U.S. MANNED SPACE FLIGHTS

ASTRONAUT	MO.	DAY	YEAR	REVOLUTIONS	FLIGHT TIME (Hr:Min)	SPACECRAFT
SHEPARD	5	5	1961	SUB-ORBITAL	00:15	FREEDOM 7
GRISSOM	7	21		SUB-ORBITAL	00:15	LIBERTY BELL 7
GLENN	2	20	1962	3	04:55	FRIENDSHIP 7
CARPENTER	5	24		3	04:56	AURORA 7
SCHIRRA	10	3		6	09:13	SIGMA 7
COOPER	5	15-16	1963	22	34:20	FAITH 7
GRISSOM, YOUNG	3	23	1965	3	04:54	GEMINI-III
McDIVITT, WHITE	6	3-17		62	97:59	GEMINI-IV
COOPER, CONRAD	8	21-29		120	190:56	GEMINI-V
SCHIRRA, STAFFORD	16	15-16		16	25:51	GEMINI-VI-A
BORMAN, LOVELL	12	4-18		206	330:35	GEMINI-VII
ARMSTRONG, SCOTT	3	16-17	1966	6.5	10:42	GEMINI-VIII
STAFFORD, CERNAN	6	3-6		45	72:21	GEMINI-IX-A
YOUNG, COLLINS	7	18-21		43	70:47	GEMINI-X
CONRAD, GORDON	9	12-15		44	71:17	GEMINI-XI
LOVELL, ALDRIN	11	11-15		59	94:33	GEMINI-XII
SCHIRRA, EISELE, CUNNINGHAM	10	11-22	1968	163	260:09	APOLLO 7
ANDERS, BORMAN, LOVELL	12	21-27		10 LUNAR ORBITS	147:00	APOLLO 8
SCHWEICKART, McDIVITT, SCOTT	3	3-13	1969	151	241:00	APOLLO 9
STAFFORD, CERNAN, YOUNG	5	18-26		31 LUNAR ORBITS	192:03	APOLLO 10
ARMSTRONG, ALDRIN, COLLINS	7	16-24		FIRST MANNED LUNAR LANDING	195:11	APOLLO 11
CONRAD, GORDON, BEAN	11	14-24		SECOND MANNED LUNAR LANDING	244:36	APOLLO 12
LOVELL, SWIGERT, HAISE	4	11-17	1970	ABORTED IN TRANSLUNAR FLIGHT	142:55	APOLLO 13
SHEPARD, MITCHELL, ROOSA	1	31-9	1971	THIRD MANNED LUNAR LANDING	216:40	APOLLO 14
Scott, Worden, Irwin 7/26/71						Apollo 15

NASA

3

January 6, 1972

PERSONAL

Honorable James C. Fletcher
Administrator
National Aeronautics and
Space Administration
Washington, D. C. 20546

Dear Jim:

I have just read the NASA release of January 5 on NASA program reductions. I realize the deep regret you and all of NASA must feel at the need to curtail so many activities. However, you have done an outstanding job in serving the President and the country by reacting to this crisis in a highly responsible and most admirable way. The release was very well done.

You have my congratulations and admiration.

Sincerely,

/s/
Tom

Clay T. Whitehead

cc:
DO Records
DO Chron
Eva ✓

CTWhitehead:jm

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546

FOR RELEASE:
4:00 P.M. EST
JAN. 5, 1973

RELEASE NO:

NASA PROGRAM REDUCTIONS

NASA is starting today to make a number of program reductions to adjust its activities in space and aeronautics to a lower spending level. These reductions are necessary as part of all the actions required to reduce total Government spending to the $250 billion target set by the President for fiscal year 1973.

Every effort has been made to continue the essential elements for a balanced and productive space and aeronautics program within tight fiscal constraints. This includes retention of the Skylab experimental space station, the Space Shuttle, the Apollo-Soyuz Test Project, Viking, the Mariner Jupiter-Saturn mission, and many applications and aeronautics projects. NASA will proceed with development of a new front fan for reducing the engine noise generated by jet aircraft.

-more-

January 4, 1973

The actions announced today are being taken in the context of NASA's planning for FY 1974. Details of the revised programs and spending plans for FY 1973 and FY 1974 will be submitted to the Congress later this month. Today's actions are taken in advance of that time in order to save the maximum amount of money in this fiscal year.

The following is a list of major actions being taken by NASA:

- In Manned Space Flight, the manpower buildup on the Space Shuttle will be slowed down, with some resulting delay in the Shuttle's first orbital flight.
- In Space Science, work on the High Energy Astronomy Observatory (HEAO) project is being suspended for the time being.
- In Space Applications, NASA will phase out of its work on communications satellites.
- In Research and Technology, work on nuclear propulsion will be discontinued and work on nuclear power will be sharply curtailed. The Plum Brook station will be closed.
- In Aeronautics, an experimental Quiet Propulsive Lift Short Takeoff and Landing (QUESTOL) research aircraft

will be cancelled. However, quiet propulsive lift technology will continue to be developed.

Here are some of the reasons for making these specific reductions:

- The Space Shuttle is the key to the U.S. future in space, and its development will proceed. However, at the overall slowed pace of the U.S. space program, Shuttle development will also be slowed somewhat so that it will not require an inordinate share of the available resources.
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- NASA has been the catalyst in bringing into being a commercially viable <u>communications satellite</u> business. The technology of communications satellites is being developed further with the flight testing of ATS-F (Applications Technology Satellite) now scheduled for 1974. Further advances in satellite communications research and development can be accomplished by industry on a commercial basis without Government support. NASA will, therefore, phase out of its in-house and contracted communications satellite work, and will cancel ATS-G which is just now getting under way as a follow-on to the ATS-F project.
- NASA's <u>research and technology</u> program provides the building blocks for future space flight projects. Here new instruments are invented, new propulsion systems are developed, and satellite technology is advanced. The rate of development of technology for advanced space missions, however, can be slowed, consistent with the likely timing for such missions. In making these reductions, NASA is seeking to retain projects which are expected to pay off in the near term future and to make the reductions in those with much longer term

expectations. In particular, work on nuclear propulsion and large scale nuclear power sources is being terminated because all prospective applications are in the very distant future. And since NASA's Plum Brook station near Sandusky, Ohio, is the principal NASA installation devoted to the testing of nuclear power sources and related work, it will be closed.

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Nevertheless, in order to keep the country's options for the 1980's open, NASA will continue work on a quiet propulsive lift engine and on research and technology applicable to STOL aircraft. NASA will also follow closely the progress of the Air Force's Advanced Medium STOL Transport program and will take advantage of information from that program.

These are the principal areas immediately affected by NASA's program reductions. Others will be affected to a lesser extent. In most cases, the necessary cut-back actions will be taken at once in order to gain the maximum possible savings.

Wednesday 6/13/73

LUNCH
7/2/73
1:00 p.m.

10:30 Dr. Fletcher's Office called. The next NASA lunch will be on Monday, July 2, at 1:00 p.m. Told them the calendar was clear so far, and that we'd call only if Mr. Whitehead could not attend.

Lunch 7/2 1 in

AGENDA

NASA MONTHLY MEETING
July 2, 1973

1. Skylab

   a. Skylab 2 results

   b. Skylab 3 preparations

2. Congressional Status

   a. House - Senate Conference on NASA Authorization Bill

   b. Vote on the NASA Appropriations bill

   c. FY '74 Apportionment problems

3. Shuttle Status

   a. External Tank SEB 19-20 July

   b. SRM RFP Release

   c. Summer Study (NAS)

4. ATS-F HEW Meeting

5. CAS-C Status

6. Johannesburg Tracking Station

7. Prospects for FY '75 budget guidelines

House Appropriation Committee and Senate Subcommittee
Actions on Appropriation Bill (H.R. 8825)
(In Millions of Dollars)

House Committee:

R&D - Reduced Advanced Supersonic Technology to FY 1973 level (-$16.3). Added 13.3 to be applied as follows: +2.5 for replacement of the Convair 990. The remaining amount of +10.8 is undistributed for continuing a low-level nuclear program within the total funds appropriated, proceeding with ERTS B, and continuing development of QUESTOL.

CoF - Reduced Space Shuttle Facilities -$24.2. Michoud Assembly Facility -$3.3 and -$20.9 for Kennedy Space Center Orbiter Landing Facility.

R&PM - No change from Agency request.

Senate Subcommittees:

R&D - Accepted House dollar mark. Advanced Supersonic Technology limited to FY 1973 level of $11.7 (a reduction of $16.3). A 13.3 increase is undistributed but is to be used for: ERTS B, QUESTOL, JT3D, Nuclear work, Replace 990, and Energy Studies.

CoF - Reduced Space Shuttle Facilities -$10.9. All projects fully funded except for the KSC Orbiter Landing Facility which is included at $17.3.

R&PM - No change from Agency request.

BT-1
6/28/73

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Status of Fiscal Year 1974 Authorization and Appropriation Bills

(In Millions of Dollars)

BUDGET ITEM	AGENCY		AUTHORIZATION BILL H.R. 7528				APPROPRIATION BILL H.R. 8825			
	Budget Plan	Request	House Approved	House Adjust.	Senate Approved	Conference Comm.	House Approved	House Adjust.	Senate Subcomm. Recomm.	Senate Subcomm Adjust.
RESEARCH & DEVELOPMENT										
Manned Space Flight...	1,057.0	1,032.0	1,050.0	+18.0	1,032.0	1,032.0				
Space Flight Ops.....	580.5	555.5	548.5	-7.0	555.5	555.5				
Space Shuttle........	475.0	475.0	500.0	+25.0	475.0	475.0				
Advanced Missions....	1.5	1.5	1.5	---	1.5	1.5				
Space Science.........	584.0	553.0	546.0	-7.0	554.0	552.0				
Physics & Astronomy..	95.0	64.6	59.6	-5.0	64.6	63.6				
Lunar & Planetary Exploration.........	312.0	312.0	309.0	-3.0	312.0	311.0				
Launch Vehicle Proc..	177.0	176.4	177.4	+1.0	177.4	177.4				
Applications..........	153.0	147.0	159.0	+12.0	161.0	161.0				
Aero. & Space Tech....	240.0	211.0	255.0	+44.0	232.0	252.0				
Aero. Res. & Tech....	171.0	146.0	180.0	+34.0	160.0	180.0				
Space Res. & Tech....	65.0	65.0	---	-65.0	---	---				
Space & Nuclear Res. & Technology........	---	---	75.0	+75.0	72.0	72.0				
Nuclear Power and Propulsion..........	4.0	---	---	---	---	---				
Tracking & Data Acq...	250.0	250.0	240.0	-10.0	248.0	244.0				
Technology Utilization	4.0	4.0	4.5	+.5	4.0	4.5				
Total R&D.........	2,288.0	2,197.0	2,254.5	+57.5	2,231.0	2,245.5	2,194.0	-3.0	2,194.0	-3.0
CONSTRUCTION OF FACILITIES	112.0	112.0	112.0	---	110.0	112.0	87.8	-24.2	101.1	-10.9
RESEARCH & PROGRAM MANAGEMENT	707.0	707.0	707.0	---	705.0	707.0	707.0	---	707.0	---
GRAND TOTAL	3,107.0	3,016.0	3,073.5	+57.5	3,046.0	3,064.5	2,988.8	-27.2	3,002.1	-13.9

May 15, 1973

Bruce Krasker, Esquire
Legal Department
Room 7909
General Accounting Office
441 G Street, N. W.
Washington, D. C.

Dear Bruce:

In our recent meeting concerning the feasibility of NASA launch insurance you requested answers to six questions. On the basis of information supplied by Mr. E. M. Shafer, NASA's Associate General Counsel, I am pleased to be able to reply.

1. Do NASA's launch fees go directly into Treasury? No, they are credited to appropriations, with the exception of one small part of the launch fee which goes into Miscellaneous Receipts.

2. When does title pass to contracting party, e.g., Comsat? It never passes. The contractor buys NASA's services; only the risk of loss, not title, passes.

3. What is NASA policy re destruction by Act of God? It is the same as the risk of loss, generally.

4. How does NASA purchase launch vehicles? Individually, in lots, etc.? In lots.

5. Contractor's fees (e.g., Comsat's) includes NASA's costs for launch vehicle, does it not? Yes, it does.

6. Has NASA, to your knowledge, held itself out publicly as being authorized to launch for others beside Comsat? Yes, often.

The NASA people tell me that they have supplied a great deal of information on this subject to GAO, and that Mr. Don Erich (Audit) and Mr. Bob Wright (Legal) are both experts on this subject. They may be able to make your job a little easier.

Please let me know if there is anything else that we can supply.

Sincerely,

/s/

F. S. Ruddy
Counsel

cc: DO Records
DO Chron
Mr. Whitehead
Eva
GC Subject
GC Chron
Ruddy Chron

FRuddy:pb:5-15-73

Log No. ______

OFFICE OF TELECOMMUNICATIONS POLICY

INFORMATION MEMORANDUM

March 23, 1973

SUBJECT: NASA Guaranteed Launch Insurance

TO: The Director *Sef*
THRU: Seb Lasher *Sef*
FROM: Vince Sardella *Vince*

BRIEF SUMMARY:
Mr. Fletcher's February 1 letter recommended a policy on launch insurance and asked us to evaluate it together with the user community. Frank Ruddy has evaluated the policy from the viewpoint of whether Congressional action is required, while we have examined the element of risk in terms of future budgetary impact, acceptability to the potential users, and possible risk sharing by commercial insurers and launch vehicle manufacturers. Principal conclusions are:

(1) The policy outlined cannot be implemented without pertinent legislation.

(2) Commercial insurance picture has substantially improved since last summer: they can now offer one-failure deductible insurance (pay for second failure) at approximately a 10% premium. They are considering insurance for part of first failure risk.

(3) Launch vehicle manufacturers seem willing to absorb part of the first failure risk through a warranty-type plan and

~~WHY IT IS WORTHWHILE TO READ~~

expanded incentive arrangements.

