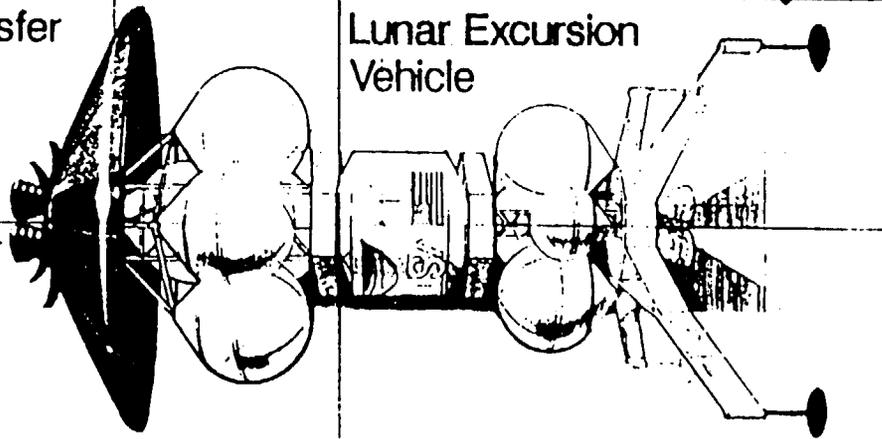
1492

Niña



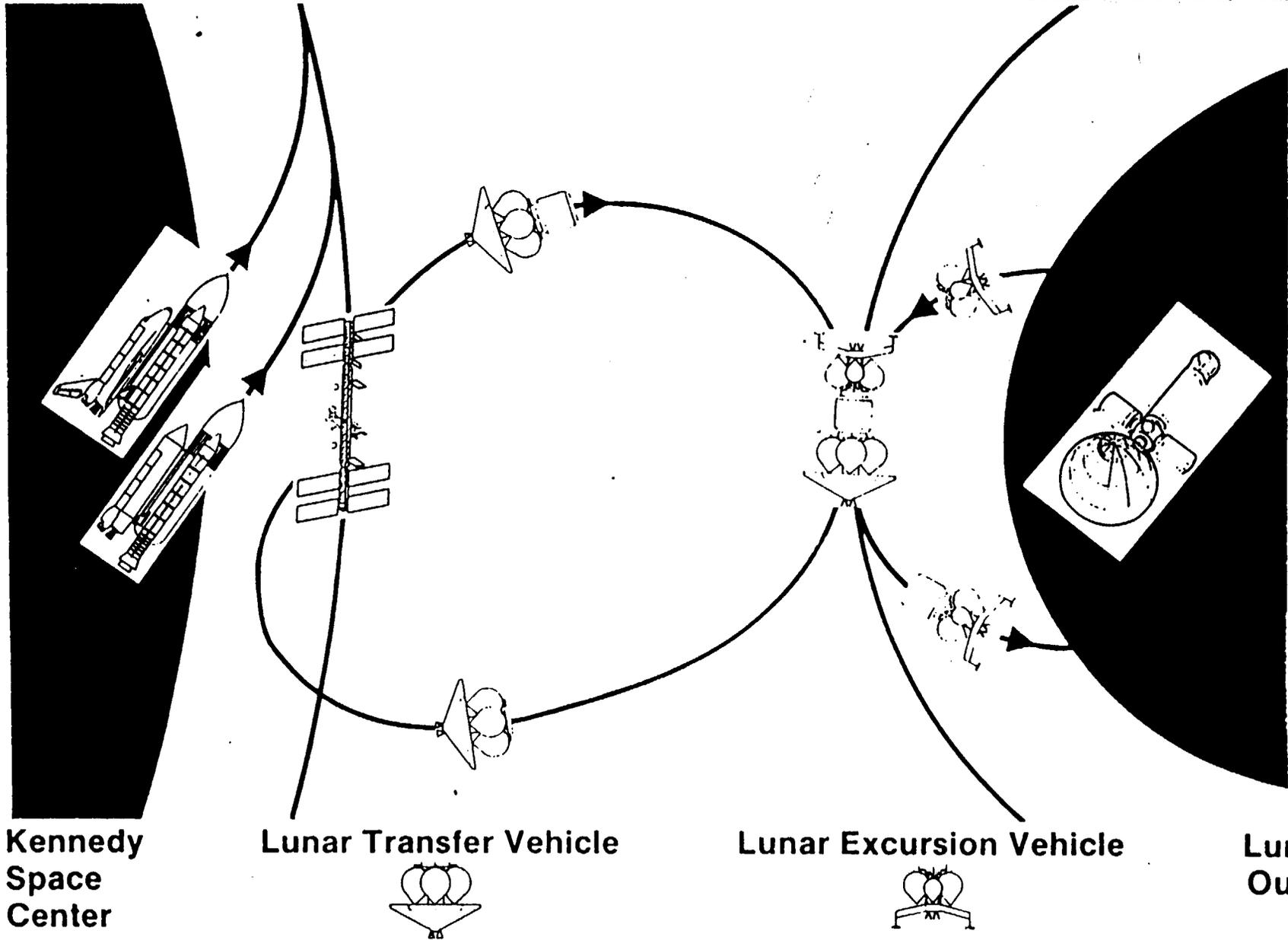
Lunar Transfer Vehicle

Lunar Excursion Vehicle



21st Century

Lunar Transportation Sequence



Why a Lunar Outpost?

U.S. leadership in human exploration

- Significant achievement by year 2001
- Major step into solar system
- Opportunities for international cooperation

Learn to live and work on other planets

- Builds on past experience
- Nearby — a 3-day trip
- Straight forward communications
- Excellent science base

Important step toward Mars

- Planetary surface experience
- Hardware and systems development
- Human experience in partial gravity
— one sixth Earth's

Science Opportunities at The Moon

Source of knowledge

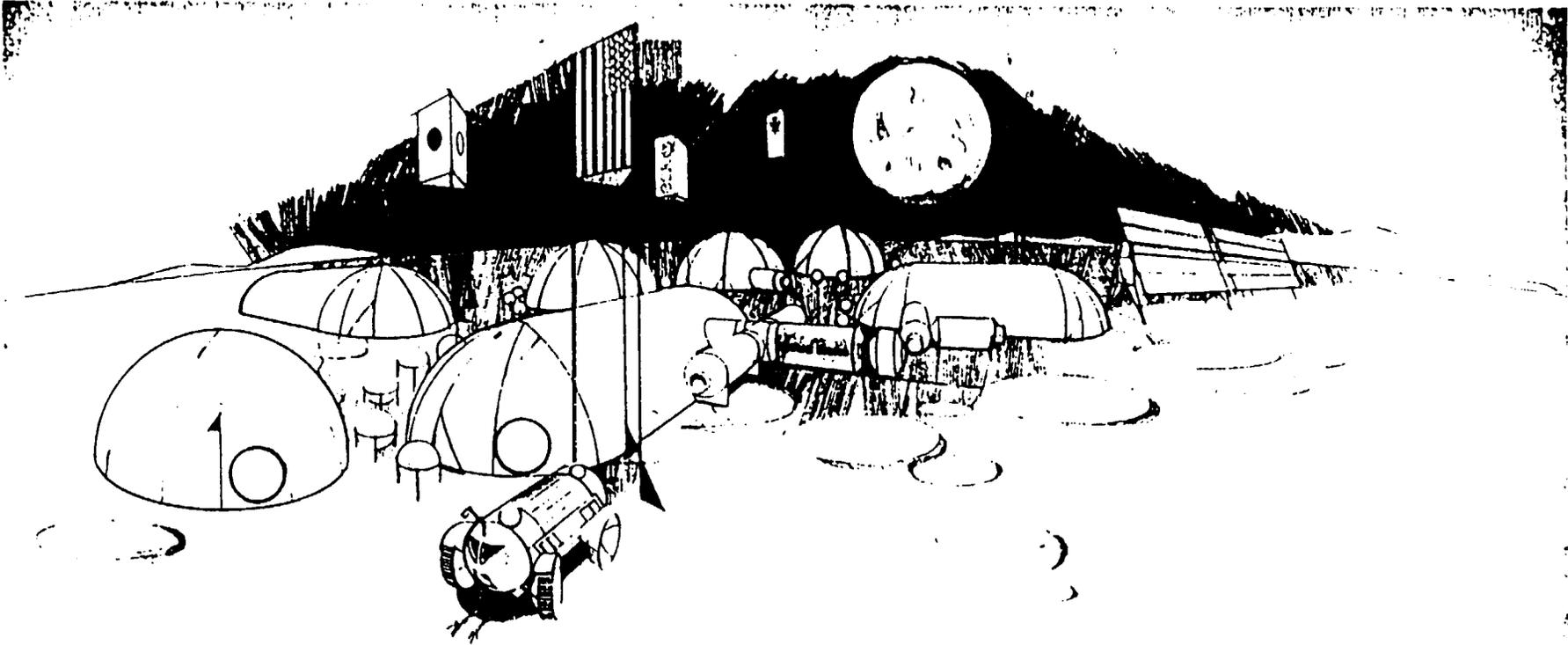
- ❑ History and relationship to Earth
- ❑ Nature of cyclic impacts - extinction events
- ❑ Four-billion-year record of solar activity

Research platform

- ❑ Earth and solar observation base
- ❑ Orders of magnitude improvement in space-based astronomy
- ❑ A one-sixth gravity life science laboratory
- ❑ Remote life support and health care

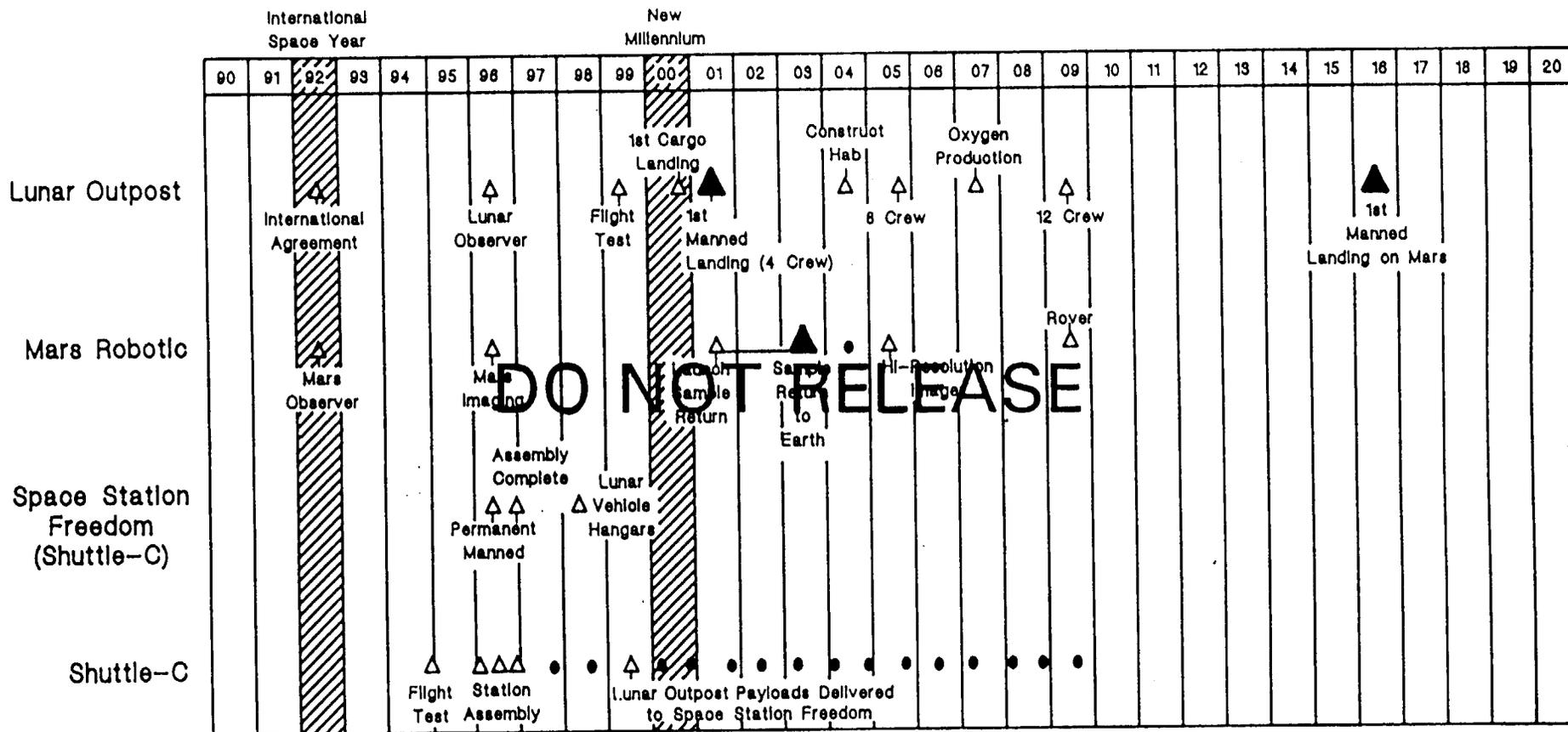
A broad range of research

Others Can Join Us On The Moon



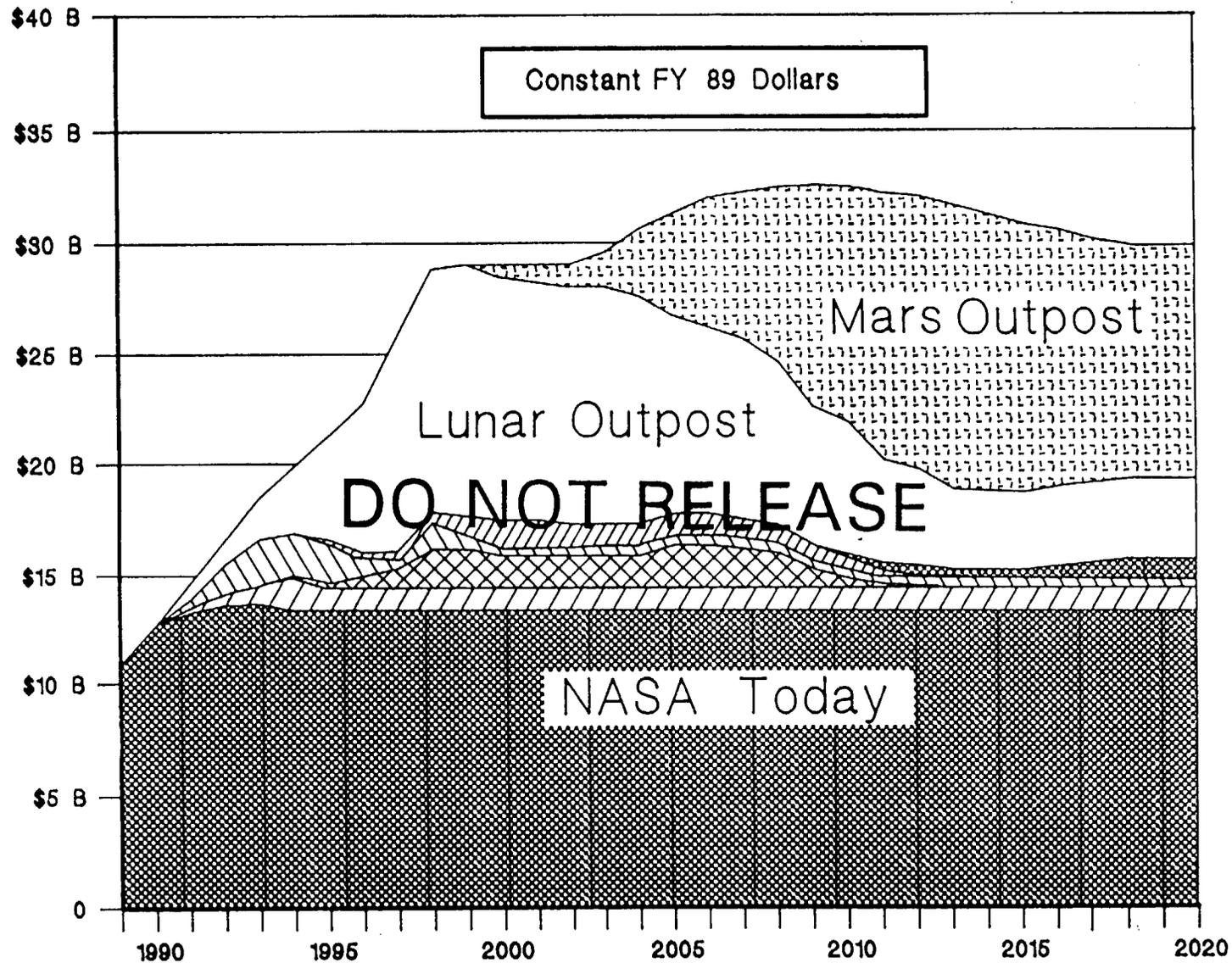
**Establish agreements in 1992
International Space Year**