(4) While purely financial forms of insurance are acceptable to some users for low premiums, schedule is much more important, especially to ComSat, ComSat/MCI/Lockheed, and Hughes.

(5) NASA's participation should be confined to that part of the first failure risk that cannot be absorbed through commercial channels and will probably take a form quite different from the Fletcher proposal.

Our survey of users, vehicle manufacturers, and insurance brokers is not yet complete. We anticipate it will be by April 15. We will then draft a complete set of findings, and a draft policy statement featuring conclusion (5) for your consideration.

Thanks

GPO 931-271

To Frank 2/6
S: 2/9
referred to [illegible] 2/9

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

FEB - 1 1973

Honorable Clay T. Whitehead
Director
Office of Telecommunications Policy
1800 G Street N.W.
Washington, D. C. 20504

Dear Tom:

Following our discussion of launch guarantees for non-United States Government customers, we have reexamined the possibilities and have developed an approach which may be acceptable.

Enclosure 1 is a statement of policy outlining the terms under which we might be able to provide a guarantee of backup launches in the event of vehicle failure. If you feel this approach to launch guarantees is basically satisfactory, I assume you will take the appropriate steps to discuss it within the Executive Office of the President and to get a reaction from the user community.

Enclosure 2 is a table of cost data from which we derive the "launch insurance premiums" we would have to charge in order to break even 95%, 90%, or 50% of the time. In order to minimize the Government's cost exposure, we have selected the higher confidence level as well as making the guarantee contingent on enough guarantee customers by vehicle type to assure us the funds for one replacement.

Enclosure 3 is a statement by our General Counsel of some of the legal problems this policy might encounter. There is some doubt that it lies within NASA's statutory authority to implement this policy without specific legislation. While such legislation would eliminate this doubt, as a minimum a full disclosure of the proposed policy to our authorization and appropriations committees in both Houses (and possibly to the General Accounting Office as well) could be considered as an alternative. This course might establish the equivalent of a legislative history for the policy.

Please let me have your reaction to these points; until we hear from you, we will not discuss launch guarantees outside the Executive Branch.

Sincerely,

James C. Fletcher
Administrator

3 Enclosures:
1. Statement of Policy
2. Cost Data
3. Legal Issues

February 15, 1973

To: Brian Lamb

From: Seb Lasher

Subj: Press Inquiry on Satellite Launch Guarantees

Dave Williamson, NASA, informed me that a reporter from Aviation Week was questioning his people about the status of Government launch guarantees. You will note that Fletcher wrote Tom proposing a plan for launch assurance on February 1st.

I requested that NASA delay any discussion of this subject until after February 20th since all these "industry" publications share the same news of rumor gathering services and we would prefer not to discuss this matter at our hearings. But, if he was hard-pressed, he could say that NASA had been looking into possibilities of risk-sharing for possible launch failures but that no definitive conclusions have emerged.

Thought you should be aware of this matter.

Seb

DO Records
DO Chron
Mr. Whitehead
✓Eva
Lasher Subj
Chron
Office Chron

To Frank 2/6
S: 2/19
referred to [illegible]
2/8

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

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3. Legal Issues

Log No.________

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THRU: Seb Lasher
FROM: Vince Sardella

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Our survey of users, vehicle manufacturers, and insurance brokers is not yet complete. We anticipate it will be by April 15. We will then draft a complete set of findings, and a draft policy statement featuring conclusion (5) for your consideration.

January 12, 1973

To: Bryan
From: Tom

Please draft a short pleasant memo to Fletcher saying maybe we could discuss how they could get 90% out of communications satellite stuff without getting 100%------ continue to have some kind of a very small advanced technology capability but no development or in-house research program.

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

January 9, 1973

~~ADMINISTRATIVELY CONFIDENTIAL~~

Eagle

MEMORANDUM FOR

THE HONORABLE ~~CLAY~~ Tom T. WHITEHEAD

Subject: NASA Press Release and Space Communications

It might be helpful for you to "remind" Jim Fletcher that NASA should not "phase out" of all space communications work as stated in the attached press release.

Jim had agreed to maintain a small research core in this field. I believe he still intends to and the words just got garbled up.

It would probably be a good idea to keep my name out of this since I have been pinging him on several rather sensitive issues lately - sometimes he confuses the devil's advocate with the devil.

Bill

William A. Anders

Attachment

~~ADMINISTRATIVELY CONFIDENTIAL~~

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
Washington, D. C. 20546
PHONE: 202/755-8370

FOR RELEASE:
4:00 P.M. EST
JAN. 5, 1973

RELEASE NO: 73-3

NASA PROGRAM REDUCTIONS

NASA is starting today to make a number of program reductions to adjust its activities in space and aeronautics to a lower spending level. These reductions are necessary as part of all the actions required to reduce total Government spending to the $250 billion target set by the President for fiscal year 1973.

Every effort has been made to continue the essential elements for a balanced and productive space and aeronautics program within tight fiscal constraints. This includes retention of the Skylab experimental space station, the Space Shuttle, the Apollo-Soyuz Test Project, Viking, the Mariner Jupiter-Saturn mission, and many applications and aeronautics projects. NASA will proceed with development of a new front fan for reducing the engine noise generated by jet aircraft.

-more-

January 5, 1973

The actions announced today are being taken in the context of NASA's planning for FY 1974. Details of the revised programs and spending plans for FY 1973 and FY 1974 will be submitted to the Congress later this month. Today's actions are taken in advance of that time in order to save the maximum amount of money in this fiscal year.

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-more-

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-more-

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-more-

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EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

January 9, 1973

~~ADMINISTRATIVELY CONFIDENTIAL~~

Eagle

MEMORANDUM FOR

THE HONORABLE ~~CLAY~~ Tom T. WHITEHEAD

Subject: NASA Press Release and Space Communications

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DECLASSIFIED
E.O. 13526, Sec. 3.3h
By MUL, NARA, Date 11/29/10

William A. Anders

Attachment

~~ADMINISTRATIVELY CONFIDENTIAL~~

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
Washington, D. C. 20546
PHONE: 202/755-8370

FOR RELEASE:
4:00 P.M. EST
JAN. 5, 1973

RELEASE NO: 73-3

NASA PROGRAM REDUCTIONS

NASA is starting today to make a number of program reductions to adjust its activities in space and aeronautics to a lower spending level. These reductions are necessary as part of all the actions required to reduce total Government spending to the $250 billion target set by the President for fiscal year 1973.

Every effort has been made to continue the essential elements for a balanced and productive space and aeronautics program within tight fiscal constraints. This includes retention of the Skylab experimental space station, the Space Shuttle, the Apollo-Soyuz Test Project, Viking, the Mariner Jupiter-Saturn mission, and many applications and aeronautics projects. NASA will proceed with development of a new front fan for reducing the engine noise generated by jet aircraft.

-more-

January 5, 1973

The actions announced today are being taken in the context of NASA's planning for FY 1974. Details of the revised programs and spending plans for FY 1973 and FY 1974 will be submitted to the Congress later this month. Today's actions are taken in advance of that time in order to save the maximum amount of money in this fiscal year.

The following is a list of major actions being taken by NASA:

- In <u>Manned Space Flight</u>, the manpower buildup on the Space Shuttle will be slowed down, with some resulting delay in the Shuttle's first orbital flight.
- In <u>Space Science</u>, work on the High Energy Astronomy Observatory (HEAO) project is being suspended for the time being.
- In <u>Space Applications</u>, NASA will phase out of its work on communications satellites.
- In <u>Research and Technology</u>, work on nuclear propulsion will be discontinued and work on nuclear power will be sharply curtailed. The Plum Brook station will be closed.
- In <u>Aeronautics</u>, an experimental Quiet Propulsive Lift Short Takeoff and Landing (QUESTOL) research aircraft

-more-

will be cancelled. However, quiet propulsive lift technology will continue to be developed.

Here are some of the reasons for making these specific reductions:

- The Space Shuttle is the key to the U.S. future in space, and its development will proceed. However, at the overall slowed pace of the U.S. space program, Shuttle development will also be slowed somewhat so that it will not require an inordinate share of the available resources.
- HEAO is designed to explore the unknown through the eyes of high-energy astrophysics. Although much is to be learned in this field, it is not essential to move out at any specific pace. Since HEAO is just now getting under way, it is possible to suspend work on this project without a great deal of wasted costs. During the period of suspension (expected to last at least one year), NASA will study ways to meet some of HEAO's objectives at lower costs. In the meantime, some work in high-energy astrophysics will continue with spacecraft such as the Small Astronomy Satellites.

- NASA has been the catalyst in bringing into being a commercially viable communications satellite business. The technology of communications satellites is being developed further with the flight testing of ATS-F (Applications Technology Satellite) now scheduled for 1974. Further advances in satellite communications research and development can be accomplished by industry on a commercial basis without Government support. NASA will, therefore, phase out of its in-house and contracted communications satellite work, and will cancel ATS-G which is just now getting under way as a follow-on to the ATS-F project.
- NASA's research and technology program provides the building blocks for future space flight projects. Here new instruments are invented, new propulsion systems are developed, and satellite technology is advanced. The rate of development of technology for advanced space missions, however, can be slowed, consistent with the likely timing for such missions. In making these reductions, NASA is seeking to retain projects which are expected to pay off in the near term future and to make the reductions in those with much longer term

expectations. In particular, work on nuclear propulsion and large scale nuclear power sources is being terminated because all prospective applications are in the very distant future. And since NASA's Plum Brook station near Sandusky, Ohio, is the princip[al] NASA installation devoted to the testing of nuclear power sources and related work, it will be closed.

- In aeronautics, it is NASA's role to do the basic research and technology required to maintain U.S. superiority in civil aviation, and to support military aviation developments. Much of this work is done on the ground--in wind tunnels, on computers, etc.--but some is done in flight with experimental aircraft. One of these experimental aircraft projects--the QUESTOL, for experimenting with quiet propulsive-lift technology for short haul aircraft for civilian use--is being cancelled because of its lower priority relative to other NASA aeronautical activities. Since this project is only just getting under way, there will be little wasted effort. Because of uncertainties in the timing of the need for commercial STOL aircraft in the 1980's, the QUESTOL project can be deferred at the present time.

-more-

Nevertheless, in order to keep the country's options for the 1980's open, NASA will continue work on a quiet propulsive lift engine and on research and technology applicable to STOL aircraft. NASA will also follow closely the progress of the Air Force's Advanced Medium STOL Transport program and will take advantage of information from that program.

These are the principal areas immediately affected by NASA's program reductions. Others will be affected to a lesser extent. In most cases, the necessary cut-back actions will be taken at once in order to gain the maximum possible savings.

=

Launch guarantees
12/4/72
2:30pm

November 24, 1972

To: Bruce Owen
From: Eva

We have confirmed the meeting for you and Tom to meet with Jim Fletcher on Monday 12/4 at 2:30 p.m. in Fletcher's office.

As you will see from the note, Tom would like you to check with the OMB guy you've been working with and get Bill Morrill's views prior to the meeting.

Is the time O.K. with you?

Hope so, as Mr. Fletcher's calendar is rather tight. If not, I will try for another time.

PLEASE LET ME KNOW ASAP.

Friday 11/24/72

MEETING
12/4/72
2:30 p.m.

10:15 Jim Fletcher's office called to set up the meeting on launch guarantees which he mentioned to you over the phone.

His secretary, Betty Covert, indicated he would be going to Houston after the launching and Monday, December 4th, looks like a time he could do it. We have scheduled the meeting for 2 30 p.m., on Monday, December 4. 755-3909

Bruce Owen isn't in today -- but his calendar is clear for that time also.

The meeting will be in Room 7137, Federal Office Bldg. #6, 400 Maryland Ave., S.W.

O.K. for Monday 12/4 -- 2:30 p.m. ✓

On Monday, when Bruce is in the office, I will ask him to check with OMB guy he's been working with and get Bill Morrill's views before the meeting with Mr. Fletcher and Bruce.

cc: Bruce

Launch Insurance

NOV 15 1972

MEMORANDUM FOR

Honorable James C. Fletcher
Administrator
National Aeronautics and Space Administration

I am seriously concerned that our inability to develop a fesasible launch insurance program for commercial applications of space, and particularly for communication satellite users, will fail to provide a much needed stimulus to this important new industry. There appear to be several insurance schemes which, while more modest than might ideally be desired, appear quite capable of providing the necessary stimulus without any substantial risk of federal expenditure. These more modest approaches appear to carry the risk of federal expenditure only in cases which would raise far more serious questions about the viability of the commercial applications programs.

Our survey of the user community shows keen interest in launch insurance, even of the purely financial sort which does not require additional "up front" programmed vehicles.

I have written Bill Morrill asking for his help in trying to break out of the dilemmas which now seem to face us in this area. If there is anything further that you can do to facilitate consideration of this idea, I think it would be of significant benefit to the industry, the public, and the Administration.

signed
TOM
Clay T. Whitehead

bcc: Mr. William A. Anders
National Aeronautics and Space Council

cc: DO Record
DO Chron
Mr. Whitehead
Eva ✓
Mr. Owen

BOwen/njs/11-14-72

Launch insurance

NOV 15 1972

MEMORANDUM FOR

Mr. William Morrill
Assistant Director
Office of Management and Budget

For nearly six months Bill Anders and I have been trying to persuade NASA that the idea of launch insurance for commercial users of NASA facilities and vehicles (such as domestic communication satellite firms) would be a substantial benefit to the industry and the public. Such an insurance scheme need not, and indeed should not, be provided at any net cost to the government over the long term. NASA seems to be hung up on schemes which, while attractive, require some near term budget expenditures which are not repaid for several years.

Launch insurance in some form, including those modest forms which do not require any initial government expenditure, would be a substantial stimulus to commercial development of space technology, and particularly to competition in the communications business. Rapid development of satellite communications, which would be of significant importance for the future of television and cable television services, would be facilitated by any scheme which spreads the risk of launch failures over all of the prospective users. Our survey of the user community suggests a very keen interest in this idea, while private insurance companies appear unwilling to provide this service.

I would appreciate any help that you can give us in developing this proposal. I think that successful implementation of a launch insurance program would benefit the industry and the public, and reflect considerable credit on the Administration.

Signed
TOM

Clay T. Whitehead

bcc: Mr. William A. Anders
National Aeronautics and Space Council

bcc: DO Records
DO Chron
Mr. Whitehead (2) Mr. Owen
Eva

Retyped
BOwen:clt:11/13/72

July 17, 1972

MEMORANDUM FOR

Mr. Bernard Moritz
Deputy Associate Administrator
for Organization & Management
National Aeronautics & Space Administration

Attached is a preliminary response to some OMB questions on the possibility of guaranteed orbital placement of communications satellites by NASA. We will be happy to participate in any further investigations in this area.

SIGNED
Walter R. Hinchman
Assistant Director

Attachment

WRHINCHMAN/dgm
cc:
DO RECORDS
DO CHRON
Mr. Whitehead (2)
Mr. Hinchman (2)
Mr. Sardella
Mr. Carruthers
Sonya

SPACECRAFT LAUNCH GUARANTEE

This memorandum responds to three of the questions posed by OMB on the feasibility of NASA guaranteed satellite launches for the communications industry. The response is a first cut, based on cursory examination of the factors involved. Areas requiring a deeper look will be apparent.

Question 1. Could the private sector provide all or part of the liability coverage? What alternatives would be available?

Based on the Comsat experience, and using a five year horizon, the answer to all coverage by the private sector is no, and to part coverage, yes. Part coverage by the private sector, with possible provision for increasing their portion as experience is gained, would probably reduce potential congressional and public opposition to the Government's role as an insurer to industry in this program. Some possible alternative government-industry joint arrangements are outlined later in this memo.

The portion of insurance the private sector may be willing to offer at the start must be estimated as very low. Comsat was first able to obtain very limited insurance after the first launch (a failure, on September, 1968) of the Intelsat III series.

The Intelsat III insurance was first written to cover the five anticipated launches following the September 1968 failure. Its chief provisions were:

1. The first failure in the five launch series would not be covered.

2. On the second failure, the insurers would pay Comsat 4.57 million dollars.

   (Note: Comsat's actual loss would be 53% (Comsat's share of Intelsat) of the approximate 11.5 million dollar total cost of an Intelsat III, or 6.1 million dollars. Comsat was to retain 25% of this risk, or 1.52 million dollars, and the insurers assured 75% of the risk, or 4.57 million dollars.

3. On the third failure in the five launch series, the insurers would again pay 4.57 million dollars.

4. No other failures would be covered.

The premium for this insurance was $872,000. Maximum possible pay-out by the insurers was 9.14 million dollars.

When the Intelsat III program was extended to two additional launches, the insurance was extended at a premium of $606,000, to pay Comsat five million dollars if both launches failed. Fifty per cent of the premium was to be refunded (and in fact, was) after the first success in this two launch add-on. The five million dollar coverage still reflects 75% of Comsat's share of an Intelsat III total cost. The last two satellites cost more than the earlier versions in this program.

Insurance coverage for the eight launch Intelsat IV program is, perhaps, even more limited than that offered on Intelsat III, considering that each Intelsat IV costs approximately 26 million dollars. Comsat's 53% share of this cost is 13.8 million dollars. Under the insurance program originally planned, Comsat would again be covered for 75% of its cost, or about 10.35 million dollars, but only under the following conditions, over an eight launch program.

1. The first two launch failures would not be covered.

2. The third launch failure, the insurers would pay out 10.35 million dollars.

3. No launches after the third failure would be covered.

4. If only zero or one failure occur in the program, one/third of the premium would be refunded.

The premium for this coverage was computed to be 1.5 million dollars, for a maximum pay-out of 10.35 million dollars.

At the start of the Intelsat IV program, Comsat's broker could get only 59.5% of the above package placed. This was shared by two firms, Lloyds and Associated Aviation Underwriters. After the first launch was successful, the U.S. Aviation Insurance Group picked up an additional 20% of the coverage. Hence, Comsat's actual compensation for the third failure would be about 8.28 million dollars, and their actual premium is about 1.2 million dollars. After the second launch was successful, Comsat refused an offer by its broker to place the remaining 20.5% of the package.

It is apparent that this coverage is far short of any guaranteed launch for commercial satellite ventures. Given the limited launch experience, we can assume this coverage is close to the maximum level of participation the private sector will be willing to undertake. This means, then, the government in some manner will have to underwrite a major part of any guaranteed launch service. Alternative arrangements for private and government coverage, both separate and joint, are outlined below.

Alternatives

1. Complete or partial self-insurance by NASA (the government) against launch failure, or insurance offered directly by the government to satellite operators. In either case, the launch cost would include a premium payment for coverage. There is a question whether such insurance should be compulsory, so all satellite operators can benefit from the broadest base of participation, or voluntary, in which case large commercial ventures (Comsat) might choose not to be covered, with the result that premiums for the small entrepreneurs could increase in cost. The basic problem with this approach, of course, is that it puts the government in the business of insuring the risks of private entrepreneurs and does not contemplate any mechanism for transferring this burden to the private sector.

2. Complete or partial coverage by launch equipment suppliers for failure of separate booster components. This concept could be extended to the payload as well, once it is in orbit. But in both cases, because there are multiple suppliers of components, there is a difficult problem of attribution of failure to particular suppliers. Indeed, there may even be some difficulty in conceptually distinguishing booster from payload components (e.g., the apogee motor).

3. Joint self-insurance pool for NASA, or satellite owners, or some combination thereof. There may be some ethical/legal problem in combining potential competitors in such a pool. Again there is the question whether it would be compulsory or voluntary. It could be designed in such a way that NASA would assume a fixed percentage of "premium" costs for each launch.

4. Complete or partial coverage of launch failure by private underwriters. Precise determination of premium amounts can be deferred until sufficient actuarial base is established per booster series. The coverage agreements could be between NASA and private underwriters or between individual satellite operators and the underwriters. In the former case, one would expect the possibility of moral risk* would set approximately a 75% upper limit on coverage; in the second case there should be no concern with moral risk since satellite operators would be insuring for performance of a third party.

   Participation agreements should be possible whereby, say, in a given series of launches, different underwriters could cover different levels of loss: one covering the first five million dollars, another the next five million dollars, etc. The greater the number of launches covered by a private underwriters consortium, of course, the lower the expected premium costs should be. This might argue for one consortium covering an entire launch series, negotiating either with NASA directly or the satellite operators. Again there is the question whether this insurance should be compulsory.

   The difficulty with relying exclusively on private underwriters is, as was mentioned before, that they have proven unwilling to provide adequate amounts of coverage.

5. Participation agreements between NASA (government) and private underwriters. This approach is designed to allow the private sector to underwrite whatever risks it is willing to and provide government coverage of higher risk levels.

   a. The government could insure up to some fixed limit of loss liability for each launch series beyond which private underwriters would absorb losses. The crossover point would be variable according to confidence in the actuarial base. Presumably there would be incentive in terms of larger expected profits on premiums for the private sector to underwrite more and more of the coverage as launch experience widens. Determination of the precise

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*An insurer is said to assume a moral risk when the insured stands to gain in payment from the insurance company more than the loss sustained.

premium amounts for the government insurance (or indeed, private coverage) could be deferred until sufficient actuarial base develops. Again, there is a question whether either private or government coverage or both, should be compulsory, and whether one private consortium or several should underwrite a full launch series.

b. The reverse of a. Private underwriters would insure up to some set loss limit beyond which the government could take over. Again, the limit would be flexible according to how much the private sector is willing to underwrite. The a. alternative has some advantage over this in that it is more in accord with current industry practice (e.g., Comsat's coverage).

6. Participation agreements between NASA and self-insured satellite operators. Similar to Alternative 5. Large satellite operators would have an advantage over small under this alternative.

7. Insurance offered by satellite users. It seems unlikely that users would find any benefit in assuring launch risks.

<u>Question 2</u>. What appears to be the potential demand for guaranteed launch services for the next five years?

Four sources were used to yield an estimate in response to this question: Data available in-house on non-NASA government requirements, Aerosat, and Maritime requirements; SRI's report, "Economic Viability of the Proposed United States Communications Satellite Systems"; Comsat's Intelsat IV plans; and an OTP estimate of one operational and one back-up satellite for the domestic use of each of four countries: Brazil, Japan, Australia, and India.

Table 1 summarizes the results. Note that the estimate is for 39 satellites. Even if they all used the same booster, it is most doubtful that any private insurer would consider the experience sample to be large enough to consider offering "guaranteed launch" coverage at any time during this period. We can expect that the government would still be the primary insurer for such coverage at the end of the next five years, although the private sector may be encouraged to provide more than their present coverage for the Intelsat IV program.

Question 3. To what extent is the present policy inhibiting the commercial exploitation of space? What data is available on this question?

The present policy (essentially no launch insurance) has certainly not been the inhibiting factor in domestic expansion while FCC Docket 16495 was still pending, since the issues of that docket overwhelm the launch insurance question.

Considering the financial resources of Intelsat, it is most doubtful their program until now, or over the next several years, would be different if guaranteed launch had been available.

The question probably has substance only if we consider how the U.S. domestic entries and certain countries desiring a satellite for their domestic use may differ with and without guaranteed launch services.

1. U.S. Domestic Commercial Ventures.

   It has been asserted that market risk is the overwhelming concern of a potential entrant in the domestic satellite field and that the risk of launch failure itself has little marginal impact on a firm's decision as to entry.

   Although this may be the case with the majority of the current applicants before the FCC, it need not be the case, and indeed, probably does not apply to the smaller (WCTI) and more thinly capitalized (WU) of the current applicants.

   Any of the firms can attempt to insulate themselves against market risk by such a strategy as signing long term pre-commitment contracts with selected users (either along the lines of the Hughes-GTE agreement or agreements with large private-line end-to-end users like GE, GM, etc.). This approach would seem particularly appropriate for small satellite operators who could fill their systems with a limited number of such large-user contracts. Since in the current vintage of satellites there are no convincingly demonstrable economies to scale, it is not unlikely that the small satellite operator could offer potential users lease terms as attractive as those of any other system operator. A problem arises, however, in the case of a small firm, if in dealing with the possibility of launch failure, it has to underwrite all or a significant proportion of the losses itself. With a relatively smaller base (in terms of number of satellites and transponders) over which to spread the expected losses, any failures (the cost of which presumably would have to be covered by the lease rates over time) can place the small operator at a decided competitive disadvantage vis a vis one larger. Not only might its lease rates have to be higher, but in the short run it could be confronted with serious cash deficits assuming its overall financial resources are also small by comparison with the competition. Of course, some arrangements might be made whereby large potential users could directly underwrite failure losses, but again this type of condition would put the small operator at a competitive disadvantage.

To give some perspective as to the possible impact of launch failure and the implied risk to the small firm, the case of WTCI is illustrative. In their current filings the estimated launch costs per satellite are 7.5 million dollars and spacecraft 6.0 million dollars (exclusive of investment in development). Failure of a launch then implies a 13.5 million dollar loss. This is approximately 35% of TCI's total net investment in plant (1971), 2.7 times their annual cash flow (1971), more than their annual gross revenues, and roughly 18 times the annual earnings. Clearly, in these terms a failure could have serious impact on the firm's overall viability. On the other hand, if insurance (covering 75% for both the launch and space vehicle investment) could be provided at a reasonable mark up above expected loss value (say 30%), the premium payment would be 1.9 million dollars (assuming .15 failure rate) and maximum possible loss to TCI in the event of failure would be 3.4 million dollars. This obviously could be absorbed more easily than a 13.5 million dollar loss. Even the 1.9 million dollar premium cost plus the 3.4 million dollar loss is more than covered by the 1971 cashflow. Considering that moral risk is not a factor in the actual launch investment (TCI, not NASA, is covered), it is conceivable that much greater coverage than 75% would be available, in which case the potential loss to TCI as a result of failure might be cut to less than 1.5 million dollars (at least 1.25 million dollars involves space vehicle where moral risk does apply).

The example of WTCI would seem to indicate that launch risk can operate as a significant barrier to entry for small firms unless some equitable arrangements for insurance coverage can be made available.

2. Foreign Commercial Ventures

With respect to the efforts of foreign countries to develop satellite systems for their own domestic or regional use, it is difficult to say whether lack of a launch guarantee would seriously inhibit their programs. If we assume that each foreign program would realistically have to budget three launches to get two satellites in orbit, launch costs are roughly 26 million dollars (18 million dollars for the booster and eight million for the payload), and the historical .15 failure probability implies roughly a four million dollar insurance premium per launch (covering the full 26 million dollars), then the budget comparison would be 60 million dollars for guaranteed launches versus 78 million dollars with no guarantees. This margin of 18 million dollars may not seem significant when compared with Brazil's annual additions to communications plant of approximately .5 billion dollars, Australia's additions of .3 billion dollars, Japan's addition of 3.2 billion dollars. However, the relevant comparisons are with the annual long-lines additions in these nations, and more specifically with the alternative costs of microwave or other terrestrial technologies.

For any hard-nosed cost comparisons of satellite technology against the alternatives (e.g., terrestrial microwave) the 18 million dollar margin could be a critical factor. The 18 million figure, for example, represents approximately 20% of the current value of Brazil's nationwide long haul microwave transmission system.