Lunar Outpost, then to Mars

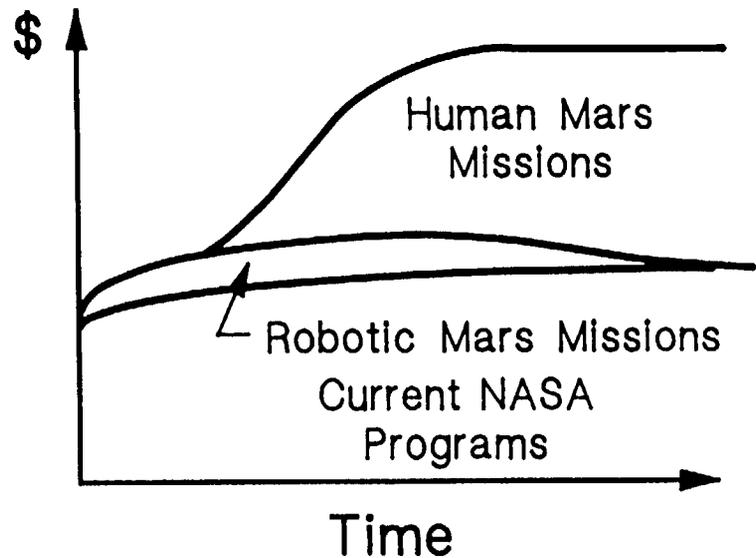


DO NOT RELEASE

Lunar Outpost, then to Mars



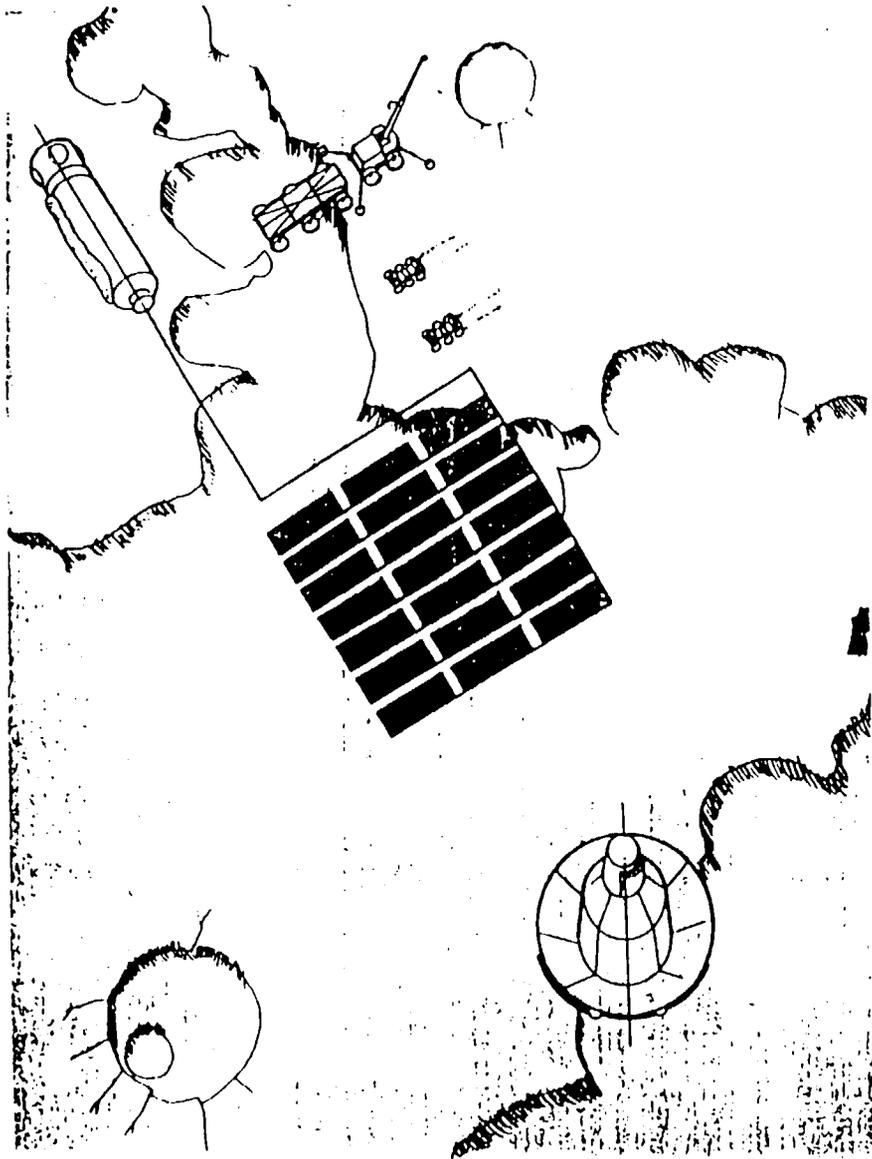
Direct to Mars



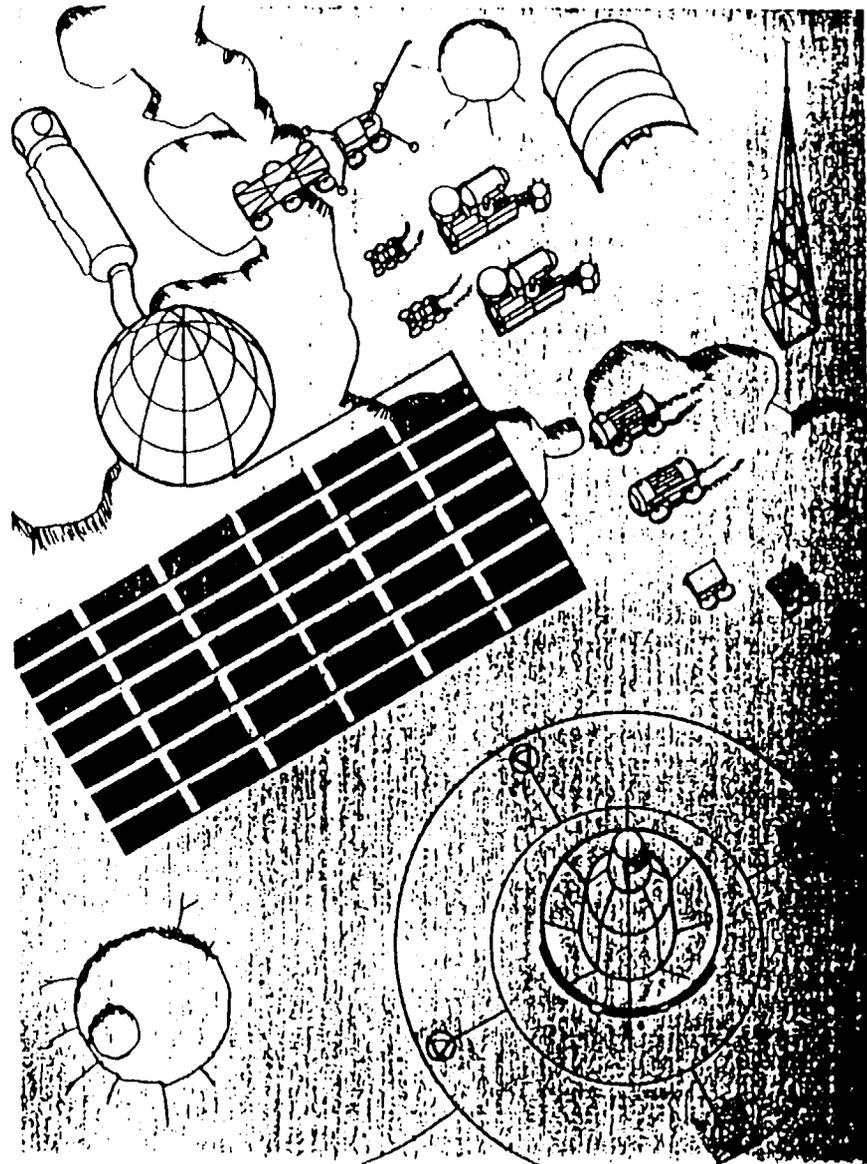
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- National investment in space transportation and Space Station *Freedom* provides pathway
- Robotic Mars missions pave way for humans
- Human expeditions to Mars in 2007 leading to permanent Mars outpost early in 21st century

Mars Outpost

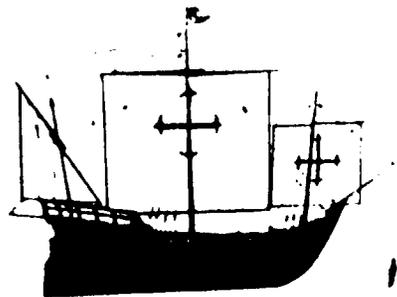


2008
4 Crew/30 days



2017
8 Crew/18 months

Ships of Exploration



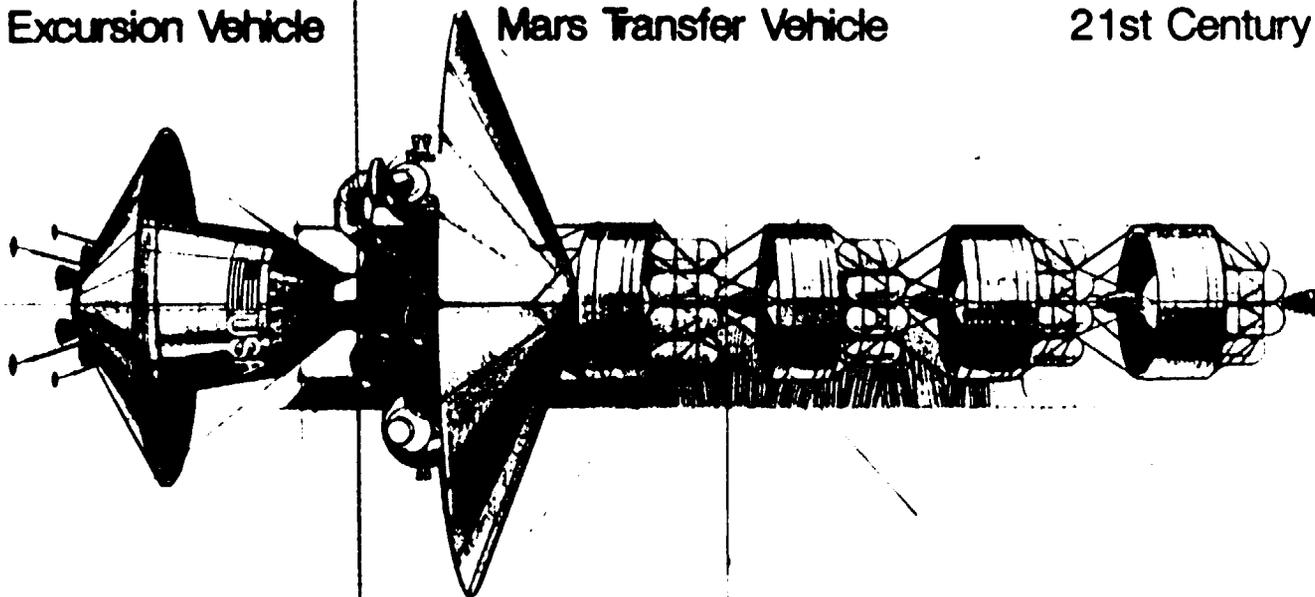
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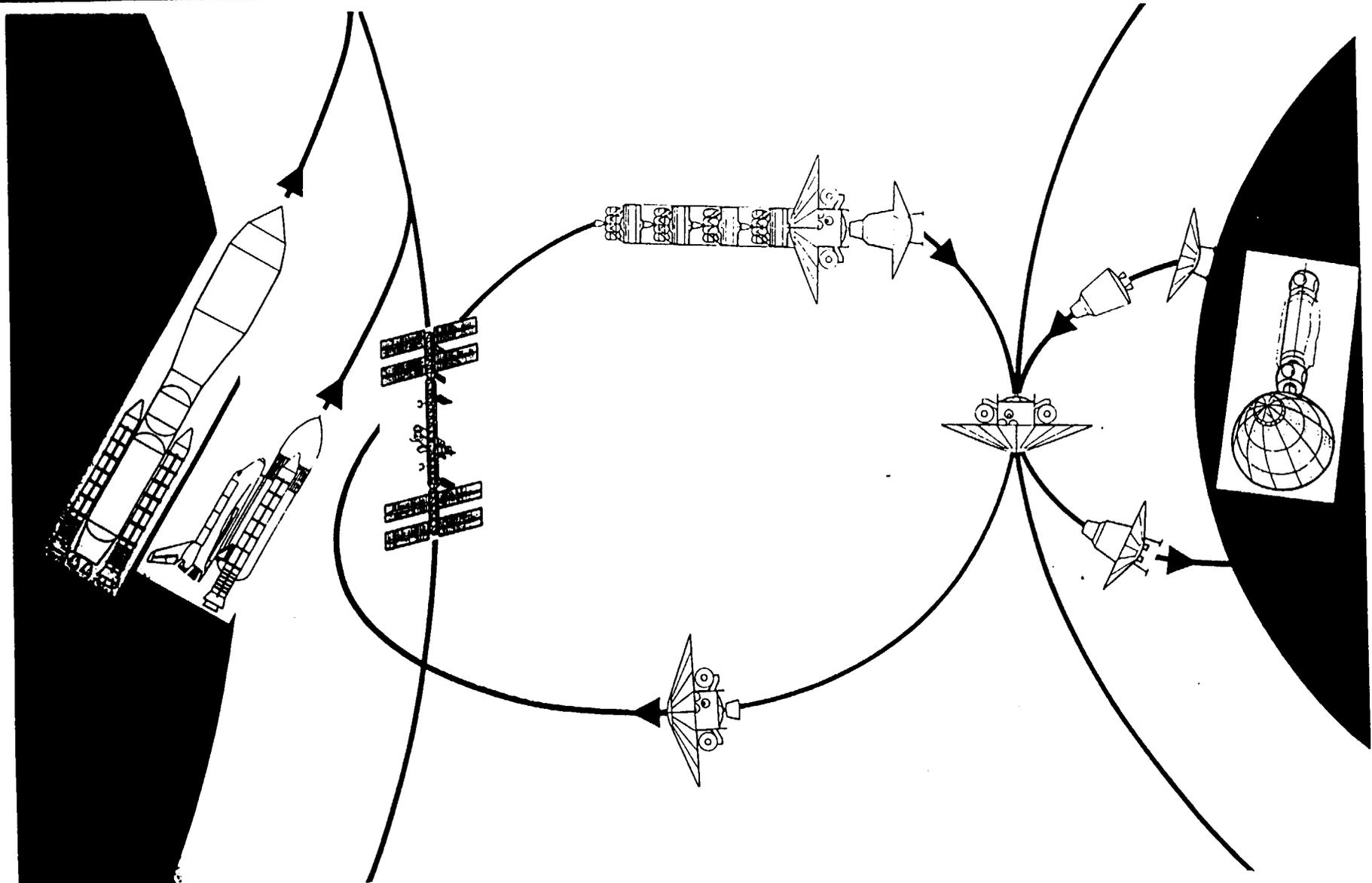
Mars Excursion Vehicle

Mars Transfer Vehicle

21st Century



Mars Transportation Sequence



**Kennedy
Space
Center**

**Mars
Outpost**

Why go to Mars?

Exploration appeals to the American spirit

- Mars has intrigued humans for centuries
- Mars is scientifically exciting

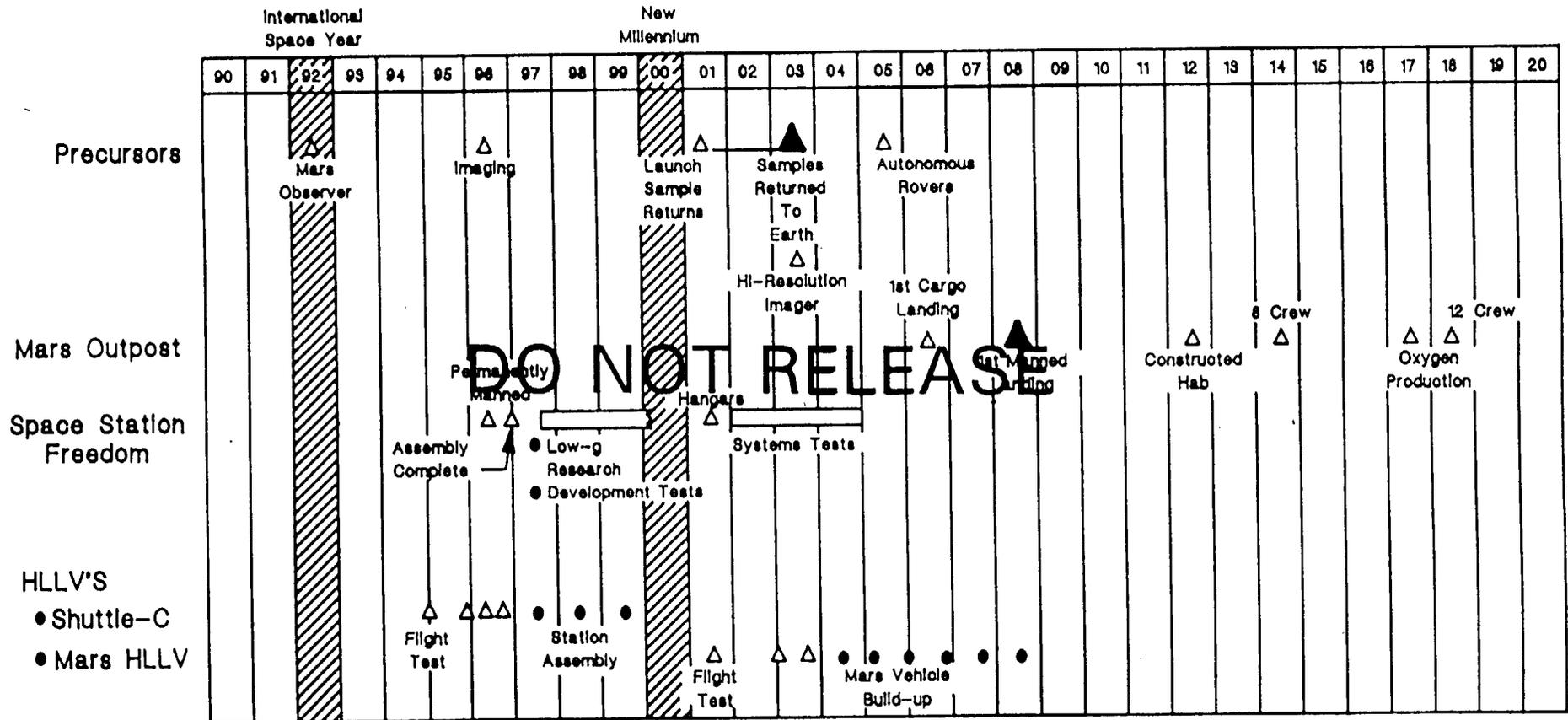
Human habitation is feasible

- Mars is the most Earth-like planet
- Resources to support human life exist

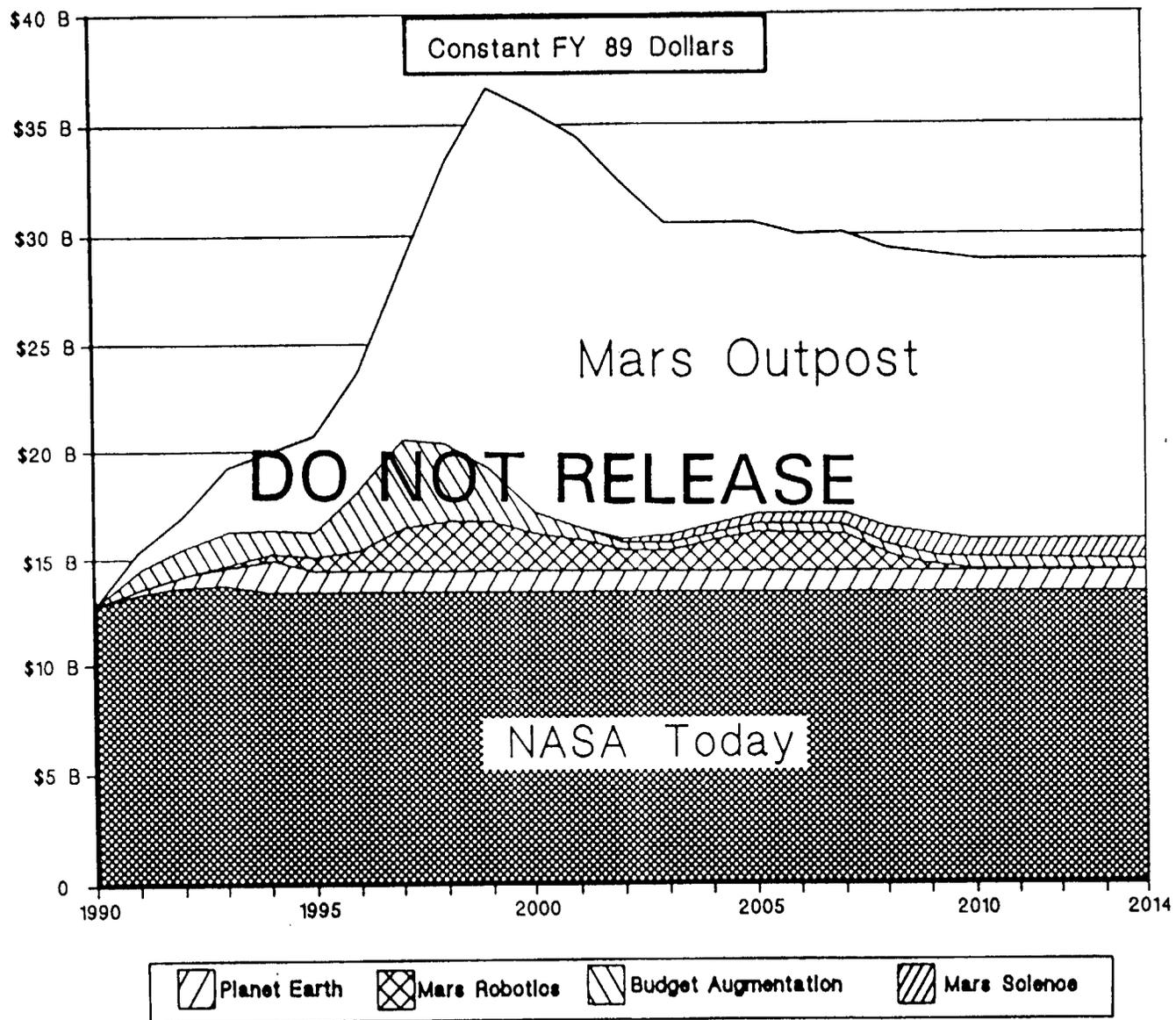
Cements long-term U.S. leadership in space

- We can do it early in the next century
- Challenging focus for space program

Direct to Mars

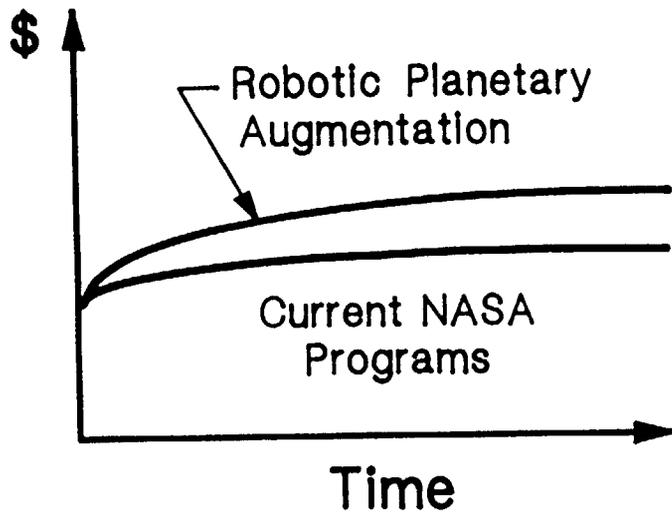


Direct to Mars



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Robots Only

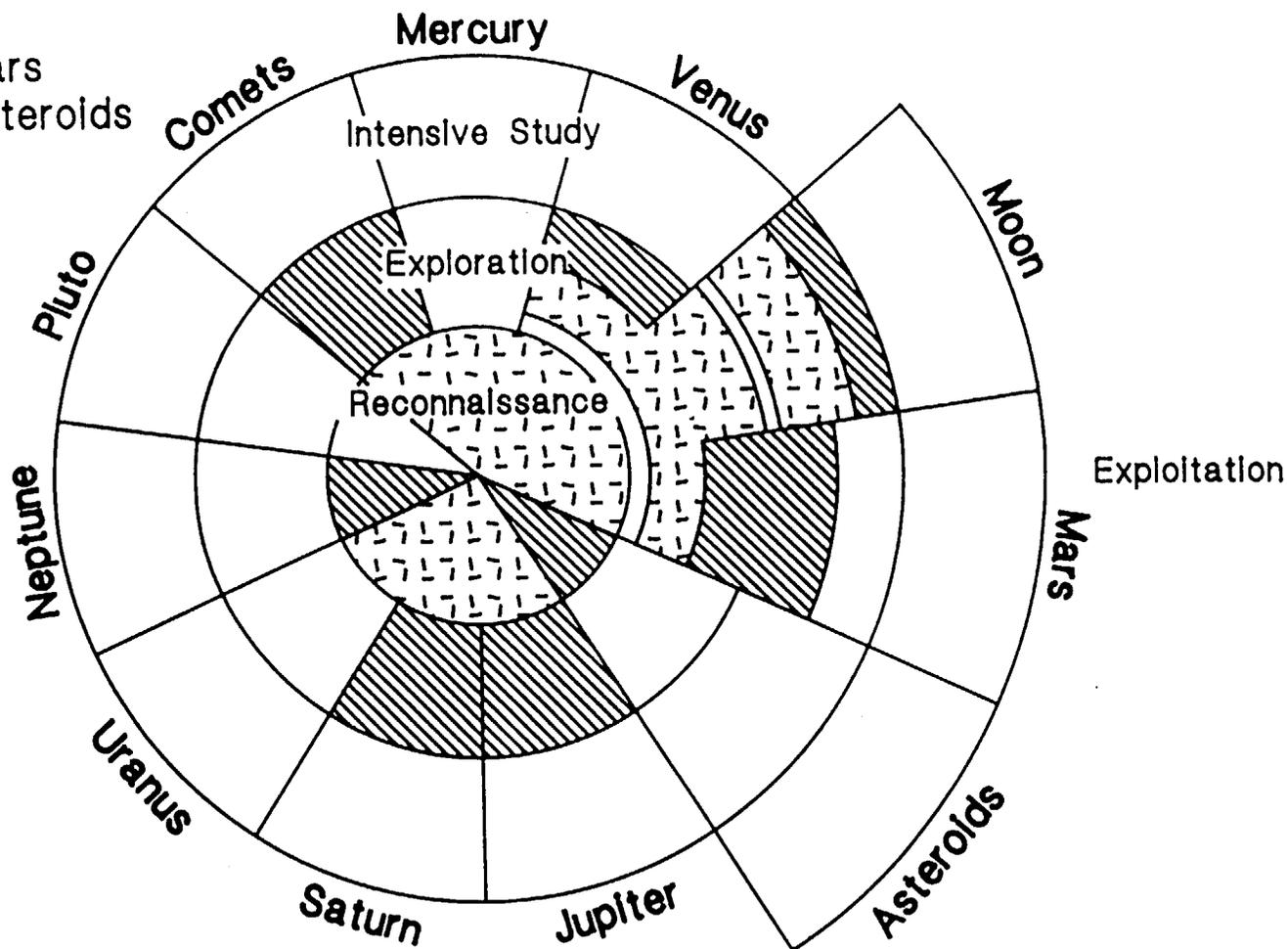


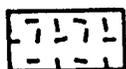
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- ❑ **Good basic science**
- ❑ **Includes a Mars focus**
- ❑ **Takes U.S. out of human space exploration**

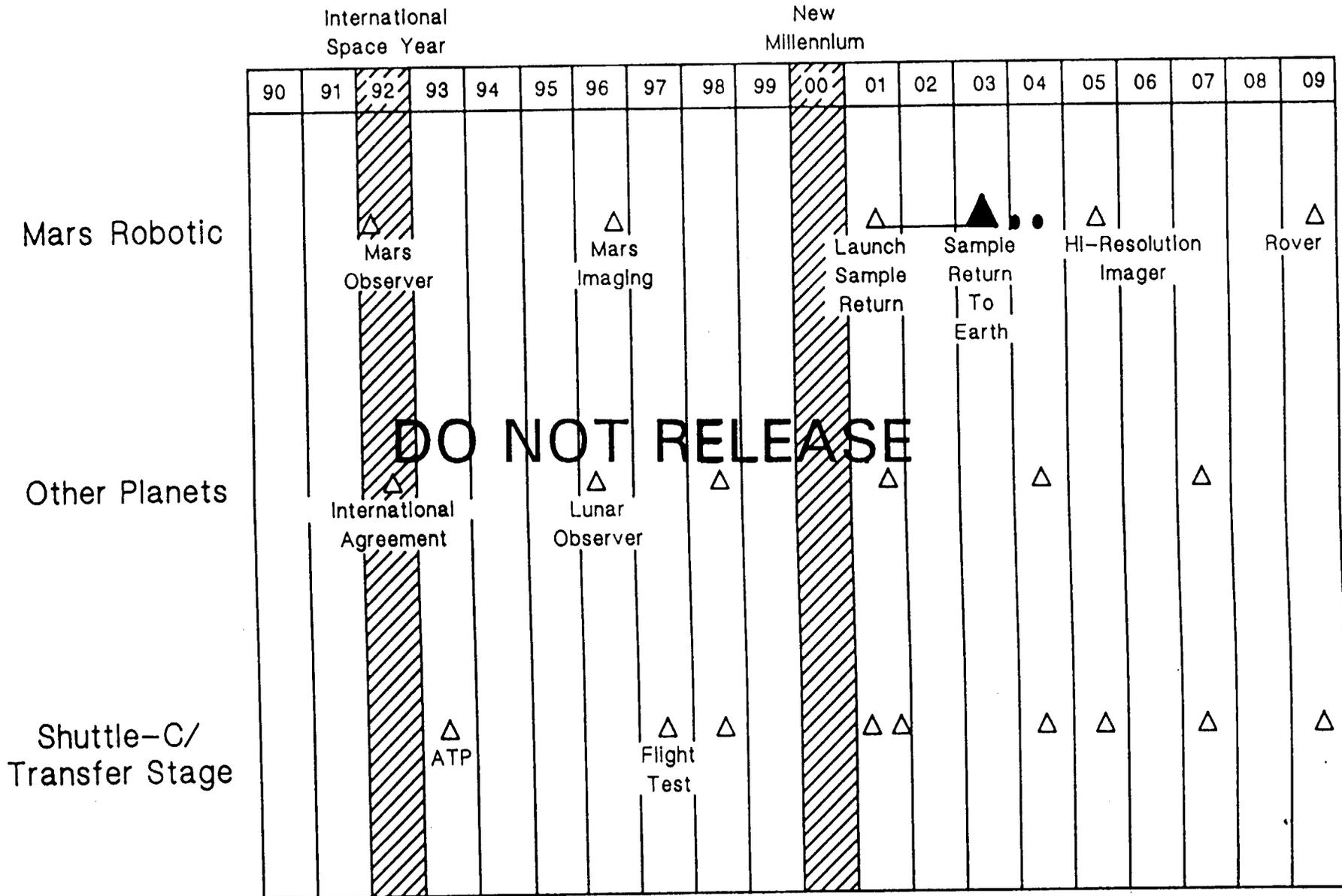
Robots Only

Galileo - Jupiter
 Magellan - Venus
 Mars Observer - Mars
 CRAF - Comets/Asteroids
 LGO - Moon
 Cassini - Saturn



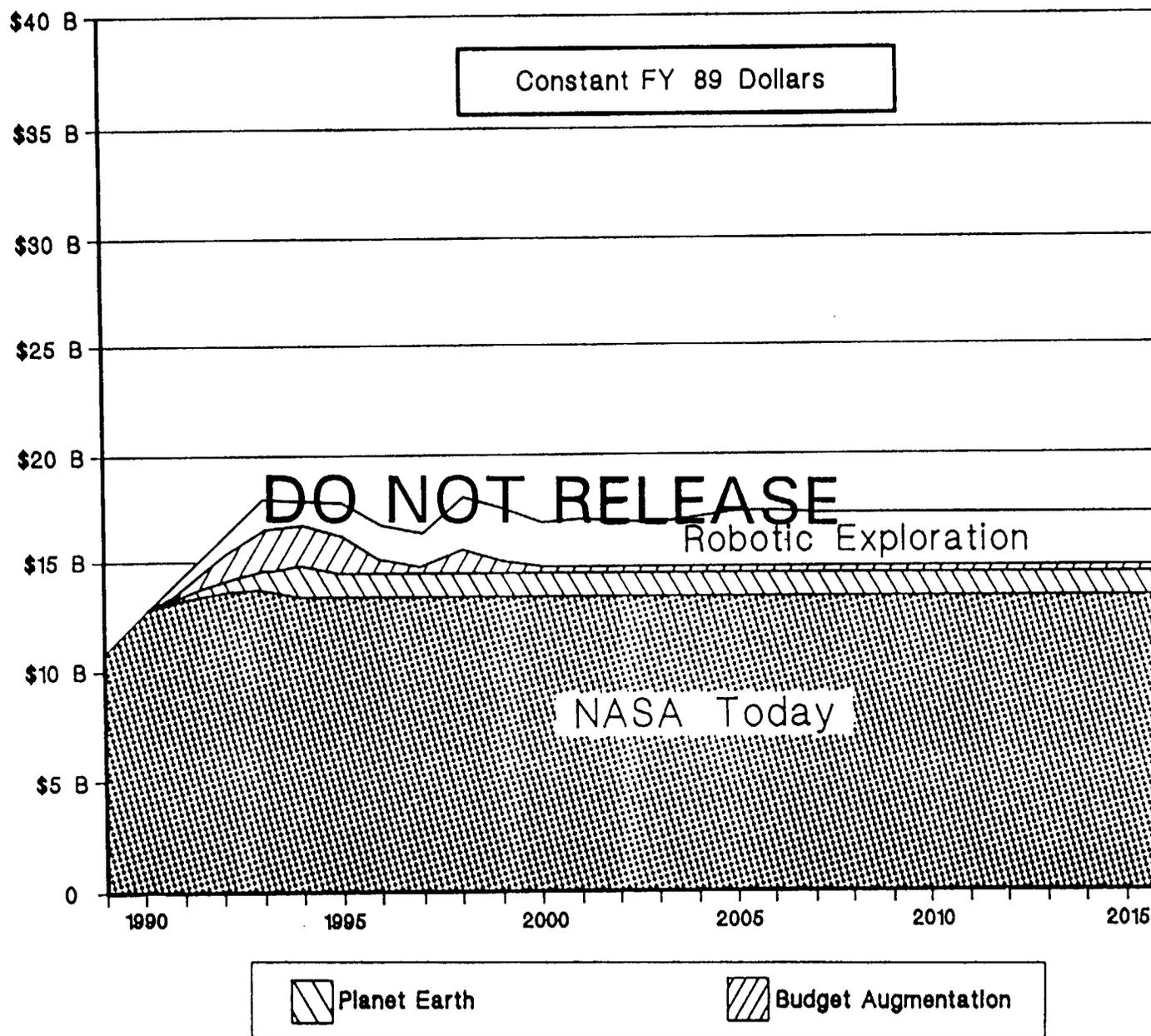
 Past Missions
 Planned

Robots Only



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Robots Only



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Rationale for Lunar Outpost, then to Mars

□ Lunar Outpost

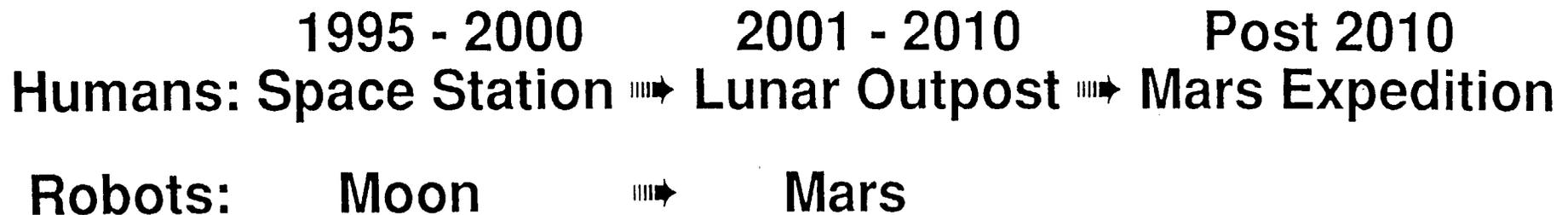
Significant achievement by very early 21st century