VSARDELLA-BCARRUTHERS/dgm

TABLE 1

ESTIMATED DEMAND FOR GUARANTEED LAUNCH SERVICES
Through Mid 1970's

	Active	Backup (in orb)	Spare	Booster	$ Per Launch (millions)	Total
U.S. DOMESTIC						
AT&T	2	1	1	Atlas Centaur	17.95	4
Hughes	2	0	1	Thor Delta	6.408	3
Network Carriers	1	1	1	Titan III Agena	21.7	3
Leased Lines	2	1	1	Thor Delta	6.408	4
Aerosat-Maritime	4	2		Thor Delta	6.408	6
U.S. Government-Non-NASA (NOAA)	3			Thor Delta	6.408	3
INTERNATIONAL						
Intelsat IV	2	2		Atlas Centaur	17.95	4
FOREIGN DOMESTIC						
Brazil	1	1		Atlas Centaur	17.95	2
Japan	1	1		"	17.95	2
Australia	1	1		"	17.95	2
India	1	1		"	17.95	2
Canada	1	1		"	17.95	2
France (Intra-European)	1	1		"	17.95	2
						39

N.A.S.A.

August 28, 1972

Mr. Willis H. Shapley
Associate Deputy Administrator
National Aeronautics and Space Administration
Washington, D. C. 20546

Dear Mr. Shapley:

Thank you for the information concerning NASA's decision not to uprate the Delta or Atlas Centaur launch vehicles. Mr. Whitehead is on leave, but I will see that he is informed of this as soon as he returns.

I don't perceive any need for further information at this time; however, we appreciate your offer and will contact you if necessary.

Sincerely,

-SIGNED

Walter R. Hinchman

WHinchman:dc
DO Records
DO Chron
Mr. Whitehead
Mr. Hinchman-Subj.
RF

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

AUG 18 1972

Honorable Clay T. Whitehead
Director
Office of Telecommunications Policy
Executive Office of the President
Washington, D. C. 20504

Dear Tom:

For your information, here is a copy of a letter we have sent to the FCC on the decision we have made not to uprate further the Delta and Atlas Centaur launch vehicles.

If you or your staff would like further information on the decision, we would be glad to discuss it.

Sincerely,

Willis H. Shapley
Associate Deputy Administrator

Enclosure

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

AUG 18 1972

OFFICE OF THE ADMINISTRATOR

Mr. Asher Ende
Deputy Chief
Federal Communications Commission
Common Carrier Bureau
Washington, DC 20554

Dear Mr. Ende:

In our letter of January 7, 1972, we informed you that NASA had indicated to the Radio Corporation of America, Global Communications, Inc., in response to their request, that a launch vehicle with approximately 1890 pounds capability would be available in the 1975 time period, subject to certain stipulations, including the condition that improvements required to uprate an existing launch vehicle would be paid for by RCA and any other proposers planning to use the uprated launch vehicle. We stated at that time that the launch vehicle selected would most likely be a Thor Delta but that we did not wish to foreclose consideration of options in a competitive performance and cost class.

We have recently completed a careful assessment of the factors which resulted in flight failures with the Delta and Atlas Centaur launch vehicles in 1971, and have initiated at substantial expense a program of engineering changes and hardware modifications required to assure maximum future reliability for these launch vehicles. One of the salient results of our assessment was the conclusion that reliability could be increased by standardization and by increased emphasis on reliability and quality assurance programs. We believe that the necessity for insuring reliability overrides other considerations, and that successive changes to uprate the vehicle in response to unique requirements could tend to impair the reliability improvement program and result in lower reliability for all users.

For these reasons, in order to maximize launch vehicle reliability, we have felt obliged to make the decision that neither the Delta nor Atlas Centaur launch vehicles will be further uprated. I recognize that this decision represents a change from the position expressed in our January 1972 letter to RCA and to you, based on the outlook at that time, but believe that it is in the best interest of all users of the Delta and Atlas Centaur launch vehicles.

The possible availability of the Atlas Agena launch vehicle as an alternative to an uprated Delta is under discussion with the Department of Defense.

We are also advising directly, RCA, Global Communications, Inc., and Fairchild Industries, who have inquired concerning the uprated Delta, of the decision we have now made as indicated above.

Sincerely,

Willis H. Shapley
Associate Deputy Administrator

cy in
PMF file

Mr. Whitehead
NASA

Eyes Only

July 7, 1972

MEMORANDUM FOR: EDWARD E. DAVID

FROM: JONATHAN C. ROSE

SUBJECT: Technology Transfer Task Force

When you hold the initial meeting of the new task force, I gather that the primary agenda item will be the possible scope of the effort and the kinds of policy questions that the group's research and study must address. I don't know whether you intend to distribute a proposed working paper beforehand, or bring the matters up for open discussion at the meeting, but in any event I thought I would pass along some of my own modest thinking about the subject.

As I recall the initial stimulus to our thinking in this area, the question was raised as to whether NASA in particular should adopt, pursuant to White House policy directives, more comprehensive mechanisms for control of the export of space technology. Your staff's review of the problem suggested that existing mechanisms at other agencies also merited a fresh examination.

Mr. Flanigan's concerns would of course tend to emphasize the extent to which, if at all, existing and proposed control mechanisms do or can incorporate consideration of the domestic economic impact of transfers of technology abroad. To include such considerations would require, I assume, that one articulate with some specificity the kinds of economic factors which would be reviewed in the course of agency decisions, and the weight to be given such factors in competition with other considerations. My experience with other efforts to urge the consideration of economic impact of technology export is that while everyone agrees that economic issues are important, there has been precious little elucidation of what the economic factors are and how they can be assessed by the bureaucracy on a routine basis. It may well be that one of CIEP's first inputs to this new study should be to flesh out the previously vague platitudes on this subject.

In considering the proper and workable scope of this task force, I gather that a couple of on-going studies are relevant. First, NSSM-72, currently under final review in this office, sets out fresh statements of the diverse policy considerations in international space cooperation, and specifically, in the transfer abroad of space technology. The main thrust of the latter policy, over and above the general statement that domestic economic impact should be considered, is to suggest that distinctions be drawn between bare "hardware", and the broader technological expertise that would more conceivably permit foreign duplication of U.S. capabilities. While NSSM-72 may accomplish some of our rudimentary policy review, I wonder whether the new task force shouldn't test this hardware/technology distinction with respect to its implementability by control mechanisms in the bureaucracy.

The other relevant study would appear to be the Treasury-chaired task force on economic impact of international technology transfers. I don't believe a final report has been circulated, and I have not even seen a draft summary or conclusions chapter. However, in reading the body of the draft report, there appears to be a critical finding to the effect that the U.S. economy benefits generally from the dissemination of technology abroad, based on the theory that we derive the greatest advantage from the increased world trade that inevitably results from accelerated industrialization of foreign countries. I wonder if we shouldn't address how this alleged longer-term benefit can be weighed against tangible short-term disadvantages. Furthermore, I wonder if we could attempt to distinguish between lesser developed countries and nations such as Germany, France, and Japan in the application of the "increased world trade" theory of U.S. benefit. Another relevant aspect of the on-going study is an attempt to define "technology" for purposes of assessing different kinds of economic impact. More generally, I would appreciate knowing, if you are tuned in to the Treasury study time-table, when we can expect circulation of a final draft of their report.

One issue in the scope of the new study would probably be the extent to which we should focus on bureaucratic controls for the smaller, routine instances of technology transfer (seminars, technical publications, small hardware), in contrast to developing policy guidelines for agency and Executive Branch review of proposed export of major hardware/technology systems. In the latter category I would include Thor-Delta, Post-Apollo cooperation, GE-SNECMA jet engines, etc. At the very least, I would hope that we could reflect on these recent major "case studies" and develop some generalizations for future handling of similar scale problems. There are two issues, at least, in these major system decisions: first, insuring White House overview, even when the agencies are in agreement and accordingly don't kick it upstairs for a referee; and secondly, who in the Executive Branch has responsibility for coordinating such an overview. If we get into this kind of question, we may need to coordinate our efforts with a possible extension of the NSSM-72 study.

It strikes me that I may be suggesting so broad an inquiry as to make this effort unmanageable, or at the least, impossible to conclude very quickly. Perhaps you and I ~~would~~ SHOULD discuss this with Whitehead and/or Anders before an initial meeting.

As to composition of the task force, I have two thoughts. First, I think that Whitehead would be a useful addition, in light of OTP's experience as well as Tom's involvement in NSSM-72. Secondly, in soliciting interagency participation, I would think it desirable to seek sufficiently senior people consistent with the importance of the policy decisions that may be taken. Unfortunately, both Whitehead and Anders are out of the country for a couple of weeks, so I suppose we can't have a first meeting very promptly. When the schedule is set, I would like to be advised of the initial session, and if you have no objection, I would be interested in sitting in. John Schaefer will, however, be CIEP's continuing representative to the panel. Assuming the panel establishes a small working group, Schaefer would probably make a good member of that team as well.

OFFICE OF TELECOMMUNICATIONS POLICY

Log In No. ____

June 27, 1972

ACTION MEMORANDUM FOR Mr. Whitehead

Through:
From: Walter Hinchman W.RH
Subject: NASA Space Applications Policy

Co-ordinated with:

Staff Opinions:

Action required by the Director:

- None _____
- For your signature _____
- Further discussion required with author _____
- Further discussion required with staff _____
  - Which member of the staff _____
- Approve attached draft _____
- Approve recommended course of action (see below) __X__
- Other _____

Available options:

- A. Discuss attached w/Rose or Flanigan.
- B. Accept draft as is.
- C.
- D.

Recommended next steps (author's recommendation):

A.

Director's comments:

____

____

Record of disposition and action taken.

Log out date __________ time __________

[illegible] ______________________________

Action requested ______________________________

Due Date ______________________________

Form OTP 10
January 1972

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL AERONAUTICS AND SPACE COUNCIL
WASHINGTON 20502

EXECUTIVE SECRETARY

June 22, 1972

MEMORANDUM FOR

Tom

THE HONORABLE CLAY T. WHITEHEAD
Director, Office of Telecommunications Policy

Subject: NASA Space Applications Policy

Attached is a draft memo from Pete to the Domestic Council, plus some "proposed views". I would appreciate your reaction to this in time that we may have an acceptable package prior to our meeting with Jon next week.

Of course, we would be pleased to participate in the policy review with the Domestic Council Staff.

Any thoughts/feedback concerning space planks?

Bill

William A. Anders

Attachment

DRAFT

MEMORANDUM FOR

THE HONORABLE JOHN D. EHRLICHMAN
Assistant to the President for Domestic Affairs

Subject: Proposed Space Applications Policy

I am enclosing a proposed statement of policy dealing with the role of NASA in stimulating the development of productive space applications for governmental or commercial purposes. Because such applications may cut across the full range of interests of other Federal departments and establishments, I believe that this proposal should be considered by the Domestic Council policy review process. I would be pleased to participate in such a review.

I have also attached some of my preliminary views on this subject.

Peter M. Flanigan

Enclosure

DRAFT

Views Regarding the Proposed Space Applications Policy

1. This policy should encourage implementation of the President's desire to shift toward space programs with practical applications.

2. The policy should be implemented in a manner which would encourage rather than inhibit assumption of a particular activity by the private sector or proper government user agency when appropriate.

3. Now that Europe has been deterred from participating in development of the launcher aspects of the Post Apollo Program, a major portion of their space budget probably will be devoted to space applications payloads. This should increase their ability to compete in the international commercial market for the provision of satellite services to third countries as well as themselves. The encouragement given to U. S. commercial interests by this policy should aid our international competitive position.

4. In order to insure that the "users" interests are given ample consideration, they should be encouraged to participate with NASA in all phases of the program.

5. Though the proposed policy may appear to be giving NASA a blank check in space applications, such need not be the case since all their undertakings would remain subject to Executive and Congressional review and approval.

June 1, 1972

SPACE APPLICATIONS POLICY

PURPOSE

To outline the role of the NASA in space applications.

DEFINITIONS

A "space application" is defined as the use of space systems and technologies to provide, improve, or support a function or service of value or benefit to a community of users.

"Users" are defined as the institutions or individuals that employ space applications systems in the execution of their own responsibilities or that benefit directly from the operation of such systems.

"Operational space application systems" are defined as those that can be relied upon by a given community of users to provide continuing, dependable services or functions.

"Operators" are defined as the institutions or individuals that provide the service or function of an operational space applications system, either governmental or private.

POLICY

Subject to the Executive and Congressional review and approval process, NASA provides service and support in space applications as appropriate to governmental departments and establishments, to commerce and industry, and to public service institutions. The NASA role differs in each of the three major phases of space applications activity:

Research. NASA may study and investigate any promising space applications concept, whether generated externally by potential system users or operators, or internally by assessment of the social and economic benefits to be derived therefrom. Research includes understanding of basic phenomena and advancement of technologies involved in an application, as well as systems oriented studies of the utility to users of the possible service or function.

NASA will normally fund space applications research and studies from its own appropriations.

Development and Demonstration. NASA may demonstrate any promising space application concept for which significant potential social or economic returns have been predicted from research and study, or for which the potential value of the technology involved has been similarly established.

Demonstration is the exercise of a partial or complete system that depends upon a space applications segment. The purpose of demonstration is to test the viability and assess the value of the system. Demonstration may include development of experimental flight hardware. Demonstration can be undertaken alone or in conjunction with potential users and operators, governmental or private. Demonstration includes operation of space and ground segments, delivery of services or benefits, and evaluation of results. Demonstration does not represent a real or implied commitment to the eventual deployment of an operational space application system. Demonstration is normally a necessary precursor to, and element of, any decision to deploy an operational space application segment or system.

In those cases where no decision as to the space application operator has been made, NASA may carry any developed space application system through to demonstration. In those cases where the space application operator has been selected, NASA may carry that application through to demonstration only after a formal policy determination has been made that this would be in the national interest.

NASA will normally fund space applications development and demonstrations from its own appropriations.

Prototype Development and Operational Deployment. When a decision has been made to deploy a government-owned operational space applications segment or system, that decision will normally include a determination of the user community to be served, the value of and method of payment for the service, and the selection of the operator or operators. For such government-owned operational systems, NASA may provide such support as: prototype system development; operational system development; procurement management; launch and orbital checkout;

data acquisition; ground data handling; or, in the case of multi-user space systems, even overall operational system management. Subject to agreement with the selected operating agency, NASA will normally fund prototype space system development from its own appropriations but be reimbursed for other functions.

For approved privately owned systems, NASA may, on request and on a reimburseable basis, provide such technical support as is in the national interest.

Note that reference to launch ~~[illegible]~~ guarantee has been struck out.

Launch policy for domestic satellites

JUN 2 2 1972

Mr. George M. Low
Deputy Administrator
National Aeronautics and Space
  Administration
Washington, D.C. 20546

Dear George:

Thank you for your letter of June 12 indicating NASA's desire to have someone from our Office work with Mr. Bernard Moritz in developing a staff study on a guaranteed launch policy for domestic satellites.

I have designated Mr. Walt Hinchman who, as you know, is an assistant director of OTP and has done a great deal of work in the area of domestic satellites. Mr. Moritz may get in touch with him directly to make further arrangements regarding the study.

Please let us know if there is anything else we can do in this regard.

Sincerely,

signed
TOM

Clay T. Whitehead

cc: DO Records
DO Chron
Mr. Whitehead (2)
Mr. Hinchman
HCH Subject
HCH Chron
Eva ✓

HHall:kmj:6/20/72

JUN 1 6 1972

Mr. Bernard Strassburg
Chief, Common Carrier Bureau
Federal Communications Commission
Washington, D.C. 20554

Dear Mr. Strassburg:

With reference to your letter of June 6, 1972, there are no national interest considerations to support COMSAT's request for further extension of its authority to provide service directly to the National Aeronautics and Space Administration (NASA) until completion of the NSC/NASCOM (Apollo Program). Further, the situation as stated in our letter to you of September 21, 1971, i.e., this requirement is not of such an exceptional or unique nature that it would warrant special consideration, remains unchanged.

Discussion of the COMSAT request with a NASA representative reveals that the facilities currently supporting the Apollo Program will be continued in support of the space shuttle and Skylab Program and that they have already gone to the commercial carriers for bids to provide this service. This development, of course, alters the reasoning that the current situation should obtain until completion of the Apollo Program. Again, as stated in my letter of September 1971, if your examination of this case were to show that conversion to a different common carrier would best serve the public interest, we would fully support such action.

Sincerely,

Clay T. Whitehead

cc: DO Record ✓
DO Chron
Mr. Whitehead (2)
GC Subj File
GC Chron File
Mr. Joyce
JACK THORNELL

DBHall/njs/6-15-72

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

June 6, 1972

IN REPLY REFER TO:

9540

Honorable Clay T. Whitehead
Office of Telecommunications Policy
1800 G Street, N. W.
Washington, D. C. 20504

Dear Mr. Whitehead:

The Commission has received a letter dated May 30, 1972, from Communications Corporation (Comsat), a copy of which is enclosed, requesting an extension of its present authority to provide service directly to the National Aeronautics and Space Administration (NASA) until the completion of NSC/NASCOM (Apollo Program), which Comsat states is scheduled for December 31, 1972.

As you know, the Commission, on October 28, 1971, extended Comsat's authority to provide this service directly to NASA through July, 1972 (32 F.C.C. 2d 433). Subsequent to that Commission action, we received a letter from NASA, a copy of which is enclosed which informed is that the Apollo Program was scheduled to end in December 1972.

In keeping with our established policy, we are requesting you to advise us whether there are any national interest consideration to support Comsat's request for this further extension of its authority. Further, we would appreciate receiving as precise information as possible concerning the date on which NASA's requirement for this service will end.

We are also inviting the interested U.S. international communications common carriers to submit comments on the Comsat request.

Sincerely yours,

Bernard Strassburg

Bernard Strassburg
Chief, Common Carrier Bureau

Enclosures - 2

#130

COMMON CARRIER BUREAU

MAY 31 1972

COMMUNICATIONS SATELLITE CORPORATION

May 30, 1972

GEORGE P. SAMPSON
Vice President
Operations

RECEIVED

MAY 30 1972

F. C. C.
OFFICE OF THE SECRETARY

Mr. Ben F. Waple, Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Attention: Common Carrier Bureau

Dear Sir:

By letter of October 28, 1971, the Commission granted the Communications Satellite Corporation an extension of authority to provide services directly to the National Aeronautical and Space Administration in support of the NCS/NASCOM (Apollo Project) through July, 1972, in the specific expectation, as noted therein, that the Apollo Project would be concluded by that date.

Due to launching postponements, it now appears however that the Apollo Project will not be concluded until the end of the year. NASA has already advised Comsat that service will definitely be required until the conclusion of the program. No further contractual arrangements between Comsat and NASA are necessary to permit this extension.

Accordingly, Comsat requests an extension of its present authority to provide services directly to NASA until the completion of the Apollo Program, now scheduled for December 31, 1972.

Respectfully submitted,

George P. Sampson

[redacted]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

NOV 11 1971

REPLY TO
ATTN OF: TN/#1765

Federal Communications Commission
Attn: Mr. Asher H. Ende
Deputy Chief, Common Carrier Bureau
Washington, DC 20554

Subject: Completion Date of Apollo Program

This is to confirm the currently scheduled completion date of the Apollo Program as was discussed in our telephone conversation on November 9, 1971.

Apollo 17, the last of the current series of Apollo flights, is scheduled for launch in December 1972 instead of July 1972. The July 1972 date was referred to in the Commission's letter to the Communications Satellite Corporation of October 26, 1971, for the Apollo service, and was apparently used because of the reference to it in OTP's letter of September 21, 1971, to the Commission.

In my discussions last September with Mr. Joyce in OTP regarding NASA's plans for continuing existing communications satellite services for the duration of the Apollo Program, I erroneously informed him that the last of the Apollo flights was scheduled for July 1972. This had been the schedule date for some time, but several months earlier, the schedule had been slipped to December 1972. Although I was aware of this slippage, I inadvertently failed to recall it in my discussion with Mr. Joyce.

I hope this explanation of how the erroneous information came about will clarify this matter and that no embarrassment is caused to the Commission as a result.

Paul A. Price

Paul A. Price
Chief, Communications and
Frequency Management

OFFICE OF TELECOMMUNICATIONS POLICY

Log In No. ____

ACTION MEMORANDUM FOR MR. WHITEHEAD

Through: Charles C. Joyce, Jr. CJ
From: David B. Hall DH
Subject: COMSAT Facilities in support of NASA Apollo Program

Co-ordinated with: Paul Price, NASA
Jack Thornell, OTP

Staff Opinions:

The justification given in our letter of September 1971, attached, is no longer valid since the facilities will continue in use past Apollo. This confirms our original position that a direct NASA/COMSAT is not justified under the unique and vital or other national security considerations.

Action required by the Director:
- None ____
- For your signature X
- Further discussion required with author ____
- Further discussion required with staff ____
  - Which member of the staff ____
- Approve attached draft ____
- Approve recommended course of action (see below) ____
- Other ____

Available options:
- A.
- B.
- C.
- D.

Recommended next steps (author's recommendation):
Your Signature

Director's comments:

Record of disposition and action taken.
- Log out date ______ time ______
- Referred to (name of staff member) ______
- Action requested ______
- Due Date ______

Form OTP 10
January 1972

September 21, 1971

Mr. Bernard Strassburg
Chief, Common Carrier Bureau
Federal Communications Commission
Washington, D.C. 20554

Dear Bernie:

With reference to the request of the Communications Satellite Corporation for continuation of certain direct contractual relationships with the National Aeronautics and Space Administration in support of the Apollo project, which was brought to our attention by your letter of August 25th, we have determined that this requirement is not of such an exceptional or unique nature that it would warrant special consideration on these grounds alone.

There is, however, the consideration that NASA has a ten year contract, executed in 1966, with Cable and Wireless, Ltd., for service from the Ascension Island Station to the satellite, and that operation of the terminal aboard the U.S.S. VANGUARD requires direct NASA involvement. Further, the Apollo program is scheduled to terminate next July. I believe this situation may point to some practical problems in the application of the Commission's "authorized-user" criteria, and a need to reexamine these, particularly in relation to this case. If such a reexamination were to show that conversion to a different carrier would best serve the public interest, either now or at any time in the future, we would fully support such action.

Sincerely,

/S/

George F. Mansur
Deputy Director

DBHall:clt:9-21-71

cc: DO Records
DO Chron
Mr. Whitehead
Mr. Hall
Mr. Doyle
Mr. Hinchman
Mr. Thornell

Coordinated with: Mr. Thornell
Mr. Hinchman
Mr. Doyle

September 21, 1971

COMSAT Service for NASA/Apollo

Dr. George Mansur

Bernie Strassburg wrote to Tom on August 25 asking for our view on whether NASA should continue to enjoy direct dealings with COMSAT for Apollo launch services. This was stimulated by a letter to Abbot Rosoman from WUI saying they would like to provide the service.

Strassburg's letter states that COMSAT has not requested continuance of these services. However, COMSAT did file tariffs for these services on September 1.

Dave Hall and I discussed this at length with Paul Price at NASA. They would like to continue dealing direct with COMSAT because:

a. They feel they are getting a lower rate.

b. The Apollo program only has one year to go and they see no point in bringing in a new intermediary now.

c. Dealing with an international record carrier is complicated, by the fact that NASA already has contracts for operation of the distant end earth facilities: The Ascension Island Station and the tracking ship.

We see no valid reason for a general exemption from the authorized user decision for NASA, but feel that some of the unique features of these two links should be considered by the FCC.

Dave Hall has checked with COMSAT on this matter. Bill Wood of COMSAT says they have no strong feelings either way re the provision of this service to NASA. Their basic opinion is that NASA should be provided with whatever facilities they want and COMSAT stands ready to cooperate with them to the extent necessary.

Recommend you sign the attached reply to Bernie Strassburg.

/S/

Charles C. Joyce, Jr.

Attachment

cc: DO Chron
DO Records
Steve Doyle
Dave Hall
Walter Hinchman
Jack Thornell

CCJoyce:clt

Tuesday 5/30/72

Assistant
5:50 David Williamson (Associate Administrator of NASA) 755-8527
said Mr. Fletcher sent over to you the proposed applications policy statement for NASA. You indicated you wanted to make some comments on it. Mr. Fletcher asked Mr. Williamson to call and see what you have specifically in mind -- prior to a meeting they are having on Thursday.

Would appreciate a call.

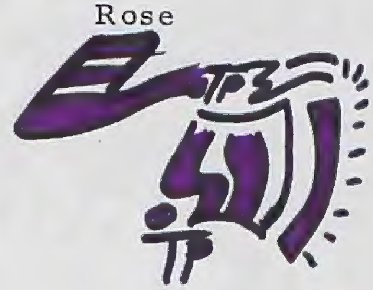
They will call us.

AGENDA

May 16, 1972
3:00 p.m.

Shuttle Congressional Status Assignments Schedule	Anders
Space Policy Questions Guarantees to Orbit Applications Satellites	Fletcher } link Rose }
NASA Budget	Low
Post Apollo International Cooperation	Rose

Early next week + cap



CTW/Anders what "we" think.

Jon (+) NASA cyclic policy

(+) NASA base study - don't let OMB end-run.

SRBT mtg

CTW, JR: good idea + US compet position in aero. (NASC?) (low-key look) Anders/Fletcher agree

+ Post-Apollo space cooprn.

H ~~Anders - Allen.~~

	SEC. CL.	ORIGIN	CONTROL NO.

DATE OF DOC	DATE REC'D	DATE OUT	SUSPENSE DATE
[illegible]	[illegible]	5-16	

CROSS REFERENCE OR POINT OF FILING

Misc. - Class.

TO

FROM [illegible]

SUBJ. [illegible]

[illegible] application.

ROUTING	DATE SENT
[illegible]	5-16
[illegible]	
[illegible]	5/17

COURIER NO.	ANSWERED	NO REPLY		
		✓		5

COPY FOR MR. WHITEHEAD

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

MAY 10 1972

OFFICE OF THE ADMINISTRATOR

MEMORANDUM

TO: Honorable Jonathan Rose
Special Assistant to the President
The White House

SUBJECT: Policy on Space Applications

In accordance with our recent discussions, I am forwarding a proposed Policy on Space Applications, together with a draft covering memorandum from Peter Flanigan to John Ehrlichman and a background paper describing the need for the policy.

If you concur in these papers, I assume that you will take whatever steps are necessary to seek approval by the Domestic Council.

Original signed by
James C. Fletcher

James C. Fletcher
Administrator

3 Attachments

cc: Mr. Whitehead
Mr. Anders

Draft Memo

MEMORANDUM FOR:

Honorable John D. Ehrlichman
Assistant to the President for
Domestic Affairs
The White House

I am enclosing a proposed statement of policy dealing with the role the National Aeronautics and Space Administration should play in bringing into being new, useful space-based systems for governmental or commercial purposes. Because the functions that such space applications systems can perform cut across the full range of interests of other Federal Departments and Establishments, an appropriate first step in promulgating such a policy would be to coordinate it with the Domestic Council. I therefore would appreciate it if you would include this proposed policy as an agenda item for the Council's review and consideration.

Peter M. Flanigan
Assistant to the President

Policy Paper

May 1, 1972

SPACE APPLICATIONS POLICY

PURPOSE

To outline the role of the NASA in space applications.

DEFINITIONS

A "space application" is defined as the use of space systems and technologies to provide, improve, or support a function or service of value or benefit to a community of users.

"Users" are defined as the institutions or individuals that employ space applications systems in the execution of their own responsibilities or that benefit directly from the operation of such systems.

"Operators" are defined as the institutions or individuals that provide the service or function of an operational space applications system, either governmental or private.

POLICY

In space applications, NASA provides service and support as appropriate to governmental departments and establishments, to commerce and industry, and to public service institutions. The NASA role differs in each of the three major phases of space applications activity:

Research. NASA may study and investigate any promising space applications concept, whether generated externally by potential system users or operators, or internally by assessment of the social and economic benefits to be derived therefrom. Research includes understanding of basic phenomena and advancement of technologies involved in an application, as well as systems oriented studies of the utility to users of the possible service or function.