Nearby — a 3-day trip

Human experience in partial gravity leads to Mars

Learn to build, live and work close to home

□ Building block approach to progressively more difficult human missions



Greatly reduced program risk

Impact of Decision

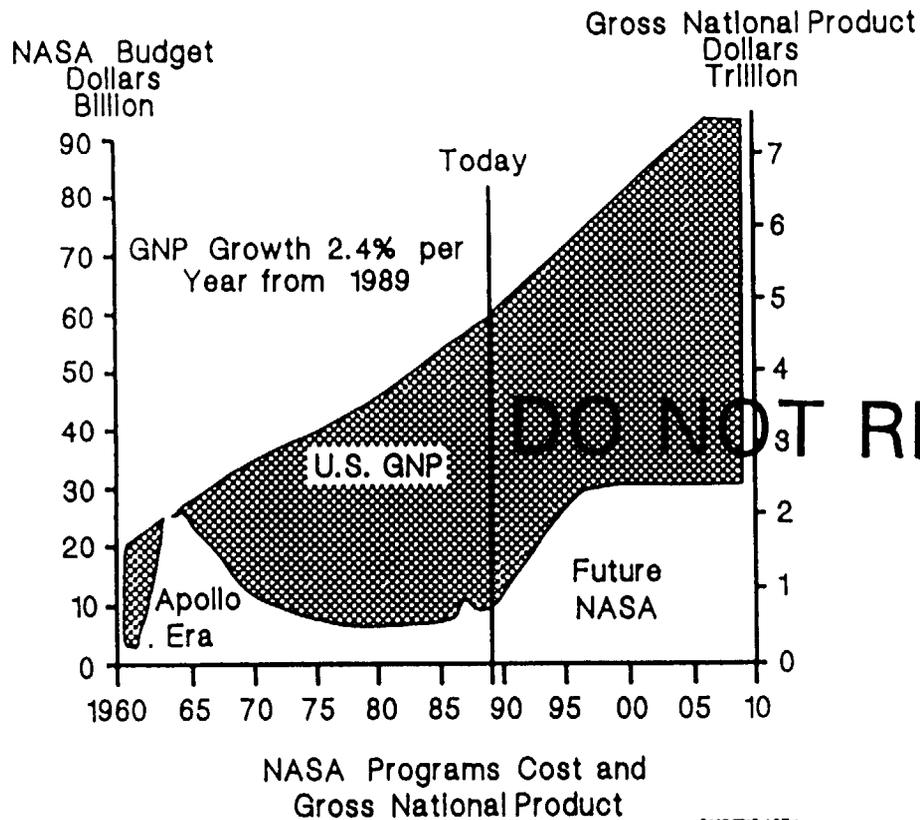
- ❑ **A major long-term commitment requires near-term action**
 - **President's FY90 Budget (\$13.3 B)**
 - **Authority for additional personnel and facilities consistent with build up of program**
 - **Streamlined procurement system**

- ❑ **A major institutional challenge for NASA**
 - **Will require restructure of agency**

- ❑ **Clear Presidential direction to civil space program**

- ❑ **Long-range goal gives direction and focus to Space Station *Freedom* and heavy-lift launch vehicles**

U.S. Investment in Future



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1991 — 2001	
Exploration	\$96 B
NASA Total	\$240 B
U.S. Budget	\$11,000 B
U.S. GNP	\$55,000 B
Exploration	.2% U.S. GNP
	.9% U.S. Budget
NASA Total	.4% U.S. GNP
	2.2% U.S. Budget

Constant FY89 Dollars

National Technology Stimulus

Getting to space

- Advanced materials
- Low temperature technology
- Improved rocket engines (reliability, maintainability)

Living in space

- Remote health care and life support
- Electronics, communications and computers
- Advanced electrical power
- Surface transportation

Working in space

- Construction and assembly techniques
- Mining and resource use
- Manufacturing
- Artificial intelligence
- Robotics and automation

Economic Impact of Investment

- Increase rate of technological change
- Increase productivity, real output
- Enhance competitiveness
- Create jobs
- 7:1 to 9:1 return on investment over 10-20 year period*

*1971 Midwest Research Institute

*1975 Chase Econometrics Associates

*1988 Midwest Research Institute

Enhances U.S. economy and competitive position in world marketplace

Snapshot of NASA 1990 — \$13.27 B

Research and Development — \$5.75 B

- Space Station *Freedom*
- Space science
- Earth applications
- Aeronautics
- Space technology
- New space transportation
- Commercial opportunities
- Universities
- Safety, reliability, and quality

Flight Operations — \$5.14 B

- Shuttle production and operations
- Expendable launch vehicles
- Space and ground networks

People and Facilities — \$2.38 B

- 23,846 civil servants
- 10 major installations

Full budget request badly needed for all options

Exploration Options

In the final analysis the nation has three options for human exploration

- Send robots only**
- Develop a lunar base, then go to Mars**
- By-pass the Moon and go directly to Mars**

Civil Space Program Direction

Background

**"The space program should always go 'Full Throttle Up.'
That 's not just our ambition, it's our destiny."**

**— President Bush
State of the Union Address
February 9, 1989**

**On April 20, President Bush and Vice President Quayle gave
the National Space Council its charter:**

- Renew U.S. emphasis on space
- Ensure U.S. leadership in space
- Establish policy coherence and continuity
- Refine and implement long – range goals

Civil Space Policy

Long – term goal: "...to expand human presence and activity beyond Earth orbit into the solar system."

**— National Space Policy
February 11, 1988**

Human Exploration

Some observations:

- Cost/benefit analysis never provides a complete rationale
- Always a result of top – down leadership and national will
- Expensive, long – term undertaking
- Focuses and enhances technology development and mission applications in all sectors

Policy Options

On May 31, 1989, the Vice President asked that options be prepared and recommendations made for Presidential decision:

- To take advantage of unique opportunity of July 20**
- To achieve significant milestones in 2000**

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release

July 20, 1989

REMARKS BY THE PRESIDENT
AT 20TH ANNIVERSARY OF
APOLLO MOON LANDINGThe Steps of the Air and Space Museum
Washington, DC

10:30 A.M. EDT

THE PRESIDENT: Thank you all very, very much. And thank you, Mr. Vice President, for your introduction and for undertaking to head the National Space Council and for -- already for demonstrating your skill for leadership there.

And thanks to all of you, who have braved the weather to join us today. Behind me stands one of the most visited places on Earth -- a symbol of American courage and ingenuity. And before me stand those on whose shoulders this legacy was built -- the men and women of the United States astronaut corps.

And we are very proud to be part of this unprecedented gathering of America's space veterans -- and to share this stage with three of the greatest heroes of this or any other century -- the crew of Apollo 11.

It's hard to believe that 20 years have passed. Neil and Buzz, who originated the moonwalk 15 years before Michael Jackson even thought of it. (Laughter)

And Michael Collins -- former director of this amazing museum -- and the brave pilot who flew alone on the dark side of the Moon, while Neil and Buzz touched down. Mike, you must be the only American over age 10 that night who didn't get to see the Moon landing. (Laughter)

And later this evening, after the crowd disperses and the sun goes down, a nearly full Moon will rise out of the darkness and shine down on an America that is prosperous and at peace. And for those old enough to remember that historic night 20 years ago -- step outside tonight with your children or your grandchildren. Lift your eyes skyward, and tell them of the flag - the American flag -- that still flies proudly in the ancient lunar soil.

And for those who were not yet born, or then too young to recall -- you who are the children of the new century -- raise your eyes to the heavens and join us in a great dream -- an American dream -- a dream without end.

Project Apollo. The first men on the Moon. Some called it quixotic, impossible -- had never been done. But America dreamed it. And America did it. And it began on July 16th, 1969. The sun rose a second time that morning as the awesome fireball of the Saturn Five lifted these three pioneers beyond the clouds. A crowd of one million -- including half of the United States Congress -- held its breath as the Earth shook beneath their feet -- and our view of the heavens was changed forevermore.

Three days and three nights they journeyed. It was a perilous, unprecedented, breathtaking voyage. And each of us remember the night.

Barbara and our daughter Dorothy were with me in our red brick house right here on the outskirts of Washington, where we moved up here to represent Houston in the United States Congress. Our 12-year-old kid, Marvin, was on a trip out West with family friends and remembers stopping at a roadside motel to watch. Second boy, Jeb, 16 that summer, teaching English and listening by radio in a small Mexican village, where electricity had yet to arrive.

The landing itself was harrowing. Alarms flashed -- and a computer overload threatened to halt the mission while Eagle dangles thousands of feet above the Moon. Armstrong seized manual control to avoid a huge crater strewn with boulders. With new alarms signalling a loss of fuel -- and the view now blocked by lunar dust -- Mission Control began the Countdown for a mandatory abort.

America -- indeed the whole world -- listened -- a lump in our throat and a prayer on our lips. And only 20 seconds of fuel remained. And then out of the static came the words: "Houston. Tranquility Base here. The Eagle has landed."

Within one lifetime, the human race had traveled from the dunes of Kitty Hawk to the dust of another world. Apollo is a monument to our nation's unparalleled ability to respond swiftly and successfully to a clearly stated challenge -- and to America's willingness to take great risks for great rewards.

We had a challenge. We set a goal. And we achieved it.

So today is not only an occasion to thank these astronauts and their colleagues -- the thousand of talented men and women across the country whose commitment, creativity, and courage brought this dream to life. It's also a time to thank the American people for their faith -- because Apollo's success was made possible by the drive and daring of an entire nation committed to a dream.

In the building behind me are the testaments to Apollo and to what came before -- the chariots of fire flown by Armstrong, Yeager, Lindberg and the Wrights. And in the National Archives -- across the great expanse of grass -- are preserved the founding documents of the idea that made it all possible -- the world's greatest experiment in freedom and diversity.

And here -- standing between these twin legacies -- is a fitting place to look forward to the future.

Because the Apollo astronauts left more than flags and footprints on the Moon. They also left some unfinished business. For even 20 years ago, we recognized that America's ultimate goal was not simply to go there and go back -- but to go there and go on.

Mike Collins said it best: "The Moon is not a destination -- it's a direction."

And space is the inescapable challenge to all the advanced nations of the Earth. And there's little question that, in the 21st century, humans will again leave their home planet for voyages of discovery and exploration. What was once improbable is now inevitable.

The time has come to look beyond brief encounters. We must commit ourselves anew to a sustained program of manned exploration of the solar system -- and yes -- the permanent settlement of space. We must commit ourselves to a future where Americans and citizens of all nations will live and work in space.

And today, yes, we are, the U.S. is the richest nation on Earth -- with the most powerful economy in the world. And our goal is nothing less than to establish the United States as the preeminent spacefaring nation.

From the voyages of Columbus -- to the Oregon Trail -- to the journey to the Moon itself -- history proves that we have never lost by pressing the limits of our frontiers.

Indeed, earlier this month, one news magazine reported that Apollo paid down-to-earth dividends -- declaring that man's conquest of the Moon "would have been a bargain at twice the price." And they called Apollo "the best return on investment since Leonardo da Vinci bought himself a sketch pad." (Laughter)

In 1961, it took a crisis -- the space race -- to speed things up. Today we don't have a crisis. We have an opportunity.

To seize this opportunity, I'm not proposing a 10-year plan like Apollo. I'm proposing a long-range, continuing commitment.

First, for the coming decade -- for the 1990's -- Space Station Freedom -- our critical next step in all our space endeavors.

And next -- for the new century -- back to the Moon. Back to the future. And this time, back to stay. (Applause)

And then -- a journey into tomorrow -- a journey to another planet -- a manned mission to Mars. (Applause)

Each mission should -- and will lay the groundwork for the next. And the pathway to the stars begins, as it did 20 years ago, with you -- the American people. And it continues just up the street there -- to the United States Congress -- where the future of the space station -- and our future as a spacefaring nation -- will be decided.

And yes, we're at a crossroads. Hard decisions must be made now as we prepare to enter the next century.

As William Jennings Bryan said -- just before the last turn of the century: "Destiny is not a matter of chance -- it is a matter of choice. It is not a thing to be waited for -- it is a thing to be achieved."

And to those who may shirk from the challenges ahead -- or who doubt our chances of success -- let me say this!

To this day, the only footprints on the Moon are American footprints. The only flag on the Moon is an American Flag. And the know-how that accomplished these feats is American know-how. What Americans dream - Americans can do.

And 10 years from now -- on the 30th anniversary of this extraordinary and astonishing flight -- the way to honor the Apollo astronauts is not by calling them back to Washington for another round of tributes. It is to have Space Station Freedom up there, operational, and underway -- a new bridge between the worlds -- (applause) -- and an investment in the growth, prosperity and technological superiority of our nation.

And the space station will also serve as a stepping to the most important planet in the solar system -- Planet Earth.

As I said in Europe just a few days ago, environmental destruction knows no borders. A major national and international initiative is needed to seek new solutions for ozone depletion, and global warming, and acid rain. And this initiative -- "Mission to Planet Earth" -- is a critical part of our space program. And it reminds us of what the astronauts remember as the most stirring sight of all. It wasn't the Moon or the stars, as I remember. It was the Earth -- tiny, fragile, precious, blue orb -- rising above the arid desert of Tranquility Base.

The space station is a first and necessary step for sustained manned exploration -- one that we're pleased has been endorsed by Senator Glenn, and Neil Armstrong, and so many of the veteran astronauts we honor today. But it's only a first step.

And today I'm asking my right hand man, our able Vice President, Dan Quayle, to lead the National Space Council in determining specifically what's needed for the next round of exploration -- the necessary money, manpower, and material -- the feasibility of international cooperation -- and develop realistic timetables, milestones along the way. The Space Council will report back to me as soon as possible with concrete recommendations to chart a new and continuing course to the Moon and Mars and beyond.

There are many reasons to explore the universe, but 10 very special reasons why America must never stop seeking distant frontiers -- the 10 courageous astronauts who made the ultimate sacrifice to further the cause of space exploration. They have taken their place in the heavens, so that America can take its place in the stars.

Like them, and like Columbus, we dream of distant shores we've not yet seen.

Why the Moon? Why Mars? Because it is humanity's destiny to strive, to seek, to find. And because it is America's destiny to lead.

Six years ago, Pioneer 10 sailed beyond the orbits of Neptune and of Pluto -- the first man-made object to leave the solar system. Its destination unknown. It's now journeyed through the tenures of five Presidents -- four billion miles from Earth.

In the decades ahead, we will follow the path of Pioneer 10. We will travel to neighboring stars, to new worlds, to discover the unknown. And it will not happen in my lifetime, and probably not during the lives of my children, but a dream to be realized by future generations must begin with this generation. We cannot take the next giant leap for mankind tomorrow unless we take a single step today. (Applause)

To all of you here, our able director of NASA and others who've served so well -- to all of you here -- and especially the astronauts -- we wish you good luck in your quests, wherever that may take you. Godspeed to you, one and all. And God bless the United States of America.

Thank you all very, very much. (Applause)

NASA

Civil Space Exploration Initiative

Agenda

- Introduction
- Direction from Vice President
- Effect on America
- Lunar Outpost, then to Mars
- Direct to Mars
- Robots Only
- Rationale for Lunar Outpost, then to Mars
- Impact of Decision

May 31, 1989 — Vice President Direction

**Prepare for a Presidential decision —
July 20, 1989**

Establish NASA exploration goal

**Achieve significant and visible milestones
early in 21st century**

Maximize use of "present" NASA capability

Identify what it will take

- Money**
- People**
- Facilities**

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Long-term goal: “Expanding human presence and activity beyond Earth orbit into the solar system”

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“The space program should always go ‘Full Throttle Up.’ That’s not just our ambition, it’s our destiny.”

President Bush is seeking advice in setting the civil space exploration goal

Los Angeles Times - Sept. 30, 1988

Liftoff to Where?

Americans watched a wounded friend get up and run again Thursday, this time aware that hundreds of things can go wrong in the crucial liftoff of a space shuttle, this time mixing their cheers with a sigh of relief. This time, too, people watching the launch on

...Sally Ride has suggested
...near great space adventure
...cost money - even if
...State

STATE, Columbia, S.C. - Sept. 30, 1988

Shuttle flies, but space goals still in limbo

DISCOVERY, the extensively redesigned American shuttle, lifted into orbit Jan. 28, and Thursday's successful flight created a very serious problem

and set back this country's space program for years. Indeed, the 32-month delay between the Challenger explosion and Thursday's successful flight created a very serious problem

The Evening Bulletin - Providence, R.I. - September 30, 1988

We're flying again, but flying to where?

America is back in space. With yesterday's successful launching of the Discovery shuttle, the nation's space program is once again in orbit, and finally three years after the loss of the Challenger, flying and soaring

...the Soviet Union is ahead. We are all and engineering plans are just as for military pur

ington Banner, Bennington, VT - Oct. 4, 1988

Is NASA Stuck in Orbit?

act that the space shuttle was launched by the National Aeronautics and Space Administration. Aside from the shuttle, the space

...next president vow to send a shuttle to Mars, a long term mission that never was. But for now at least, the agency will probably have to call it for less. One implication Congress prob

Where, in space, is U.S. heading?

America began its blundering withdrawal from space leadership at the very moment of its crowning achievement. Just as the Apollo program was succeeding, the Nixon administration cut the program's budget, forcing it to cancel its last scheduled moon flight

Scientists still... station as NASA... deploy it. M... gobble up... programs... orbit, se

Is NASA Headed?

...the shuttle... and... success... The other... ce, is as

NASA is caught in another bind. The new shuttle cost \$2.4 billion to make safer and is more expensive than ever to operate. With 10 or more launches a year, each flight costs around \$300 million. Unmanned rockets, depending on size, cost \$80 million to \$200 million. Yet if the shuttle's flight rate is in

JULY 1989

Popular Science

20 YEARS AFTER APOLLO

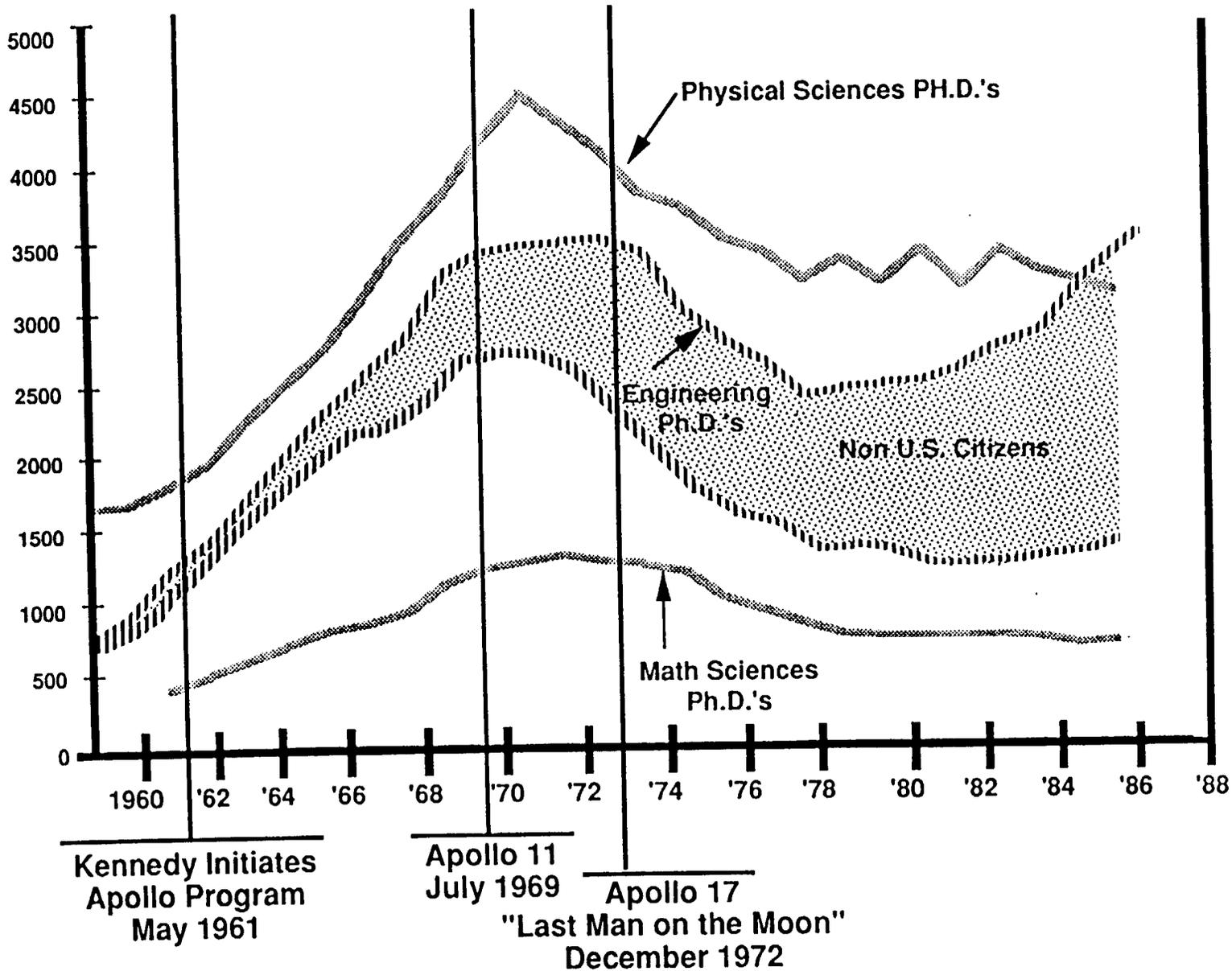
IS THE U.S. LOST IN SPACE?

Effect on America

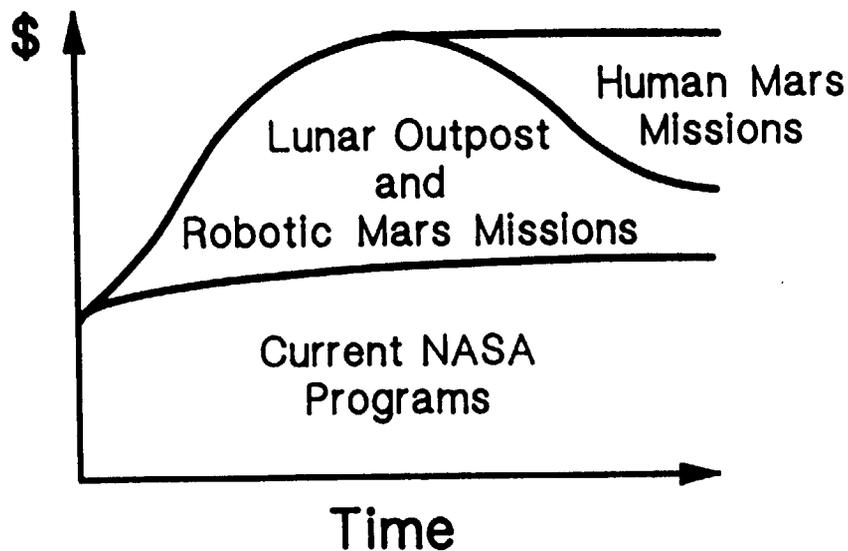
- **Education**
- **Technology Stimulus**
- **Economic Impact**

Science and Engineering Doctorates

Number of Degrees



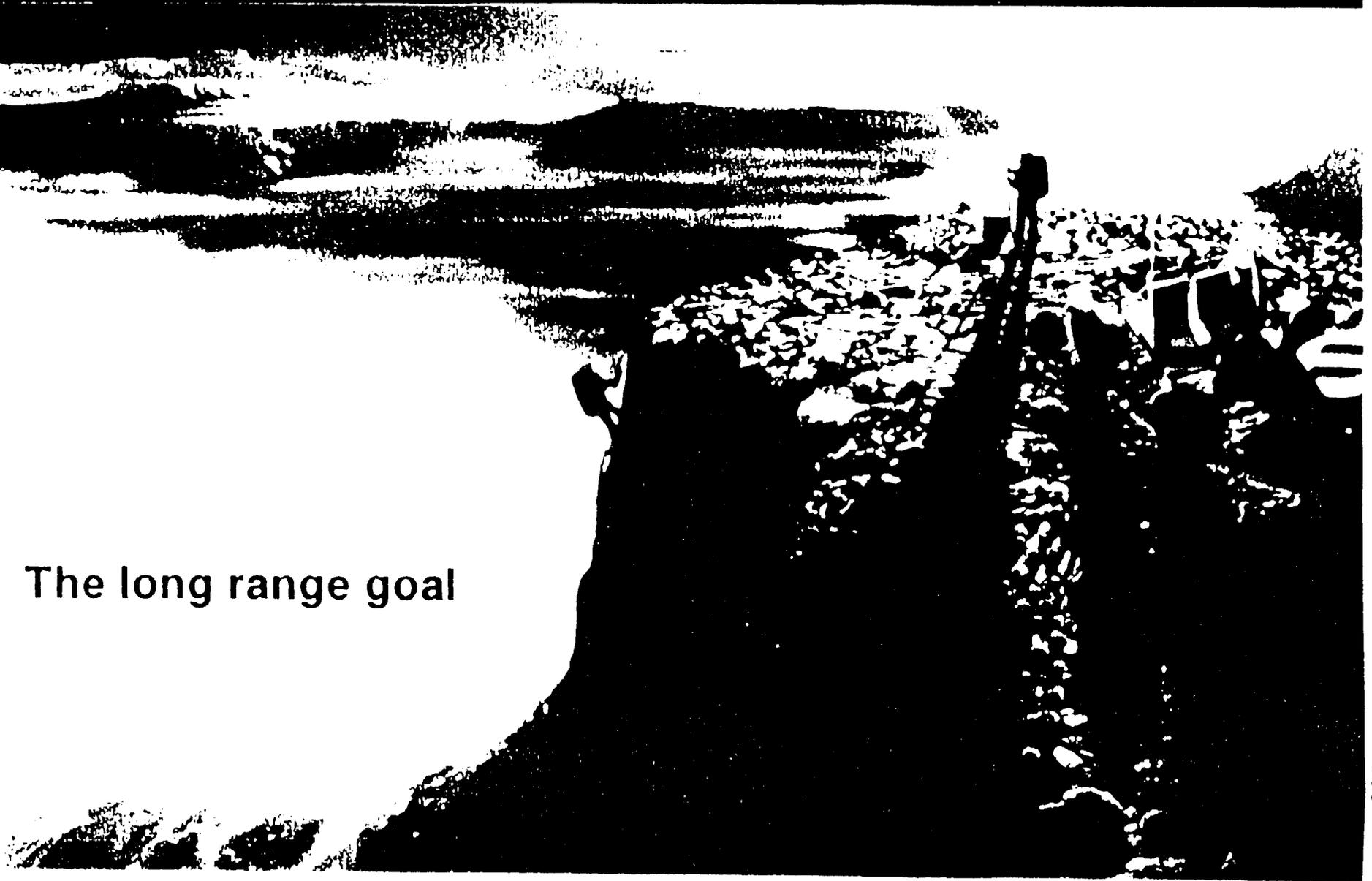
Lunar Outpost, then to Mars



C907568C.ART;1

- National investment in space transportation and Space Station *Freedom* provides pathway
- Lunar Outpost: research base test bed for humans to Mars
- Robotic Mars missions pave way for humans
- Humans to Mars when lunar development falls off