NASA will normally fund space applications research and studies from its own appropriations.

Development and Demonstration. NASA may demonstrate any promising space application concept for which significant potential social or economic returns have been predicted from research and study, or for which the potential value of the technology involved has been similarly established.

Demonstration is the exercise of a partial or complete system that includes a space applications segment to test its viability and assess its value. Demonstration may include development of experimental flight hardware. Demonstration can be undertaken alone or in conjunction with potential users and operators, governmental or private. Demonstration includes operation of space and ground segments, delivery of services or benefits, and evaluation of results. Demonstration does not represent a real or implied commitment to the eventual deployment of an operational space application system. Demonstration is normally a necessary precursor to, and element of, the governmental decision to deploy, or permit to be deployed by private parties, an operational space application segment or system.

In those cases where no decision as to the space application operator has been made, NASA may carry any developed space application system through to demonstration. In those cases where the space application operator has been selected, NASA may carry that application through to demonstration only after a formal policy determination has been made that this would be in the national interest.

NASA will normally fund space applications development and demonstrations from its own appropriations.

Prototype Development and Operational Deployment. When a governmental decision has been made to deploy in its own right, or to permit private parties to deploy, operational space applications segments or systems, that decision will normally include a determination of the user community to be served, the value of and method of payment for the service, and the selection of the operator or operators. An operational space applications system implies permanent reliance on its services by a given community of users.

For government-owned systems, NASA may provide such support as: prototype system development; operational system development; procurement management; launch and orbital checkout; data acquisition; ground data handling; or, in the case of multi-user space systems, even overall operational system management. For government-owned systems, NASA will normally fund prototype space system development from its own appropriations but be reimbursed for other functions.

For privately owned systems, NASA may provide such technical support as is in the national interest on a reimbursable basis and will undertake to guarantee the placement in orbit of approved private and commercial space applications systems at a reasonable predetermined cost.

Background Paper

BACKGROUND

1. It is timely for the Administration to define now its policy on space applications and on the role of the National Aeronautics and Space Administration in space applications research, development, and demonstration:

    a. The direction of the NASA applications programs in the FY 1974 budget should clearly reflect the overall Administration posture, and the budget process is already under way.

    b. New applications of space technology and systems to useful governmental and commercial purposes are rapidly maturing; a coherent policy framework for selecting those to be afforded priority in development and deployment is necessary. Growing interest in the utilization of space capabilities is being frustrated by uncertainty as to agency roles and lack of a clearcut Administration commitment to its own space applications programs.

2. Specifically, space applications systems do or soon will provide services in such areas as point-to-point communication, radio and television broadcasting, navigation and traffic management, agricultural and geological resources surveys, meteorology, and environmental monitoring and prediction. Before such systems can be operationally deployed by governmental or private institutions, there needs to be an adequate basis of experience in research, experimental hardware development, and systems demonstration. Such experience limits risk and establishes the relationship between the costs expected and the social or economic returns proven feasible.

3. The proposed policy clearly outlines the role of NASA as being responsive to the possibilities of space technology for useful applications as well as to the stated needs and requirements of system users and operators. The policy would permit NASA to develop

experimental systems and demonstrate their utility under a variety of arrangements, including participation with commercial interests. The policy would clearly encourage private commercial exploitation of space technology by guaranteeing delivery to orbit of commercial systems at a reasonable cost.

4. The policy would establish NASA as the prototype developer for government-owned operational systems, as is the practice now relative to the Department of Commerce environmental satellite series. The Department of Commerce's operational satellite program was established by Congress in 1962 in recognition of NASA's highly successful experimental TIROS meteorological research satellite experience. In 1964, a formal interagency agreement was implemented between Commerce and NASA to define the roles of each agency relative to operational environmental satellite systems. This agreement, currently being updated, has provided the management mechanism under which NASA has funded and launched fifteen successful meteorological research and prototype satellites of its own and has, on a reimburseable basis, built and launched ten successful operational environmental satellites for Commerce. In addition, NASA has made available to Commerce the data relay services of an Applications Technology Satellite, permitting the rapid distribution of meteorological information to all parts of the nation. The key elements of the NASA-Commerce agreement are noted below, and offer a successful model for future interagency arrangements for other operational satellite systems:

   a. NASA with its own funds develops advanced technology and experimental satellites (TIROS, NIMBUS, ATS) with consideration of the future needs of the user communities.

   b. NASA with its own funds develops prototype operational spacecraft (TIROS-M, ITOS-A, TIROS-N, Synchronous Meteorological Satellite) in specific response to requirements established by the Department of Commerce.

c. The Department of Commerce funds NASA to design, engineer, procure, and launch operational satellites; Commerce also funds NASA to design and construct necessary operational ground stations.

d. The Department of Commerce obtains and uses for operational purposes data from sensors flown on NASA-funded satellites; any additional costs incurred by NASA in providing such data are reimbursed by Commerce.

e. A joint Commerce-NASA board maintains a continuing overview of both the experimental and operational programs to assure coordination and to resolve interagency issues.

5. It is felt that the Administration's enunciation of the proposed policy would be an important step toward the larger objective of assuring the earliest and fullest contribution of our national space investment to the public and private sectors. It is therefore recommended that the proposed policy be coordinated with the Domestic Council and, if accepted, become the formal Administration position on NASA's role in space applications.

NASA

May 11, 1972

MEMORANDUM FOR

Honorable George Shultz
Director
Office of Management and Budget

Jim Fletcher has written you regarding a revision of the NASA policy on launch cost recovery. The proposed action would, in essence, make the Government the insurer to cover the risk of launch failure with the insurance "premium" reflected in a higher launch fee, retaining full cost recovery over a number of launches.

This is an important and desirable change that we have been urging on NASA for three years. In view of the pending domestic communications satellite proceedings before the FCC and with serious corporate planning likely to begin in the near future, we should expedite this now that NASA has agreed to move. Our General Counsel, Antonin Scalia, has looked into the matter in some detail and would be pleased to discuss it with your staff if you would like.

Clay T. Whitehead

CTWhitehead:slr:5/11/72

cc: DO Records
DO Chron
Mr. Scalia
Mr. Whitehead ✓

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

MAY 10 1972

Honorable George P. Shultz
Director
Office of Management and Budget
Washington, D.C. 20503

Dear George:

The purpose of this letter is to recommend a change in the current policy regarding reimbursement to NASA for satellite launch services performed for others and to request your assistance in working out the most appropriate method for accomplishing this. NASA's present policy is to launch satellites for non-U.S. Government organizations subject to appropriate reimbursement for the services provided but without guarantee of the success of the launch. In essence, NASA now agrees to use best efforts to achieve specified launch objectives but we do not, in so doing, undertake any liability for damages to customer-owned spacecraft either prior to, during or after launch, damages due to delay in launch or third-party liability, excepting for that covered in the Federal Tort Claims Act, caused by spacecraft or launch vehicles.

Under this policy some commercial use has been made of our launch services but the full range of space applications has been inhibited by the uncertainty which characterizes the costs of placing a satellite in orbit. For example, in the event of a single launch failure or the remote possibility of failure of successive launches, a customer would be charged the cost of all launches needed to achieve launch success. Customers who cannot risk the uncertainty of large unknowns in their investment costs are inhibited from using space. Also, commercial customers who do now accept these risks would apparently prefer different arrangements under which launch services costs would be fixed with the Government guaranteeing launch success.

Experience to date is that a commercial customer has not been able to obtain full insurance coverage from the private sector against launch failures. While the space shuttle, when it becomes operational, should considerably improve the probability of launch success and lead to the availability of private insurance, we believe it is desirable now to encourage the use of space by private enterprise. Accordingly, we recommend that our launch services reimbursement policy relative to non-U.S. Government users should be altered to permit reimbursement on a fixed-price basis with guarantee of launch success. We would expect that the reimbursement would cover the anticipated or normal cost of a particular launch (as now calculated or as the Government should in the future determine to calculate it) as well as an additional amount representing the cost of NASA's success guarantee. The additional amount could be calculated from the launch failure rate related to particular launch vehicles and could be made subject to downward or upward adjustment at an appropriate time if a particular failure rate did not actually occur as contemplated when the amount of reimbursement was originally set. Our objective would be that the guarantee program would operate, over time, at no cost to the Government, with receipts precisely offsetting costs.

We have been able to implement the present policy under existing law and regulation. However, the recommended policy involves undertakings different from those we now make and may require specific legislative authorization. I would appreciate your designating a member of your staff to work with Mr. Bernard Moritz, NASA's Deputy Associate Administrator for Organization and Management, to develop the most appropriate method for implementing the recommended new policy.

Sincerely,

Original signed by
James C. Fletcher

James C. Fletcher
Administrator

cc:
Mr. William Morrill
Assistant Director
Office of Management and Budget
Washington, D.C. 20503

bcc:
Honorable Clay T. Whitehead
Director
Office of Telecommunications Policy
Washington, D.C. 20504

Honorable William A. Anders
Executive Secretary
National Aeronautics & Space Council
Executive Office of the President
Washington, D.C. 20500

Honorable Jonathan Rose
Special Assistant to the President
The White House
Washington, D.C. 20500

May 11, 1972

MEMORANDUM FOR

Honorable George Shultz
Director
Office of Management and Budget

Jim Fletcher has written you regarding a revision of the NASA policy on launch cost recovery. The proposed action would, in essence, make the Government the insurer to cover the risk of launch failure with the insurance "premium" reflected in a higher launch fee, retaining full cost recovery over a number of launches.

This is an important and desirable change that we have been urging on NASA for three years. In view of the pending domestic communications satellite proceedings before the FCC and with serious corporate planning likely to begin in the near future, we should expedite this now that NASA has agreed to move. Our General Counsel, Antonin Scalia, has looked into the matter in some detail and would be pleased to discuss it with your staff if you would like.

Clay T. Whitehead

cc: Dr. James Fletcher, NASA
Mr. David Williamson, Jr., NASA
DO Records
DO Chron
Mr. Whitehead
Mr. Scalia

CTWhitehead:slr

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

MAY 10 1972

Honorable George P. Shultz
Director
Office of Management and Budget
Washington, D.C. 20503

Dear George:

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Original signed by
James C. Fletcher

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Administrator

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Assistant Director
Office of Management and Budget
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bcc:
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Executive Secretary
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Executive Office of the President
Washington, D.C. 20500

Honorable Jonathan Rose
Special Assistant to the President
The White House
Washington, D.C. 20500

NATIONAL AERONAUTICS and SPACE COUNCIL

Executive Secretary

May 12, 1972

Tom:

You should find the attached interesting.

Bill

Bill Anders

Attachments (2)

Post 5/12/72

Congressional Report

Washington Post 5/12/72

NASA

Senate Votes NASA $3 Billion

The Senate yesterday overwhelmingly approved President Nixon's program to develop a reusable spacecraft capable of shutting men to and from a space station in orbit around the earth.

Members defeated 61 to 21 an attempt to kill the project by denying $227.9 million in the fiscal year beginning July 1 for research and development.

The Senate then passed by voice vote a $3.4 billion authorization for the National Aeronautics and Space Administration.

Sen. Walter F. Mondale (D-Minn.), charging that this year's space shuttle authorization was "merely the tip of a multibillion-dollar iceberg," said it would end up costing taxpayers more than $42 billion over a 12-year period.

The $3.4 billion bill is almost identical to a measure approved by the House last month. Senators added $12.5 million to the administration's budget request.

The authorization includes $540 million to develop the manned orbital Skylab space station, and $128.7 million to complete the Apollo moon exploration program with Apollo 17 in December.

The space shuttle, when completed, is to be capable of carrying three-man crews to an orbiting space station and returning to earth like a plane for up to 100 flights.

All four Washington-area senators voted against Mondale.

New York Times 5/12/72

NYT 5/12/72

SENATE VOTES AID TO SPACE SHUTTLE

$200-Million Is Authorized for Controversial Project

By RICHARD D. LYONS

Special to The New York Times

WASHINGTON, May 11 — The Senate approved today $3.4 billion in space authorization funds and all but committed the United States to a new era in space activities.

In line with the Administration's budget request and action by the House three weeks ago, the Senate bill authorized among its provisions the spending of over $200-million in funds for the controversial space shuttle program.

While minor differences in the House and Senate versions of the bill will have to be resolved before final passage, today's action assures that the National Aeronautics and Space Administration will be allowed to proceed with its favored project—a space transportation system far different from the one now in use.

The space shuttle, which might be test-flown in five years and in operation by 1980, combines the features of a plane and a rocket, allowing the vehicle to blast off from a launching pad, go into earth orbit and land on an airfield.

Use Craft 100 Times

Current blueprints call for a craft about the size of a DC-9 airliner, to be used perhaps as many as 100 times rather than being discarded after one mission as spacecraft are today.

Shuttle proponents have stressed that the vehicle would permit much greater flexibility in both civilian and military space operations since flights could be launched in a matter of days, rather than months as is now the case.

In addition, the main backers of the shuttle, NASA, the aerospace industry and their Congressional allies, insist that the use of the new vehicle would save perhaps as much as $7-billion over its lifetime since most of the shuttle's equipment could be used repeatedly.

But critics insisted again today in 90 minutes of generally unenthusiastic debate that the $200-million in shuttle funds, in the words of Senator Walter F. Mondale, "was only the tip of the iceberg of a program that would eventually cost as much as $5-billion before it was over."

The final voice vote came after critics of the shuttle, led by the Minnesota Democrat, were defeated 61 to 21 in attempts to have shuttle funds deleted from the bill.

The debate followed traditional lines with liberal Senators from the North trying to defeat the shuttle, while a coalition of conservatives and Senators from states with space installations backed the authorization measure.

Senator Edward J. Gurney, Republican of Florida, contended that the case being made against the shuttle was riddled with "shopworn arguments."

The authorization bill also includes $540-million for the manned Skylab space station, which is to go into operation next year, and $128-million to complete the lunar exploration program, which will end in December with the last flight, Apollo 17.