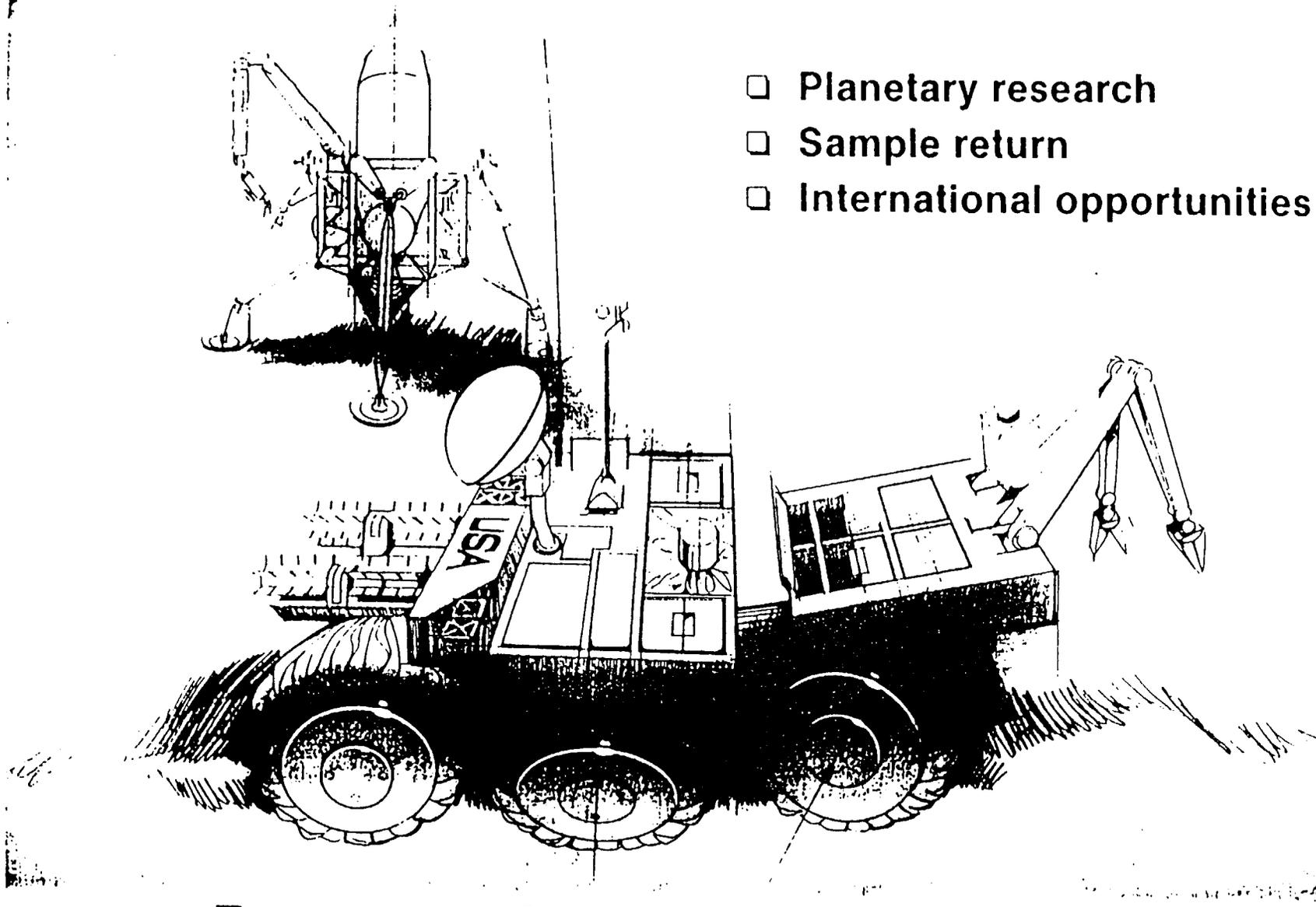
Human Exploration of Mars



The long range goal

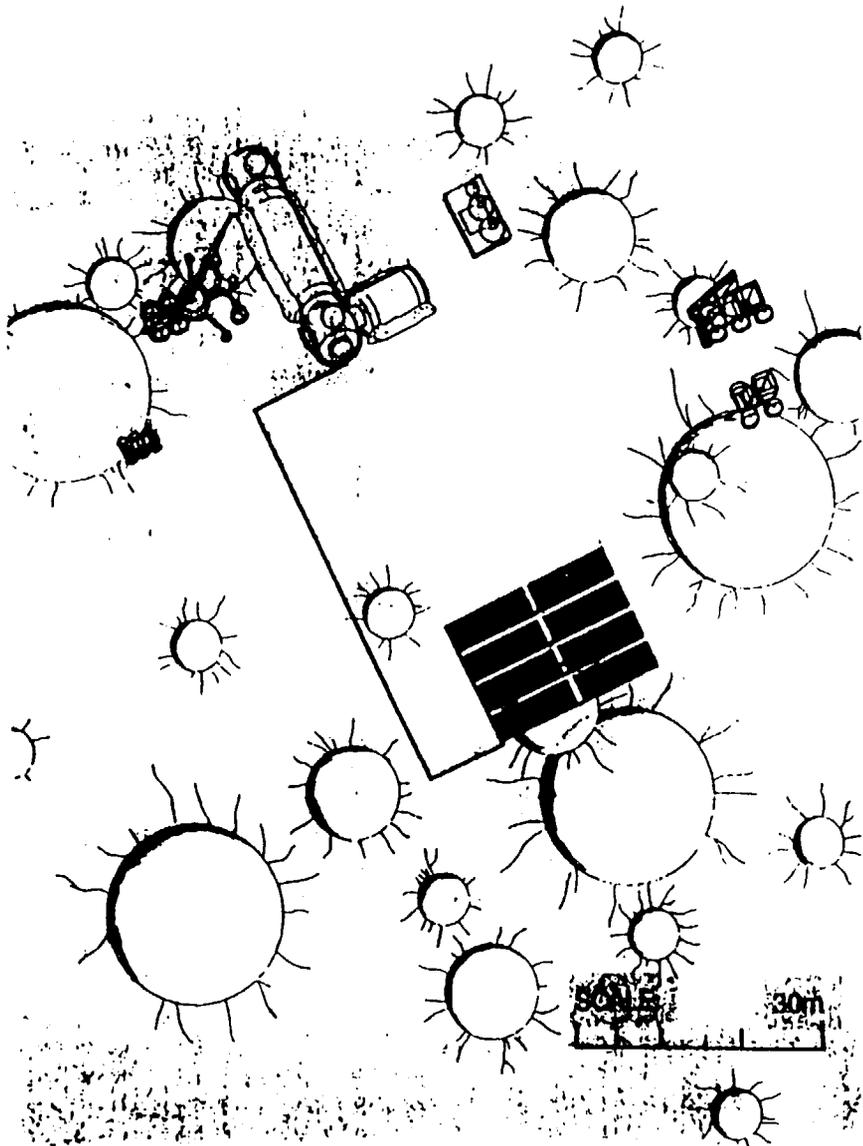
Mars Robotic Exploration

- Planetary research
- Sample return
- International opportunities

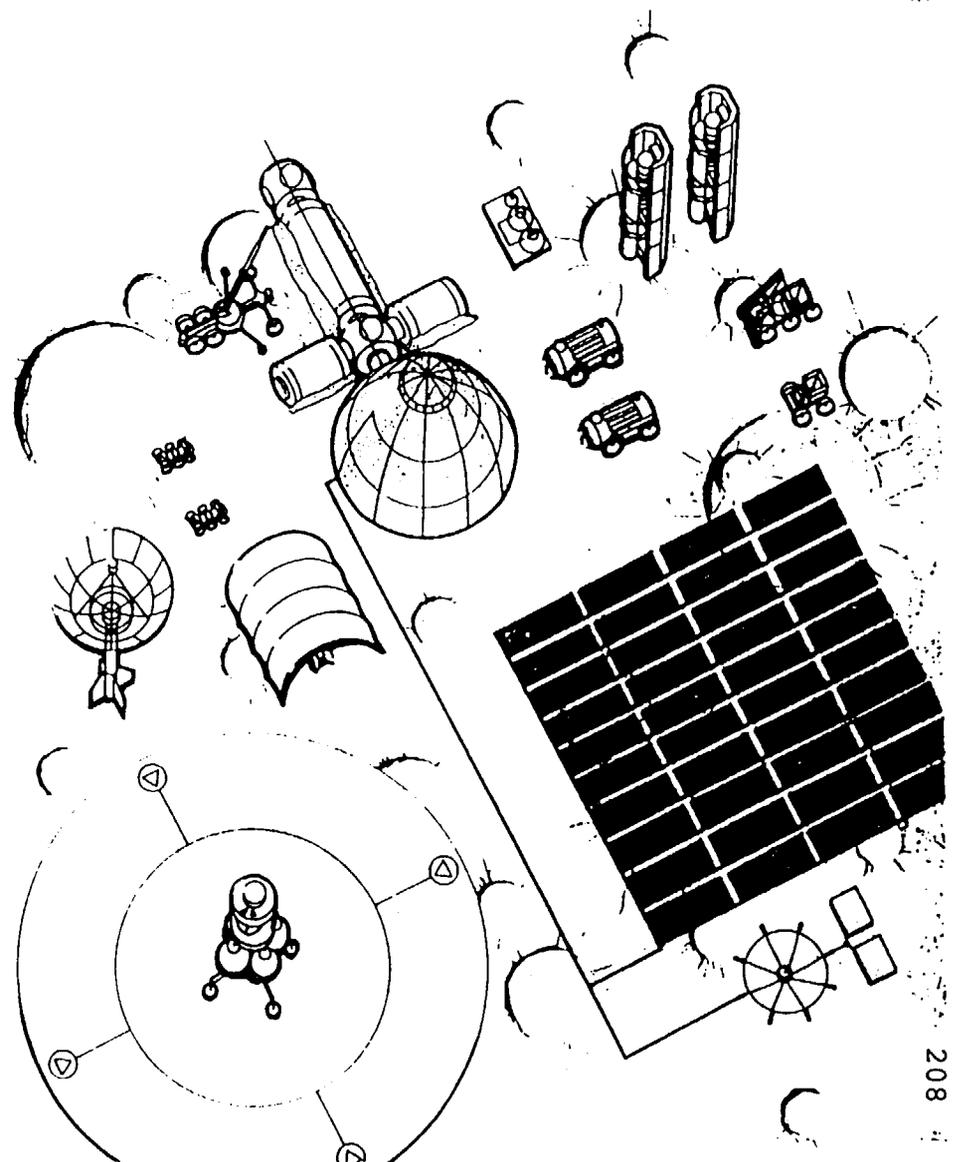


Precursor for human exploration

Lunar Outpost



2001
4 Crew/30 days

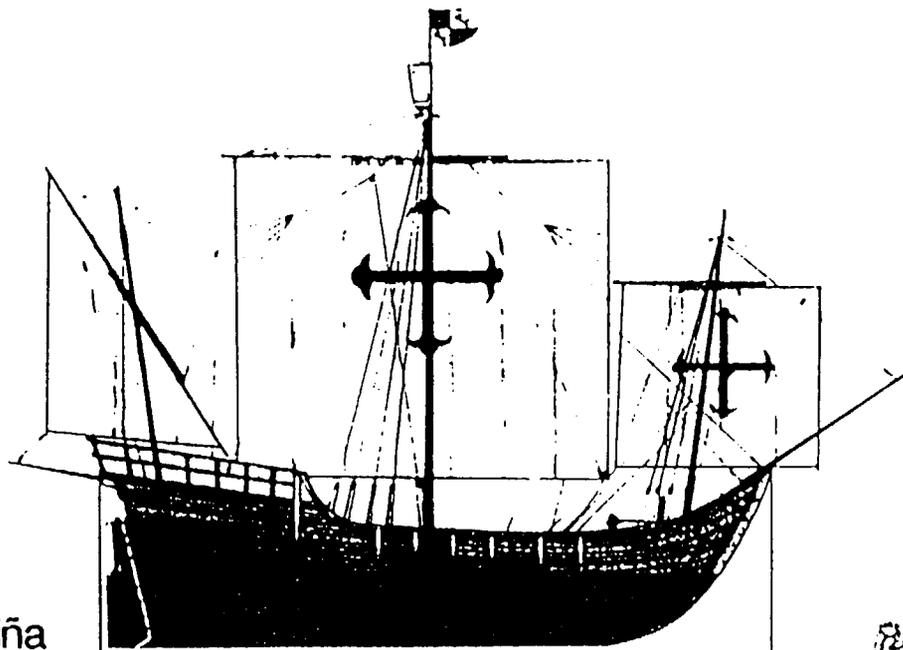


2010
12 Crew/1 year

Ships of Exploration

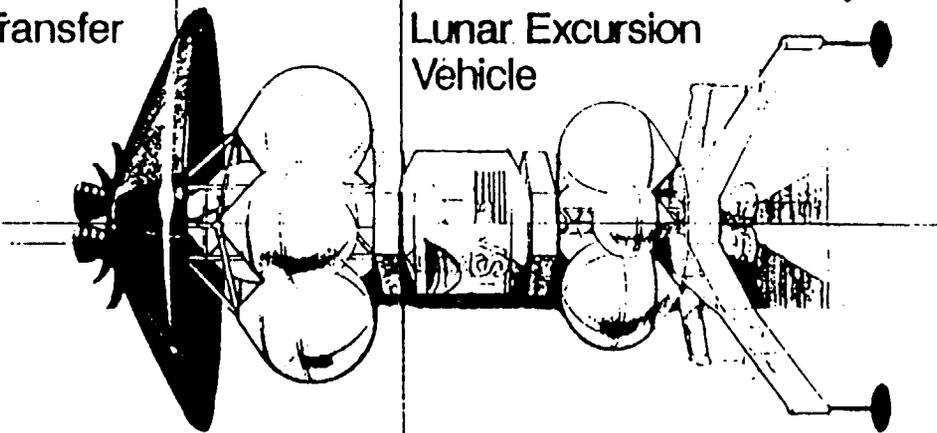
1492

Niña



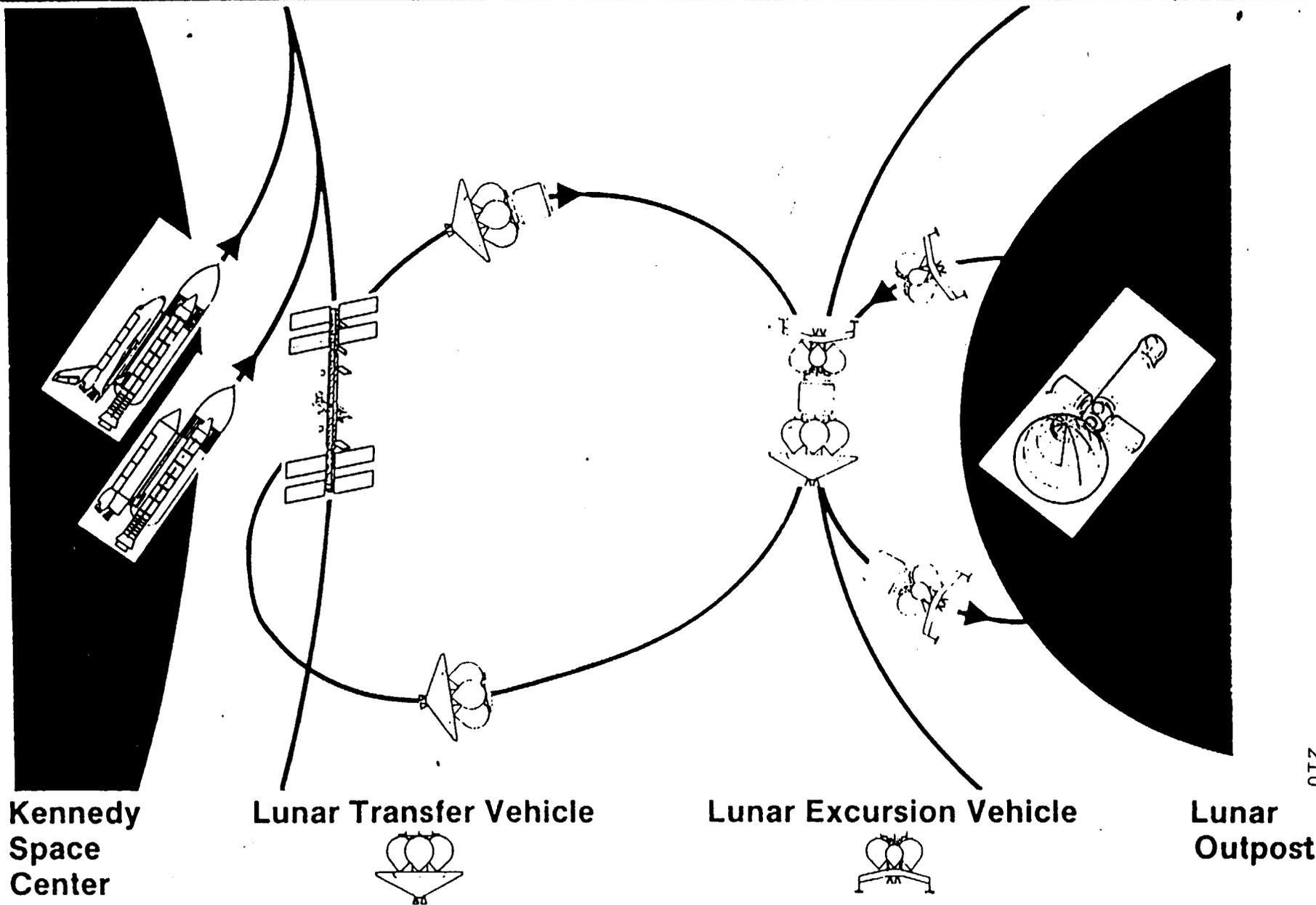
Lunar Transfer Vehicle

Lunar Excursion Vehicle



21st Century

Lunar Transportation Sequence



Why a Lunar Outpost?

U.S. leadership in human exploration

- Significant achievement by year 2001
- Major step into solar system
- Opportunities for international cooperation

Learn to live and work on other planets

- Builds on past experience
- Nearby — a 3-day trip
- Straight forward communications
- Excellent science base

Important step toward Mars

- Planetary surface experience
- Hardware and systems development
- Human experience in partial gravity
— one sixth Earth's

Science Opportunities at The Moon

Source of knowledge

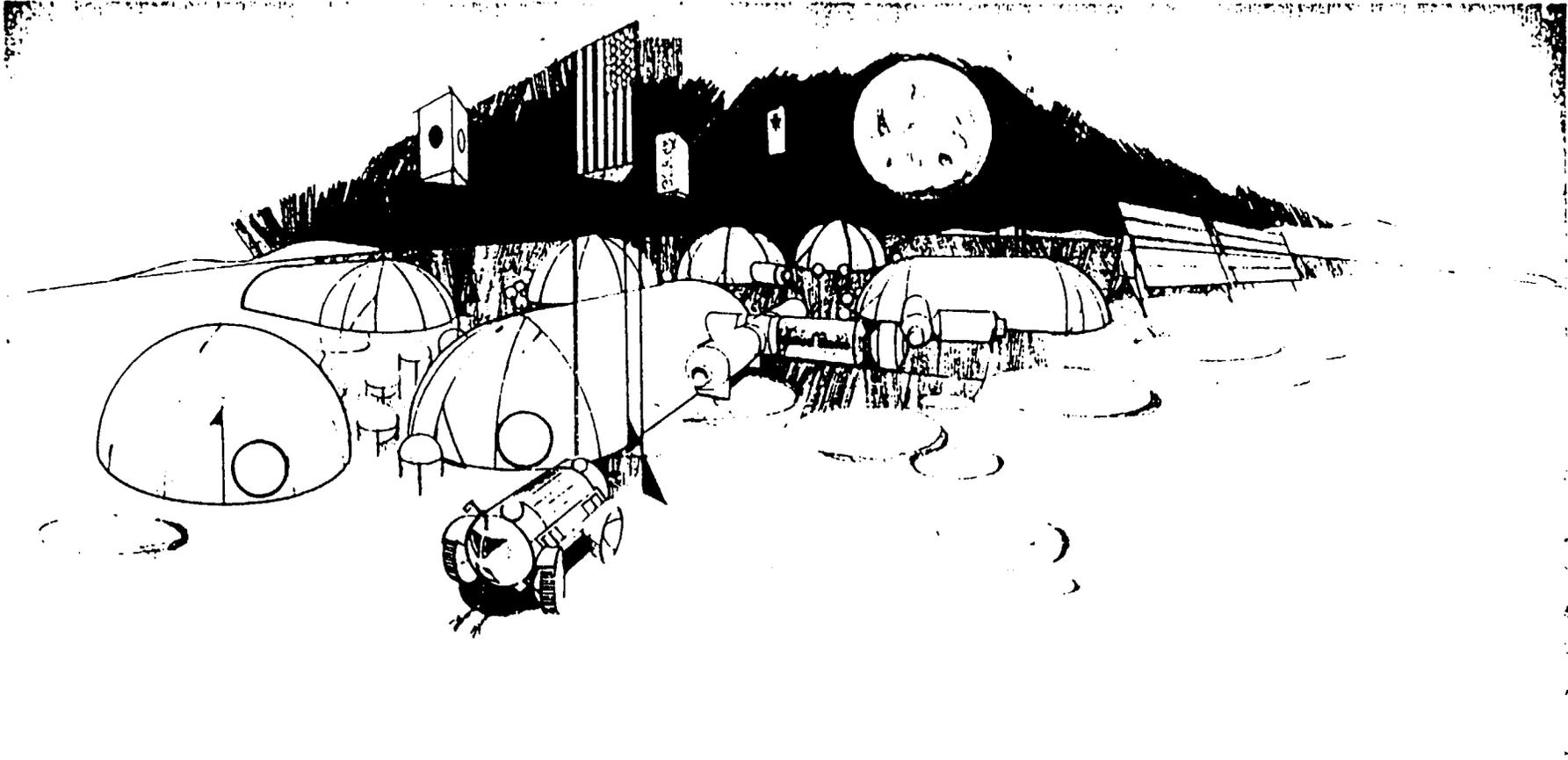
- ❑ History and relationship to Earth
- ❑ Nature of cyclic impacts - extinction events
- ❑ Four-billion-year record of solar activity

Research platform

- ❑ Earth and solar observation base
- ❑ Orders of magnitude improvement in space-based astronomy
- ❑ A one-sixth gravity life science laboratory
- ❑ Remote life support and health care

A broad range of research

Others Can Join Us On The Moon

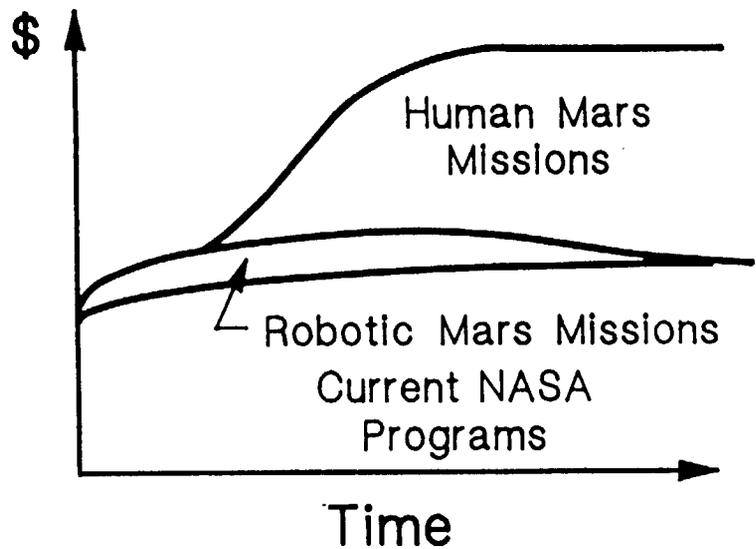


**Establish agreements in 1992
International Space Year**

Lunar Outpost, then to Mars

Lunar Outpost, then to Mars

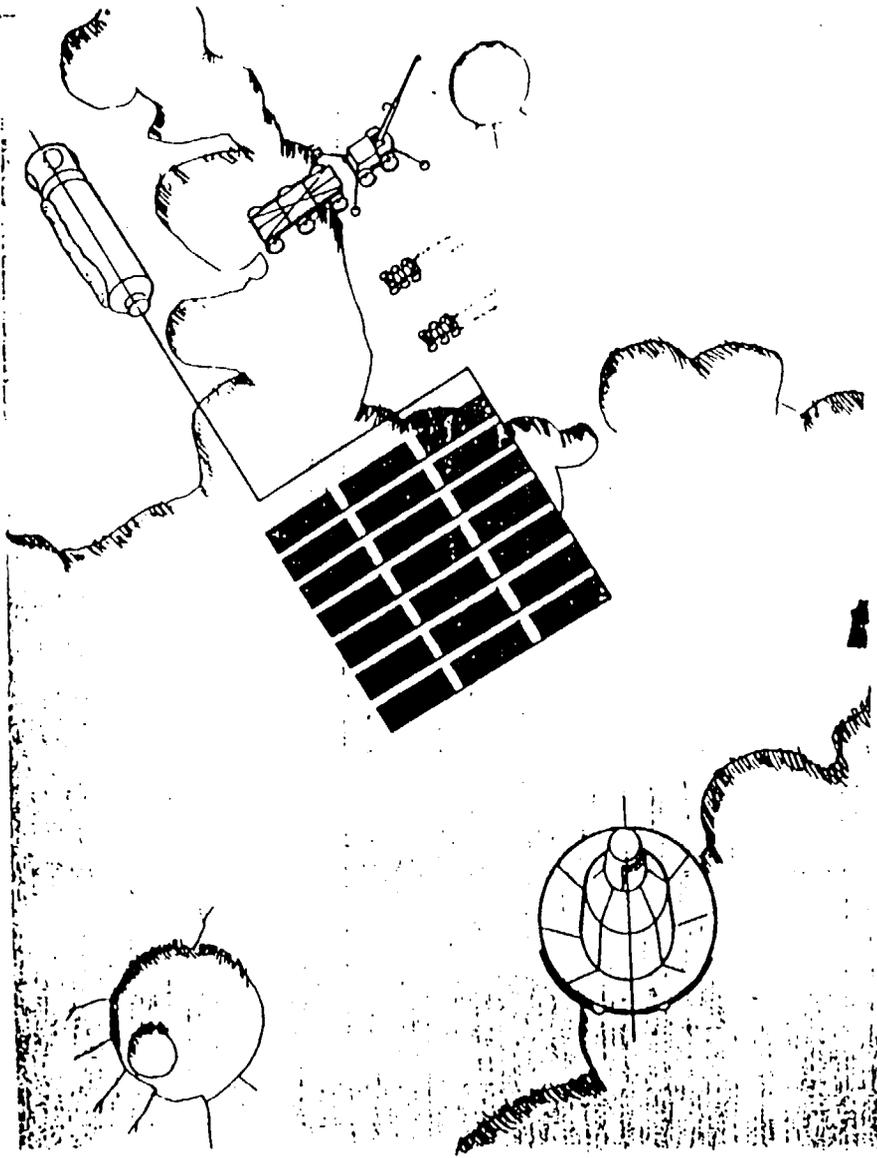
Direct to Mars



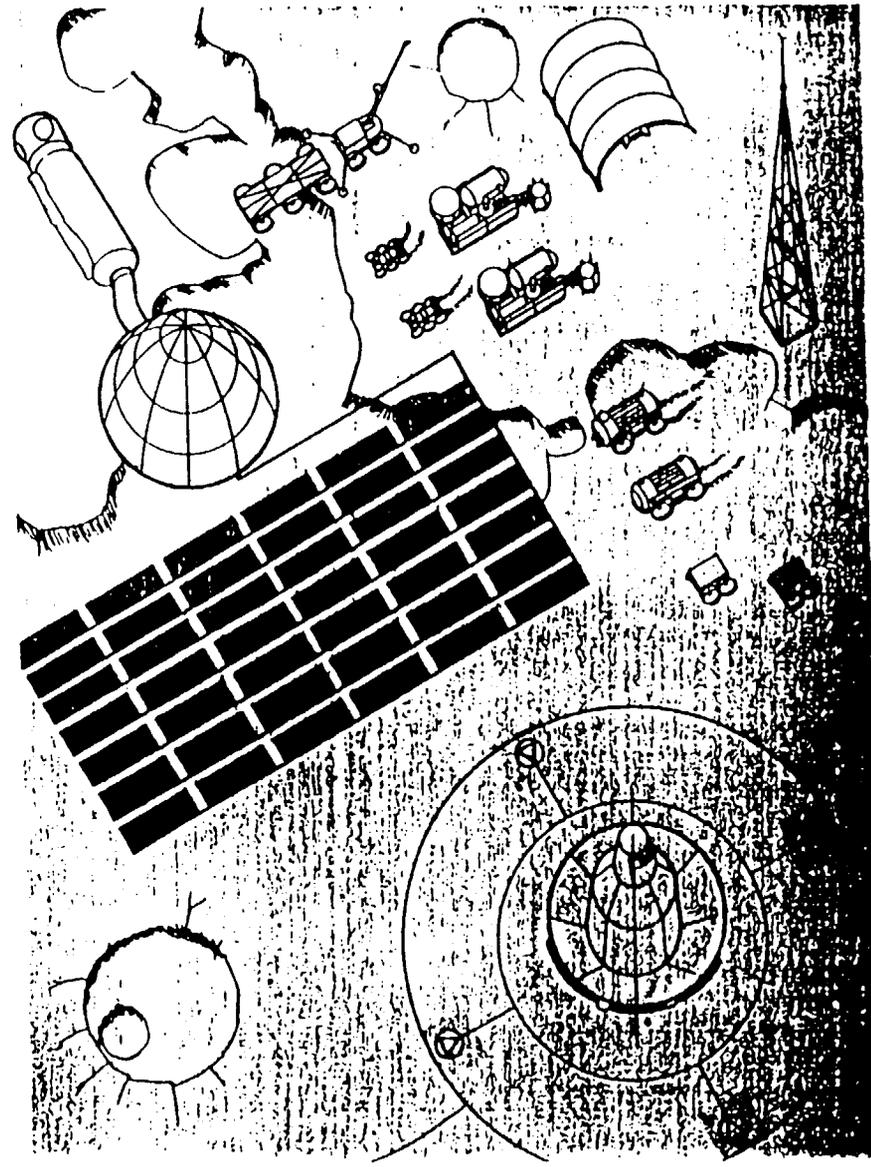
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- National investment in space transportation and Space Station *Freedom* provides pathway
- Robotic Mars missions pave way for humans
- Human expeditions to Mars in 2007 leading to permanent Mars outpost early in 21st century

Mars Outpost

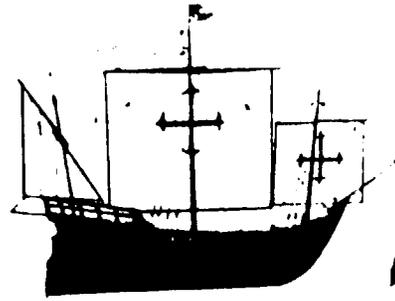


2008
4 Crew/30 days



2017
8 Crew/18 months

Ships of Exploration



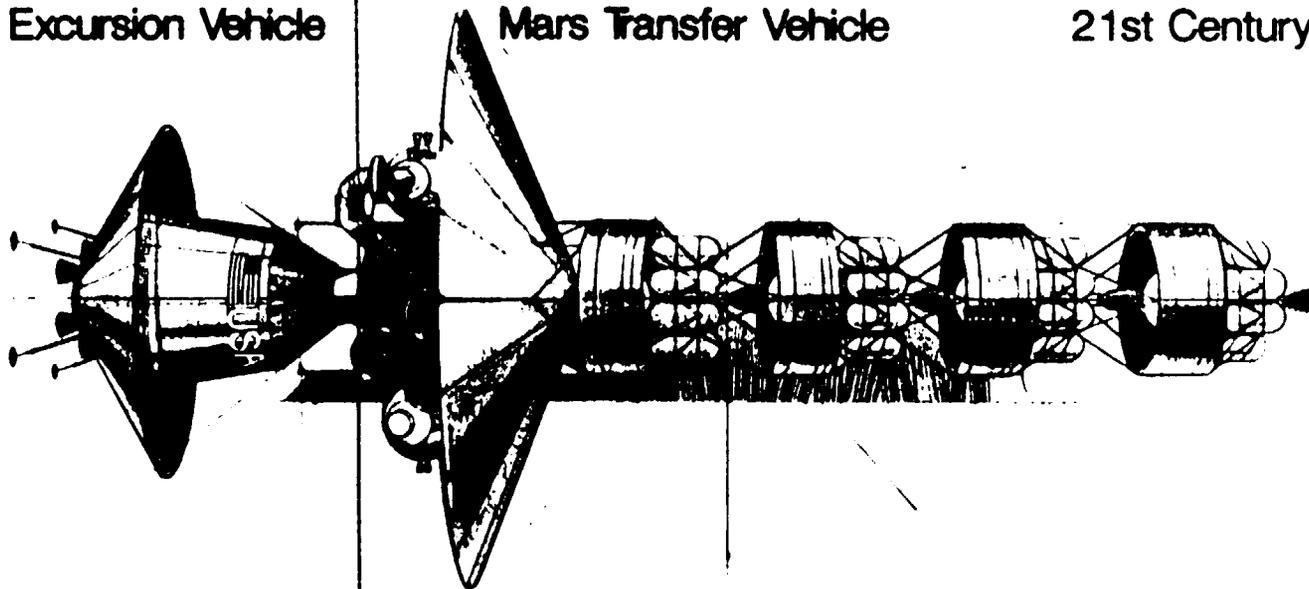
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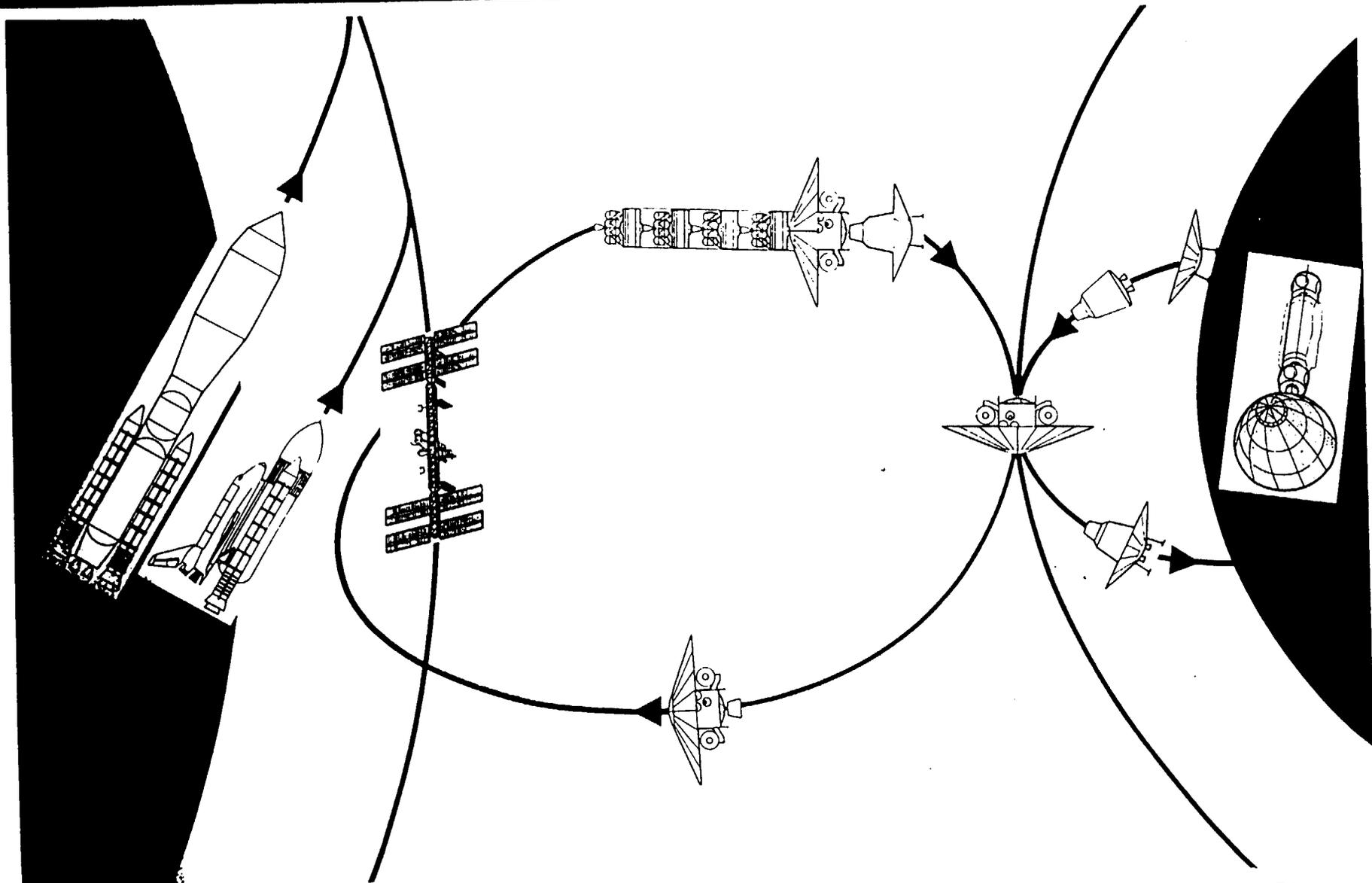
Mars Excursion Vehicle

Mars Transfer Vehicle

21st Century



Mars Transportation Sequence



**Kennedy
Space
Center**

**Mars
Outpost**

Why go to Mars?

Exploration appeals to the American spirit

- Mars has intrigued humans for centuries
- Mars is scientifically exciting

Human habitation is feasible

- Mars is the most Earth-like planet
- Resources to support human life exist

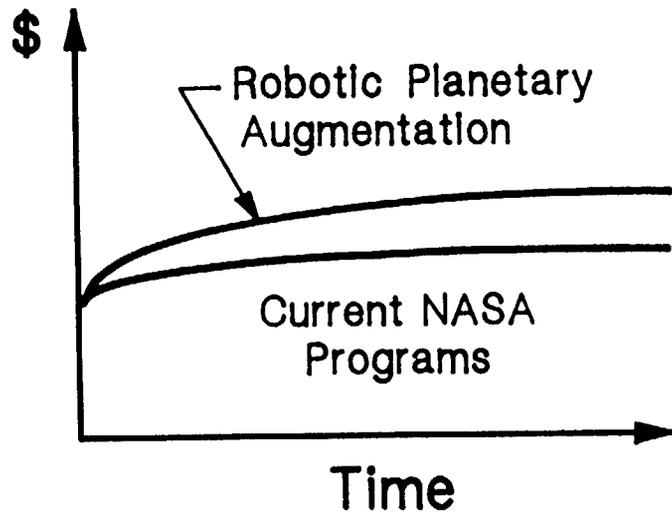
Cements long-term U.S. leadership in space

- We can do it early in the next century
- Challenging focus for space program

Direct to Mars

Direct to Mars

Robots Only

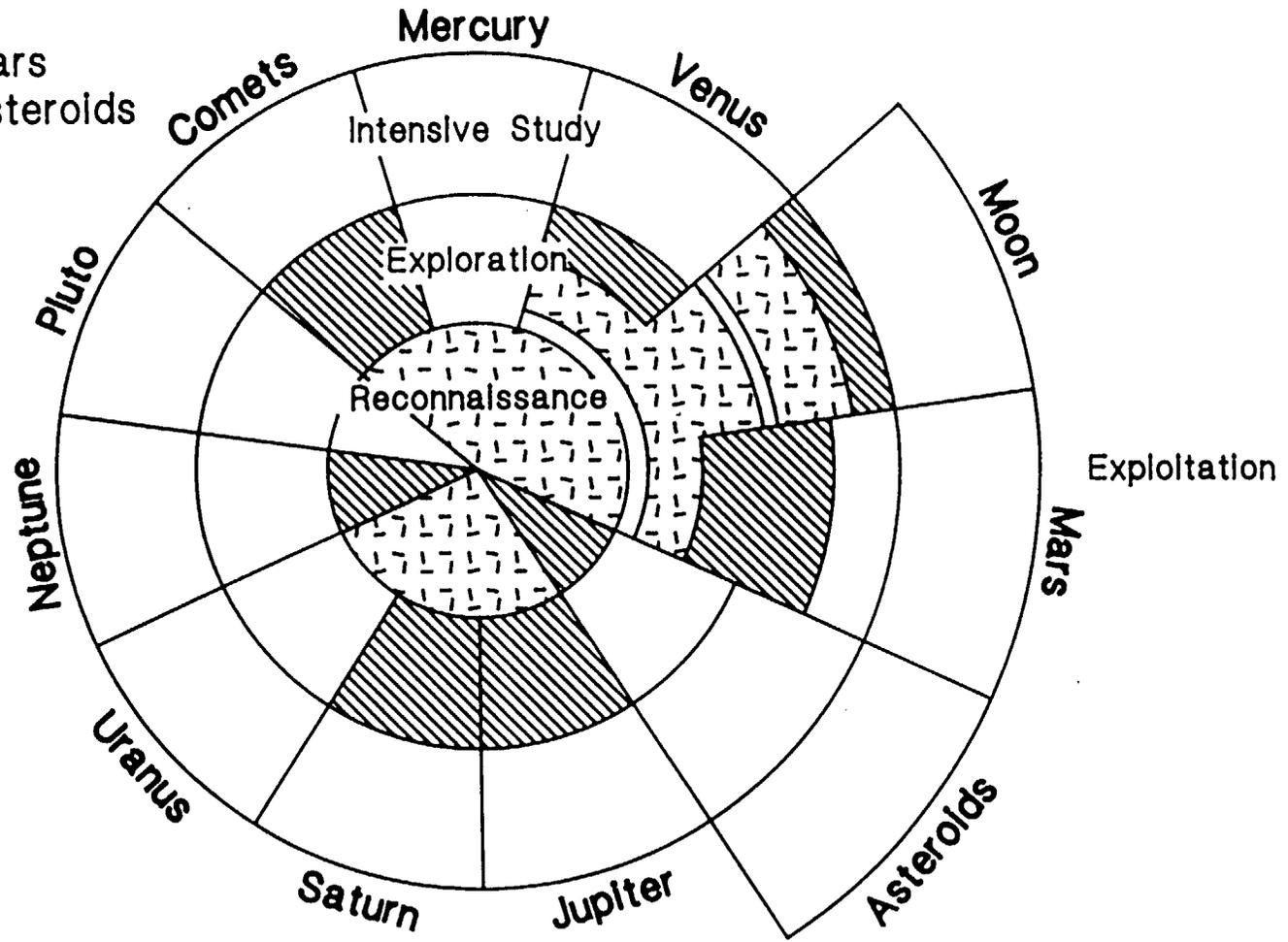


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- ❑ **Good basic science**
- ❑ **Includes a Mars focus**
- ❑ **Takes U.S. out of human space exploration**

Robots Only

Galileo - Jupiter
 Magellan - Venus
 Mars Observer - Mars
 CRAF - Comets/Asteroids
 LGO - Moon
 Cassini - Saturn



Robots Only

Robots Only

Rationale for Lunar Outpost, then to Mars

❑ Lunar Outpost

Significant achievement by very early 21st century

Nearby — a 3-day trip

Human experience in partial gravity leads to Mars

Learn to build, live and work close to home

❑ Building block approach to progressively more difficult human missions



Greatly reduced program risk

Impact of Decision

- **A major long-term commitment requires near-term action**
 - **President's FY90 Budget (\$13.3 B)**
 - **Authority for additional personnel and facilities consistent with build up of program**
 - **Streamlined procurement system**

- **A major institutional challenge for NASA**
 - **Will require restructure of agency**

- **Clear Presidential direction to civil space program**

- **Long-range goal gives direction and focus to Space Station *Freedom* and heavy-lift launch vehicles**

U.S. Investment in Future

National Technology Stimulus

Getting to space

- Advanced materials
- Low temperature technology
- Improved rocket engines (reliability, maintainability)

Living in space

- Remote health care and life support
- Electronics, communications and computers
- Advanced electrical power
- Surface transportation

Working in space

- Construction and assembly techniques
- Mining and resource use
- Manufacturing
- Artificial intelligence
- Robotics and automation

Economic Impact of Investment

- Increase rate of technological change
- Increase productivity, real output
- Enhance competitiveness
- Create jobs
- 7:1 to 9:1 return on investment over 10-20 year period*

*1971 Midwest Research Institute

*1975 Chase Econometrics Associates

*1988 Midwest Research Institute

Enhances U.S. economy and competitive position in world marketplace

Snapshot of NASA 1990 — \$13.27 B

Research and Development — \$5.75 B

- Space Station *Freedom*
- Space science
- Earth applications
- Aeronautics
- Space technology
- New space transportation
- Commercial opportunities
- Universities
- Safety, reliability, and quality

Flight Operations — \$5.14 B

- Shuttle production and operations
- Expendable launch vehicles
- Space and ground networks

People and Facilities — \$2.38 B

- 23,846 civil servants
- 10 major installations

Full budget request badly needed for all options

Exploration Options

In the final analysis the nation has three options for human exploration

- Send robots only**
- Develop a lunar base, then go to Mars**
- By-pass the Moon and go directly to Mars**

Civil Space Program Direction

Background

**"The space program should always go 'Full Throttle Up.'
That 's not just our ambition, it's our destiny."**

**— President Bush
State of the Union Address
February 9, 1989**

**On April 20, President Bush and Vice President Quayle gave
the National Space Council its charter:**

- Renew U.S. emphasis on space**
- Ensure U.S. leadership in space**
- Establish policy coherence and continuity**
- Refine and implement long – range goals**

Civil Space Policy

Long – term goal: "...to expand human presence and activity beyond Earth orbit into the solar system."