Senate Vote Analysis

Results	For	Against	Paired	Declared For	Not Voting
	61	21	1+1	5	11

Total Prediction Accuracy

Votes Predicted	86
Votes Mispredicted	3
Prediction Accuracy, %	96+

Analysis

Negative Votes)
Negative Votes by State) See Attachments
Positive Votes Predicted to be Negative)
Not Voting Analysis by State)

Summary

The prediction accuracy was actually based on the vote against the Mondale amendment to delete the space shuttle from the NASA authorization bill; only a voice vote was taken on the bill itself. Although it is not believed that any substantial change in the vote would have resulted, it is also believed that those changes would have likely favored passage of the bill.

As shown above, the prediction accuracy was quite high. Of the three votes mispredicted, two were forecast negative and voted plus; the other was forecast positive (by several sources) and voted negative. Most senators were contacted by several sources. This approach was found to be quite effective. Several senators who previously were negative changed their vote to positive. All major contactors had impressively high accuracy of prediction.

Analysis of the negative votes by state indicates that Rhode Island, West Virginia and Wisconsin were totally against the shuttle. These states are not anticipated to receive prime or major subcontracts on the shuttle, and, on the basis, these votes are explicable. Of the states which can anticipate a large share of shuttle work, Missouri and New York had one senator each that voted negative. The reasons for this condition should be determined if at all possible.

Adding the negative and not voting totals indicates that Arkansas, Oklahoma and South Dakota did not provide any support for the shuttle. Again, these states are not anticipated to receive major contracts on this project. However, if these votes did not change if the vote had been on the total NASA bill (rather than just the shuttle), it would be indicative that these states were not in favor of the space program. Under such circumstances an attempt should be made to illustrate the benefits of space to the residents of these states and their representatives.

Conclusions

The NASA authorization bill passed by an impressive margin. The appropriations bills, barring possible but unexpected entanglement in some large political issue, are expected to do likewise. Providing "strategic" focus to the ongoing "tactical" activities of the agency, et al, has shown to be advantageous. Such an arrangement should continue in order to maximize the probability of maintaining continuing support of the President's program as it faces successive budget cycles. Undoubtedly, detractors will appear as contracts are awarded and annual program funding requirements increase.

Senate Vote Analysis

I. Negative Votes - Including Paring

Name	State	Forecast	By
Burdick	D. N.Dak.	Negative	
Byrd	D. W.Va.	Negative	
Church	D. Idaho	Negative	
Eagleton	D. Mo.	Negative	
Fulbright	D. Ark.	Negative	
Harris	D. Okla.	Negative	
Hart	D. Mich.	Negative	
Hughes	D. Iowa	Negative	
Javits	R. N.Y.	Negative	
Kennedy	D. Mass.	Negative	
McGovern	D. S. Dak.	Negative	
Mansfield	D. Mont.	Negative	
Mondale	D. Minn.	Negative	
Muskie	D. Maine	Negative	
Nelson	D. Wisc.	Negative	
Pastore	D. R.I.	Negative	
Pell	D. R.I.	Negative	
Proxmire	D. Wisc.	Negative	
Randolph	D. W.Va.	Negative	
Roth	R. Del.	Positive	North American
Stevenson	D. Ill.	Negative	
Williams	D. N.J.	Negative	

II. Negative Vote Analysis by State

State	D	R	Total
Arkansas	1	—	1
Delaware	–	1	1
Idaho	1	–	1
Illinois	1	—	1
Iowa	1	—	1
Maine	1	—	1
Massachusetts	1	—	1
Michigan	1	–	1
Minnesota	1	–	1
Missouri	1	—	1
Montana	1	–	1
New Jersey	1	–	1
New York	—	1	1

II. Negative Vote Analysis by State (continued)

State	D	R	Total
North Dakota	1	–	1
Oklahoma	1	–	1
Rhode Island	2	–	2
South Dakota	1	–	1
West Virginia	2	–	2
Wisconsin	2	–	2
Total	20	2	22

III. Positive Votes Predicted to be Negative

Name	State	Predictor
Case	R. N.J.	Union
Metcalf	D. Mont.	Union

IV. Not Voting Analysis by State

State	D	R	Total
Alaska	1	–	1
Arkansas	1	–	1
Indiana	1	–	1
New Mexico	1	–	1
Ohio	–	1	1
Oklahoma	–	1	1
South Dakota	–	1	1
Tennessee	–	1	1
Vermont	–	1	1
Wyoming	1	1	2
Total	5	6	11

Of the not voting Senators, 8 were forecast to vote positive, 2 negative and 1 not voting.

	5-11 Prediction +	-	5-11 Vote +	-				
Aiken (R-Vt.)	✓		Absent					
Allen (D-Ala.)	✓		✓					
Allott (R-Colo)	✓		✓					
Anderson (D-N.Mex.)	✓		✓					
Baker (R-Tenn.)	✓		✓					
Bayh (D-Ind.)		✓	Absent					
Beall (R-Md.)	✓		✓					
Bellmon (R-Okla.)	✓		Absent					
Bennett (R-Utah)	✓		✓					
Bentsen (D-Tex.)	✓		✓					
Bible (D-Nev.)	✓		✓					
Boggs (R-Del.)	✓		✓					
Brock (R-Tenn.)	✓		Absent					
Brooke (R-Mass.)	✓		✓					
Buckley (D-N.Y.)	✓		✓					
Burdick (D-N.Dak.)		✓		✓				
Byrd (D-Va.)	✓		✓					
Byrd (D-W.Va.)		✓		✓				
Cannon (D-Nev.)	✓		✓					
Case (R-N.J.)		✓	✓					
Chiles (D-Fla.)	✓		✓					
Church (D-Idaho)		✓		✓				
Cook (R-Ky.)	✓		✓					
Cooper (R-Ky.)	✓		✓					
Cotton (R-N.H.)	✓		✓					
Cranston (D-Calif.)	✓		✓					

	5-11 Prediction +	5-11 Prediction −	5-11 Vote +	5-11 Vote −				
Curtis (R-Nebr.)	✓		✓					
Dole (R-Kans.)	✓		✓					
Dominick (R-Colo.)	✓		✓					
Eagleton (D-Mo.)		✓		✓				
Eastland (D-Miss.)	✓		Absent					
Ellender (D-La.)	✓		✓					
Ervin (D-N.C.)	✓		✓					
Fannin (R-Ariz.)	✓		✓					
Fong (R-Hawaii)	✓		✓					
Fulbright (D-Ark.)		✓		✓				
Gambrell (D-Ga.)	✓		Absent					
Goldwater (R-Ariz.)	✓		✓					
Gravel (D-Alaska)	✓		Absent					
Griffin (R-Mich.)	✓		✓					
Gurney (R-Fla.)	✓		✓					
Hansen (R-Wyo.)	✓		Absent					
Harris (D-Okla.)		✓		✓				
Hart (D-Mich.		✓		✓				
Hartke (D-Ind.)	✓		✓					
Hatfield (R-Oreg.)	✓		Absent					
Hollings (D-S.C.)	✓		✓					
Hruska (R-Nebr.)	✓		✓					
Hughes (D-Iowa)		✓		✓				
Humphrey (D-Minn.)	✓		Absent					
Inouye (D-Hawaii)	✓		✓					
Jackson (D-Wash.)	✓		✓					

	5-11 PREDICTION		5-11 VOTE					
	+	−	+	−				
Javits (R-N.Y.)		✓		✓				
Jordan (D-N.C.)	✓		✓					
Jordan (R-Idaho)	✓		✓					
Kennedy (D-Mass.)		✓		✓				
Long (D-La.)	✓		✓					
McClellan (D-Ark.)	✓		Absent					
McGee (D-Wyo.)	✓		Absent					
McGovern (D-S.Dak.)		✓	Absent					
McIntyre (D-N.H.)	✓		✓					
Magnuson (D-Wash.)	✓		✓					
Mansfield (D-Mont.)		✓		✓				
Mathias (R-Md.)	✓		✓					
Metcalf (D-Mont.)		✓	✓					
Miller (R-Iowa)	✓		✓					
Mondale (D-Minn.)		✓		✓				
Montoya (D-N. Mex.)	✓		Absent					
Moss (D-Utah)	✓		✓					
Mundt (R-S.Dak.)								
Muskie (D-Me.)		✓		✓				
Nelson (D-Wis.)		✓		✓				
Packwood (R-Oreg.)	✓		✓					
Pastore (D-R.I.)		✓		✓				
Pearson (R-Kans.)	✓		✓					
Pell (D-R.I.)		✓		✓				
Percy (R-Ill.)	✓		✓					
~~Prouty (R-Vt.)~~								

	5-11 Prediction +	5-11 Prediction −	5-11 Vote +	5-11 Vote −
Proxmire (D-Wis.)		✓		✓
Randolph (D-W.Va.)		✓		✓
Ribicoff (D-Conn.)	✓		✓	
Roth (R-Del.)	✓			✓
Saxbe (R-Ohio)	✓		✓	
Schweiker (R-Pa.)	✓		✓	
Scott (R-Pa.)	✓		✓	
Smith (R-Me.)	✓		✓	
Sparkman (D-Ala.)	✓		✓	
Spong (D-Va.)	✓		✓	
Stafford (R.Vt)	✓		Absent	
Stennis (D-Miss.)	✓		✓	
Stevens (R-Alaska)	✓		Absent	
Stevenson (D-Ill.)		✓		✓
Symington (D-Mo.)	✓		✓	
Taft (R-Ohio)		✓	Absent	
Talmadge (D-Ga.)	✓		✓	
Thurmond (R-S.C.)	✓		✓	
Tower (R-Tex.)	✓		✓	
Tunney (D-Calif.)	✓		✓	
Weicker (R-Conn.)	✓		✓	
Williams (D-N.J.)		✓		✓
Young (R-N.Dak.)	✓		✓	
Total Predicted	74	25		
Less Absent	14	3		
Net	60	22	61	21
If Present & Voting			6	1
Total Declared			67	22

Miller P

NASA

October 6, 1971

MEMORANDUM FOR THE EXECUTIVE SECRETARY

This memorandum is in response to your questions.

(1) The current nuclear rocket program is to develop a 75,000-pound thrust engine by about 1982 at a cost of about $1 billion for the reactor and engine and another $300 million for a flight stage.

(2) There are a number of ways that the cost and time could be reduced:

(a) Eliminate the requirement for manned operation. This would reduce much of the development aimed at providing adequate shielding.

(b) Simplify engine system and lower target performance. This would mean derating the reactor and pump to operate in a region where we are clearly not pushing the technology. For example, a one hour 6 start capability instead of the 10 hour 60 start now currently envisioned. Reactor thrust would also be reduced from 75,000 pounds to 50-60,000 pounds.

(c) Reduce expenditure on everything else but the main effort. In the past a disportionately high amount of funds have been spent on advanced technology for systems which were themselves advanced technology. The return on investment is much higher for systems which would be used in the near future.

The overall effect of the above changes would be to reduce the reactor and engine program to a total of $400 million to $600 million and the stage to $200 to $300. First flight for such a system could be envisioned by 1976, if go-ahead was given soon. Most of this money would be spent in California, with Aerojet the engine contractor and Douglas, already selected as the stage contractor, probably adding 1500-2500 people in the next year.

LASER/MHD

(3) Your question as to whether a prototype could be developed in a small size raises some complex questions. Studies were carried out in about 1965 or 1966 of a nuclear rocket engine of about 20,000 pounds thrust, based on a 200-400MW reactor which was actually built and tested by LASL. These studies were carried out by among others, Rocketdyne, Douglas, and Lockheed. The advantages of the smaller system are its lower cost and shorter development time (1/3 the cost and might be developed and fly in 3-1/2 to 4 years if given top priority). Although much of the specific design work carried out over the past few years by the contractors would not be applicable to a smaller size engine, the basic technology is the same. It would be a very straightforward development with no surprises. A 20,000 thrust engine would demonstrate the nuclear technology and would appear to be highly useful for unmanned orbit-to-orbit transfers thus leading to improved knowledge of how to operate with nuclear engines in space at the earliest date. The project people (SNPO) should really be consulted carefully on this as I don't think they would support it unless there was no other alternative.

John E. Morrissey

September 21, 1971

Mr. Bernard Strassburg
Chief, Common Carrier Bureau
Federal Communications Commission
Washington, D.C. 20554

Dear Bernie:

With reference to the request of the Communications Satellite Corporation for continuation of certain direct contractual relationships with the National Aeronautics and Space Administration in support of the Apollo project, which was brought to our attention by your letter of August 25th, we have determined that this requirement is not of such an exceptional or unique nature that it would warrant special consideration on these grounds alone.

There is, however, the consideration that NASA has a ten year contract, executed in 1966, with Cable and Wireless, Ltd., for service from the Ascension Island Station to the satellite, and that operation of the terminal aboard the U.S.S. VANGUARD requires direct NASA involvement. Further, the Apollo program is scheduled to terminate next July. I believe this situation may point to some practical problems in the application of the Commission's "authorized-user" criteria, and a need to reexamine these, particularly in relation to this case. If such a reexamination were to show that conversion to a different carrier would best serve the public interest, either now or at any time in the future, we would fully support such action.

Sincerely,

/S/

George F. Mansur
Deputy Director

DBHall:clt:9-21-71

cc: DO Records
DO Chron
Mr. Whitehead
Mr. Hall
Mr. Doyle
Mr. Hinchman
Mr. Thornell

Coordinated with: Mr. Thornell
Mr. Hinchman
Mr. Doyle

OFFICE OF TELECOMMUNICATIONS POLICY

Log In No. ____

ACTION MEMORANDUM FOR MR. WHITEHEAD

Through: Charles C. Joyce, Jr.
From: David B. Hall
Subject: COMSAT Facilities in support of NASA Apollo Program

Co-ordinated with: Paul Price, NASA
Jack Thornell, OTP

Staff Opinions:

The justification given in our letter of September 1971, attached, is no longer valid since the facilities will continue in use past Apollo. This confirms our original position that a direct NASA/COMSAT is not justified under the unique and vital or other national security considerations.