— National Space Policy
February 11, 1988

Human Exploration

Some observations:

- Cost/benefit analysis never provides a complete rationale
- Always a result of top – down leadership and national will
- Expensive, long – term undertaking
- Focuses and enhances technology development and mission applications in all sectors

Policy Options

On May 31, 1989, the Vice President asked that options be prepared and recommendations made for Presidential decision:

- To take advantage of unique opportunity of July 20**
- To achieve significant milestones in 2000**



National Aeronautics and
Space Administration
Washington, DC
20546

Office of Special Studies
NASA Advisory Council

3/13/92

Roger -

It seems to me that the
Minutes of the NASA Advisory
Council mtg. at which
Cohen / Martin / Craig + Duke
presented the SEI might be a
useful addition to Howard's
project.

Signatures

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ipson, Jr.
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The agenda is attached. Presentation materials on file are as follows:

<u>Item</u>	<u>Description</u>	
1.	Human Exploration Initiative	10 charts
2.	Relationship of Procurement Ethics Program to Special Government Employees	1 folder

NASA ADVISORY COUNCIL
Fact-Finding Session
October 25-26, 1989
NASA Headquarters
Washington, DC

ATTENDANCE:

Members:

John L. McLucas, Chairman
Robert McC. Adams
Larry Haskin
Harry C. Holloway
Samuel W. Keller
Margaret G. Kivelson
Louis J. Lanzerotti

Berrien Moore, III
Douglas Morrow
Arthur Norberg
Herman Pollack
Julian Scheer
Irwin I. Shapiro
Joseph F. Shea

Staff:

Sylvia D. Fries
Mary Anne T. Haren
Jane E. Scott

NASA Personnel:

James D. Bain
Thomas W. Chappelle
Aaron Cohen
Mark K. Craig
Michael B. Duke
Richard J. Keegan
Franklin D. Martin
John E. O'Brien

William P. Raney
George E. Reese
Nancy G. Robertson
Teresa J. Stremel
James R. Thompson, Jr.
Richard H. Truly
Wayne Young

AGENDA:

The agenda is attached. Presentation materials on file are as follows:

<u>Item</u>	<u>Description</u>	
1.	Human Exploration Initiative	10 charts
2.	Relationship of Procurement Ethics Program to Special Government Employees	1 folder

SUMMARY:

The principal agenda item for this fact-finding meeting of the NASA Advisory Council was NASA's preliminary planning of options to implement the President's initiative for establishing a base on the Moon and launching a human expedition to Mars. Mr. Aaron Cohen, director of Johnson Space Center (JSC), who has been leading NASA's "Moon Base/Mars" planning effort, was assisted by Frank Martin (Assistant Administrator for Exploration) and Michael Duke and Mark Craig of JSC in making a presentation to the Council.

NASA's presentation (1) reviewed the key elements in the President's speech of July 20, 1989, summoning the Nation to launch a new exploration initiative to the Moon and Mars; (2) outlined five candidate options analyzed in terms of schedule and scale of effort (for a return to the Moon, and for a voyage to Mars); (3) outlined tentative robotic mission milestones for both a "vigorous deployment" option and a "paced deployment" option; (4) reviewed Earth-to-orbit delivery requirements for a lunar heavy-lift launch vehicle, the National Space Transportation System, and a Mars heavy-lift launch vehicle; (5) summarized the associated Space Station Freedom requirements; (6) outlined the technology as well as human factors requirements for the candidate options; and (7) summarized the themes and approaches that could be employed for the science aspects of a national Moon/Mars exploration program.

Initial Council comments questioned the relative roles of NASA and the National Space Council (NSC) in conducting the detailed planning for the Moon/Mars program. Replies from Sam Keller (Associate Deputy Administrator) and Jack O'Brien (Assistant Deputy Administrator) indicated that the roles of the two organizations were still fluid as the NSC determines its role within the framework of executive branch policy-making.

Joseph Shea questioned the apparent assumption that a sustained program of manned exploration of the Moon and Mars would, in fact, achieve the policy objective stated during the Reagan Presidency of establishing U.S. preeminence in space. Such an assumption might not do justice to the option of achieving this broad policy objective primarily through broadly conceived robotic missions for space exploration. Moreover, observed Shea, there was a danger of focusing too many resources on a "point design," that is, on replicating the experience of the Apollo program, in which overwhelming emphasis was placed on achieving a particular set of missions that were followed by a diminished public commitment once those missions were completed. Cohen and Martin attempted to assure the Council that NASA understood that a "single point sprint" approach, as in the case of the Apollo program, would be inadequate, and that the program envisioned would embrace all aspects of space exploration, including robotic missions and space science.

Discussion returned several times to the relative weight to be given to science missions in the program. Berrien Moore emphasized that, in the context of President Bush's speech, the program called for a sustained, full science program, including the "Mission to Planet Earth" (MPE). Cohen pointed out that, while references to MPE had not been included in NASA's current planning charts, the agency had every intention of proposing a broad program that would include MPE. Shapiro voiced his fear that, in the constrained budget environment which was likely to continue, "peripherals" would be sacrificed and space science missions would be regarded as peripheral to a program of establishing a continuously manned base on the Moon and sending a human expedition to Mars. Shea suggested that NASA could partition portions of its budget to assure that certain program elements be protected from budgetary invasion by other elements.

Moore requested a clarification of the expected role of Space Station Freedom in NASA's Moon/Mars planning. Craig responded that the Space Station has a role throughout the envisioned program, initially supporting life science research and technology development. Admiral Truly noted that the Station was an essential step in the program, and that an attempt to pursue an overly ambitious, accelerated Moon/Mars schedule might jeopardize station funding--a situation he wished to avoid. In the ensuing discussion, members observed that a "paced deployment" approach would provide better margins for interim funding problems. Discussion repeatedly emphasized the need to anticipate problems not only of funding, but of technology development, e.g., for a reusable lunar vehicle, heavy-lift and advanced launch vehicles.

Shapiro then asked how essential a base on the Moon was to a human expedition to Mars. Martin responded that, inasmuch as the Nation's space policy is to expand human presence in space, the Moon and Mars were the two most logical places to go. In addition, said Cohen, a lunar base will provide a valuable "test bed" for the technologies and human factors necessary for a successful Mars expedition. NASA, in its preliminary planning, was following the same step-by-step approach that had been successfully used in the Apollo program (the Mercury and Gemini projects provided the incremental knowledge and experience needed for Apollo).

Prompted by Haskin's statement that he believed the primary goal should be the Moon, discussion turned to the relative emphasis to be given to the Moon base vs. the Mars expedition. Haskin said that the experience acquired on the Moon would enable us to answer many critical questions about how we do and can function in space. Nonetheless, he sensed a felt pressure within the agency to get to Mars, and less interest in learning along the way. Martin responded that, if we did not aim for Mars, we would never get there. Keller observed that NASA was not a monolith; there were legitimate differences of opinion within the agency. While certain systems (e.g., aerobraking, physical, chemical, and nuclear propulsion) are incorporated in both the planning for a Moon base and a Mars expedition, noted

Martin and Craig, a schedule for returning to the Moon would not be particularly affected by a "slip" in the schedule for a Mars expedition. Robert Adams and Shapiro voiced a continuing concern that the twin goals of a return to the Moon and a Mars expedition would put a funding squeeze on other parts of NASA's program, namely, science. Shapiro added that there was a likelihood that the goal of robustness would be compromised along the way.

Admiral Truly, commenting on the discussion, noted that, after many meetings during the previous summer, he had become convinced not only that a lunar base was an important step on the road to Mars, but that the entire venture required a sustained commitment for the long run and that it must benefit the entire NASA program. He also expressed his belief that any Moon/Mars program proposal, whatever its details, must be both achievable and sensitive to probable cost and schedule uncertainties.

Council discussion then turned to the "achievability" aspect of Moon/Mars planning. Keller and Cohen articulated a strong commitment at NASA's top levels to proposing a carefully bounded program, and not committing to an undertaking that NASA cannot do well. Hence the need to examine clear options so that various resource requirements (personnel, facilities, funds) can be understood from the beginning.

Cohen then reviewed for the Council key issues raised by preliminary planning for a Moon/Mars program: (1) Earth-to-orbit transportation, (2) robotic missions, (3) technology needs and human factors needs, (4) the interface with Space Station, and (5) institutional impediments. Comments on these issues related to whether the heavy-lift launch vehicle (HLLV) for a Moon mission would be a Shuttle-C or an Advanced Launch System; the importance of robotic missions in their own right (e.g., Mars Sample Return, the High Resolution Imager), rather than as mere precursors for a human expedition to Mars; the need to protect Mars from contamination, lest the biological history of the planet be corrupted; the prospects for an advanced space engine; and the uncertainty of our knowledge about the human need for artificial gravity in space.

Following the luncheon break, Craig presented the themes and approaches that might govern the science dimension of a Moon/Mars program. Craig stressed that NASA had explored this aspect of its planning with numerous individual scientists, workshops, and committees, and had concluded that there were, indeed, important scientific objectives to be met. The proposed strategy for a robotic program was to proceed from the general to the particular; for human exploration, to proceed from the local to the regional; and for lunar science, to regard the Moon as a site for future observatories (e.g., large mirror telescopes). Lanzerotti commended the thematic approach as a sensible one, but cautioned NASA against repeating the "shopping list" science planning he believed the agency had done for

Space Shuttle and Space Station. NASA should keep itself clearly focused on the principal national objective to be met by this program, he said, and not attempt an all-inclusive science approach to placate every scientific group.

Robert Adams objected, insisting that the program could only be justified by "keeping the scientists on the trolley," to which Lanzerotti replied that only the science that could be uniquely accomplished in space could be justified. Shea noted that, in his view, some of the stated goals of a Moon/Mars program could be met as well by unmanned missions; NASA might consider emphasizing "man in space" as the unifying element of its planning and then add as much good science and technology as makes sense. Haskin stated that he agreed with Lanzerotti's view, adding that NASA must resist the natural desire of its own program offices, in league with their own constituencies, to parcel out amongst themselves percentages of NASA's limited available resources for any new program. Indeed, suggested Haskin, NASA might be in danger of attempting too much science. Moore agreed, noting that Earth sciences cannot be pursued better on the Moon. Haskin added that his concern was somewhat different: the science should be paced by its most appropriate time frame. For example, the first need in any such program is learning what it takes to live and work beyond the Earth. Thus, the first science to be pursued should be life sciences. Then, we needed to learn how best to use lunar resources, and so on.

Council questions concerning Space Station addressed its role vis-à-vis a Moon station (e.g., a filling station vs. a life science laboratory?), and how soon the life support system would be closed in anticipation of a Mars expedition. Cohen commented that closing the life support loop was high on NASA's list. At the same time, he cautioned, the fact that there are debatable questions about the use of the Space Station should not be allowed to prevent NASA from moving ahead with it.

Discussion then turned to the politics of a Moon/Mars program. Norberg asked about the implications of recent patterns in congressional and White House interest in space. Cohen replied that, naturally, congressional and White House support would be critical. Keller added, while it is often said that in American politics you can't plan beyond 8 years, NASA could not limit itself to 8-year intervals in its planning. The agency had a responsibility to develop responsive plans, plans that have integrity and honest cost estimates attached to them, and then to inform its constituencies fully about those plans. J.R. Thompson added that he believes much depends on NASA, which should forward "bare-bones" proposals and, resisting the temptation to begin everything "from scratch," make extensive use of previously developed technologies such as lab modules and nodes. Discussion then turned to whether the need for microgravity facilities was either as urgent or complicated a need as alleged by some. (Shea later disagreed with the view that NASA could implement the Moon/Mars program without developing substantial new technologies, e.g., life support, on-orbit propulsion, and nuclear propulsion.)

O'Brien spoke about the institutional impediments NASA had identified to executing a Moon/Mars program. These included diminished executive flexibility--especially over personnel management and the acquisitions process--reduced funding, and less unanimity in Congress and the White House. NASA did not expect to use the Moon/Mars initiative as a means to leverage change; at the same time, the agency was examining those areas of flexibility that it did have, especially over its own internal processes. Counteracting the bureaucratic tendencies of any mature organization would be a challenge. Keller and Thompson commented on the agency's need to welcome the occasional mistakes from which we learn, to streamline its program management, and to deal with the centrifugal forces of its centers. Scheer spoke emphatically about NASA's need to rely on its own considerable skills rather than to await salvation by the White House.

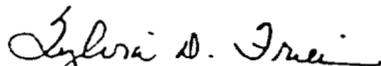
Summarizing their reactions to NASA's presentation, Council members noted that they had heard too little about the possible role of international participation to make a recommendation other than that international participation was desirable. Holloway added that a joint life science program with the Soviet Union, achieving some commonalities in data collection, would be helpful. There was some agreement that NASA planning materials avoid the appearance of being driven by precise dates rather than a sequence of events and milestones. Moreover, these materials should clearly show ranges of activity, with flexibility built in, to account for unpredictable circumstances (funding shortfalls, accidents, technology roadblocks). In addition, members suggested that the differences between different options be clearly explicated, as well as whether our intent was to remain on the Moon or use it primarily as a way-station.

Haskin voiced concern that NASA would be unable to discipline itself to remain focused internally on its unifying goals, rather than yield to the tug and pull of competing projects and those who are interested primarily in their own advantage. Shea reiterated his warning that the agency not become unbalanced "again" by manned exploration, as it had, in his view, with the Space Shuttle and Space Station programs; it must work harder to sustain a well-balanced program for the Nation. Keller said that he and Truly concurred wholly with Shea's concern. Holloway asked: what does balance mean? McLucas and Keller commented that NASA could become larger, or even restructured. McLucas urged NASA to stop thinking of itself as principally an R & D agency and to start thinking of itself as an organization that operates in space; that may include R & D.

Returning to the science aspects of NASA's preliminary Moon/Mars planning, Council members reiterated their concern that the science be well integrated with other planning. Keller reminded the Council that NASA had been at work on its plans for only a few months; developing a solid, rational, Moon/Mars science program would take some time. Lanzerotti observed that the analogy of a lunar base to the Antarctic base made earlier in the day by Admiral Truly was a useful

Science only consumes about 10 percent of the logistics for Antarctica, said Anzerotti, and occasionally the National Science Board questions whether the scientific yield from Antarctica is worth the expense. As a result, the scientific work being done at Antarctica has been "well scrubbed" by the respective disciplines. NASA shouldn't be doing scientific research in an area just because there is an office to do it.

The Council's discussion concluded with a review of the expected course of Moon/Mars planning after NASA makes its submission to the National Space Council. Chairman McLucas also asked Council members to submit to him suggested topics and themes for further Council study. [A letter from McLucas to the Council with this request was subsequently sent.]



Sylvia D. Fries
Acting Executive Secretary
NASA Advisory Council

October 24, 1989

NASA ADVISORY COUNCIL
October 25-26, 1989

AGENDA

Location: NASA Headquarters
400 Maryland Avenue, SW
Washington, DC 20546
Room 7002

Wednesday, October 25

<u>Time</u>	<u>Item</u>
9 a.m.	Opening Remarks Chairman Welcome Keller
9:15 a.m.	NASA Planning for Lunar Base/Mars Exploration Cohen, Martin, et al.
Noon	Lunch
1 p.m.	Discussion of Lunar Base/Mars Exploration Council, Thompson, Keller, O'Brien
5 p.m.	Adjourn
6:30 p.m.	Dinner at Fort McNair

Thursday, October 26

9 a.m.	Briefing on Applicability of Ethics Laws to Special Government Employees Reese
9:30 a.m.	Space Station Advisory Committee Report Raney
10 a.m.	Summation and Council Planning for Next Year Council
Noon	Adjourn

REPORT DOCUMENTATION PAGE

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