Action required by the Director:

None ____
For your signature X
Further discussion required with author ____
Further discussion required with staff ____
Which member of the staff ____
Approve attached draft ____
Approve recommended course of action (see below) ____
Other ____

Available options:

A. C.
B. D.

Recommended next steps (author's recommendation):
Your Signature

Director's comments:

Record of disposition and action taken.

Log out date 6/26 time ____
Referred to (name of staff member) ____
Action requested ____
Due Date ____

Form OTP 10
January 1972

September 21, 1971

COMSAT Service for NASA/Apollo

Dr. George Mansur

Bernie Strassburg wrote to Tom on August 25 asking for our view on whether NASA should continue to enjoy direct dealings with COMSAT for Apollo launch services. This was stimulated by a letter to Abbot Roseman from WUI saying they would like to provide the service.

Strassburg's letter states that COMSAT has not requested continuance of these services. However, COMSAT did file tariffs for these services on September 1.

Dave Hall and I discussed this at length with Paul Price at NASA. They would like to continue dealing direct with COMSAT because:

a. They feel they are getting a lower rate.

b. The Apollo program only has one year to go and they see no point in bringing in a new intermediary now.

c. Dealing with an international record carrier is complicated, by the fact that NASA already has contracts for operation of the distant end earth facilities: The Ascension Island Station and the tracking ship.

We see no valid reason for a general exemption from the authorized user decision for NASA, but feel that some of the unique features of these two links should be considered by the FCC.

Dave Hall has checked with COMSAT on this matter. Bill Wood of COMSAT says they have no strong feelings either way re the provision of this service to NASA. Their basic opinion is that NASA should be provided with whatever facilities they want and COMSAT stands ready to cooperate with them to the extent necessary.

Recommend you sign the attached reply to Bernie Strassburg.

/S/

Charles C. Joyce, Jr.

Attachment

cc: DO Chron
DO Records
Steve Doyle
Dave Hall
Walter Hinchman
Jack Thornell

CCJoyce:clt

Routing Slip
Office of Telecommunications Policy

Date: SEP 14 1971

From:
To:

✓	~~Whitehead, C. T.~~	Copy
	Mansur, G. F.	Copy
	Babcock, C.	
	Buss, L.	
	Carruthers, B.	
	Cooke, A.	
	Culpepper, C.	
	Dean, W.	
	Doyle, S.	
	Enslow, P.	
	Goldberg, H.	
	Hailey, L.	
	Hall, D.	
	Hinchman, W.	
	Jansky, D.	
	Johnston, B.	
	Joyce, C.	
	Lamb, B.	
	Lasher, S.	
	Lyons, W.	
	McCrudden, M.	
	Nelson, R.	
	Owen, B.	
	Raish, L.	
	Robinson, K.	
	Scalia, A.	
	Smith, L.	
	Thornell, J.	Copy
	Urbany, F.	
	Ward, D.	

Remarks:

343 D
NASA
Send copy
To Tom Whitehead
from: Jon Rose

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICE OF THE ADMINISTRATOR

AUG 20 1971

Honorable Peter M. Flanigan
Assistant to the President
The White House
Washington, DC 20500

Dear Peter:

George Shultz asked me for a short paper on the scientific results of Apollo 15. A copy of the paper we sent him is enclosed for your information.

Enclosed with the paper is a sampling of thirteen statements by some of the scientists involved in the flight, giving their views concerning the mission. Their exuberance is clearly evident.

Sincerely,

Jim F

James C. Fletcher
Administrator

Enclosures

SCIENCE ON APOLLO 15

The moon, the only body in our solar system other than the earth which man himself can now explore, has long held the promise of revealing exciting, scientific discoveries. Man's seventh flight to the moon and fourth landing has been called a great scientific achievement. The first manned lunar landing, and each subsequent mission have added greatly to our store of new knowledge. Apollo 15 is expected to surpass by far any of the previous missions when the final analyses of all the data are carried out, because it had an expanded payload capability and because it was the first mission involving coordinated surface and orbital experiments.

The Apollo 15 mission has demonstrated, more than any previous manned flight, the value of man in space. The explicit and keen observations of the astronauts, combined with the analysis of material returned from the moon, have already led to new scientific discoveries. In addition to their roles as explorers, the crew diagnosed and corrected equipment malfunctions which permitted the successful completion of several important objectives that would have been lost had man not been present.

Exploration of the Hadley/Apennine landing site by the crew of Apollo 15 accomplished all of the primary mission objectives. The four geological targets of highest priority were reached. The lowest priority target, exploration of the North Complex, was omitted because of lack of time. Deployment of the geophysical station (ALSEP) was completely successful, and all experiments are operating as planned. A final high-priority objective, the return of a deep core sample, was also attained.

Some of the significant scientific aspects of the Apollo 15 mission are already evident, although it may well be several years before sufficient analysis and data correlation are in hand to appreciate fully the magnitude of this accomplishment. Several examples follow. The Apennine

Mountains are now known to be layered, thus indicating that the history of the moon, prior to the formation of the Imbrium Basin some four billion years ago, was complex but evolving along processes similar to those already observed on the earth and moon. It is this early history in the evolution of a planet that has intrigued scientists, primarily because the comparable early history of the earth has been obliterated by later processes and cannot now be studied. A detailed understanding of the moon will thus lead to a better understanding about the earth, its origin and evolution, and perhaps even its mineral resources. The white crystalline rock described by Scott, may well be a piece of the early lunar crust which has never been conclusively identified among the samples returned from previous missions. This rock may prove to be the missing chemical link in understanding the early evolution of the moon. (Because of the importance of collecting this material, Apollos 16 and 17, among the many other scientific objectives to be accomplished, will continue the search, and hopefully will unravel the complex history of the moon through the study of the lunar highlands.) Another significant find was the bedrock collected at Hadley Rille. Samples of this bedrock will indicate the processes of formation of the Mare and, hopefully, the Rille itself. Finally, the deep core sample will allow us to study, layer by layer, a long period in the moon's past, from the present back perhaps a billion years in the moon's history.

Data now being telemetered from the ALSEP experiments left on the moon's surface are already disclosing new information about the moon's deep interior. Seismic events were recorded for the first time simultaneously on three instruments during the moon's recent perigee. The centers of these events are now being precisely located. Data from the second magnetometer, in conjunction with orbital magnetometer readings from the subsatellite, will now allow us to interpret the structure and thermal regime of the moon to its very core. Both of these interpretations, supported by data from the first heat flow experiment, will give us a firm starting point from which valid comparisons of the earth and moon can be made. A three station laser ranging retroreflector network has also been established. Precise measurements between the earth and these stations on the moon over many years will give us a better understanding of the interior structure of both bodies and eventually allow us to measure movements in the earth's crust.

A major factor in the Apollo Program's increase in capability for scientific exploration was the addition in Apollo 15 of the orbital science payload. This global survey technique adds a new dimension to the Apollo Program. From the data acquired, the moon's magnetic and gravity fields will be plotted, and physical and chemical maps will be compiled and correlated with large portions of the surface photographed.

The orbital geochemical sensors have demonstrated that we now have the capability to extrapolate our knowledge, obtained at the landing sites, to other areas of the moon, including the farside. The preliminary orbital data have already shown that Mare material is low in aluminum and high in magnesium relative to the Highlands. Radioactivity profiles obtained from orbit show relatively high levels over Imbrium. This is compatible with earlier geologic studies suggesting that the Fra Mauro material is ejecta from the Imbrium impact. Correlation of the orbital data with sample studies will lead to the understanding of the processes and events which have modified the moon. Orbital data have shown that in addition to distinct relationships between topography and chemical composition, there is a relationship between chemical composition and gravity profile as well.

In summary, Apollo 15 has established that a comprehensive scientific endeavor, including disciplines from both orbital and surface science, can materially add to the understanding of the history and composition of the moon. The crew was superbly trained and highly skilled and was thus able to focus on the important and on the unexpected -- to help develop a new level of understanding about our sister planet. The observed layering and organization of the lunar material in the Apennine Mountains and the Hadley Rille, together with the information from the third scientific station emplaced on the moon, as well as detailed measurements from lunar orbit, have already added many pieces to the puzzle about the origin of the moon, the earth, the solar system, and the universe.

Enclosures:
1. Summary of Scientific Achievements
2. Statements from scientists associated with Apollo 15.

NASA/August 17, 1971.

APOLLO 15 SCIENTIFIC ACHIEVEMENTS

Achievements

Total Distance Traversed	27.9 Km
Total Sample Return	~ 80 kg
Total EVA Manhours	37 hours

First three-station lunar network of geophysical instruments
- Passive Seismometer
- Laser Ranging Retroreflector
- Suprathermal Ion Detector

First two-station lunar network of geophysical instruments
- Lunar Surface Magnetometer
- Cold Cathode Ionization Gauge
- Solar Wind Spectrometer

Solar Wind Composition Experiment exposure time doubled

Deep core from lunar surface (~ 225 cm.)

Layering of Apennine Mountains photographed and described

Bedrock samples collected for first time

First major science station in lunar orbit

First comprehensive study of lunar chemical composition from lunar orbit

First comprehensive study of lunar atmosphere from lunar orbit

Orbital location of local lunar magnetic anomalies associated with craters

Confirmation of chemical difference between Mare and Highlands

High quality mapping photography

Correlation of Laser altimetry with spacecraft doppler tracking measured the offset between Center of Mass and Center of Figure of moon

Unique studies of galactic X-Ray Sources

Surface Experiments

Passive Seismic Experiment
Heat Flow Experiment
Lunar Surface Magnetometer
Suprathermal Ion Detector Experiment
Solar Wind Composition
Cold Cathode Gauge Experiment
Laser Ranging Retroreflector
Solar Wind Composition
Lunar Geology Investigation
Soil Mechanics Experiment
Lunar Dust Detector

Orbital Experiments

Gamma-Ray Spectrometer
X-Ray Spectrometer
Alpha-Particle Spectrometer
S-Band Transponder (CSM & LM)
Mass Spectrometer
Bistatic Radar
Subsatellite:
- Particle Measurement
- Magnetometer
- S-Band Transponder

CM Window Meteoroid
UV Photo Earth and Moon
Gegenschein

Orbital Facilities

61 cm. Panoramic Camera
7.6 cm. Mapping Camera
Laser Astimeter

Mr. Frederick J. Doyle
Research Scientist, Mapping Division
United States Geological Survey,
Topographic Division
Chairman, Apollo Orbital Science Photographic Team
Past President, American Society of Photogrammetry

"The orbital cameras flown on Apollo 15 are part of an integrated system which includes the cameras themselves, the spacecraft tracking, the Laser Altimeter, and the ground data reduction equipment and techniques. Simply in terms of information gathering ability, the Panoramic Camera is equivalent to sixty Lunar Orbiters, and the Mapping Camera to fifteen more Lunar Orbiters. The combination of Mapping Camera, Stellar Camera, Laser Altimeter, and tracking data will permit the precise location of any point on the moon's surface recorded by the cameras.

In addition to providing a cartographic base for location of the data recorded by the other Apollo orbital sensors, this information will permit inferences to be drawn regarding the departure of the moon's shape from spherical, the separation of the center of mass from the center of figure and the correlation of topographic features with gravity anomalies.

These facts have geophysical implications regarding a hot or cold genesis for the moon, and the extent to which tectonic forces may still be operating."

Dr. Leon Silver
Professor,
California Institute of Technology
Co-Investigator, Lunar Surface Geology Experiment
Member, Preliminary Examination Team

"Apollo 15 has yielded the most comprehensive sampling observations and photography of any lunar mission today. These should provide the basis for developing a more accurate understanding and should extend the effective known time span of the history of the moon. They should also extend our understanding of the physical nature of the moon to significant depths, perhaps to 10 km or more. We have probably moved a major step closer to understanding the evolution of the sister planetary body. The new clues to the chemical evolution of the moon can mean a closer understanding of how important chemical elements useful to man were concentrated on our own planet. Equally important, the deep core of the soil and the other cores and soil samples are the best record we have of the activities of our sun for the past several billion years. We share the effects of variations in solar activities with the moon and this record will provide knowledge vital to the well being of man who is so dependent on the activities of the sun."

Dr. Richard H. Jahns
Dean, Department of Earth Sciences
Stanford University
President, Geological Society of America

"Beyond the more obvious elements of spectacular success, the Apollo 15 mission deserves special recognition in the context of scientific accomplishment. The return of records, materials, and descriptive information from a site of great geologic density was remarkable in scope and quality; it was an impressive "delivery of the goods" RELATIVE TO SCIENTIFIC JUSTIFICATION OF THE LUNAR EXPLORATION PROGRAM.

More than this, Apollo 15 firmly demonstrated the wisdom of a manned lunar program. The astronauts handled an astonishingly large number of complex tasks, including some for which direct human input was uniquely required. Their presence on the scene yielded the best description and documentation of lunar features yet obtained, and it made possible some useful changes in procedure as responses to unexpected conditions. It is difficult to conceive of a comparable unmanned mission that would have been more than a pallid substitute in terms of results obtained.

The combination of a carefully selected site, exceptionally able and well trained astronauts, top quality equipment, and coordinated planning and back-up efforts paid off handsomely for science, and from Apollo 15 we should learn a great deal about lunar materials, features, and history. From it we may also learn something about the early history of the earth, which it is felt has been little more than conjecture."

Dr. Robert M. Walker
McDonnell Professor of Physics
Washington University
Principal Investigator Lunar Sample Program

"The Apollo 15 mission was clearly a milestone in human achievement. Perhaps most astonishing was the evident advance in scientific accomplishment over earlier missions. So many things were so much better that it is hard to single out any one improvement. The Lunar Rover, made it possible to sample many important formations. The deep drill represents a quantum jump in our ability to understand the evolution of the lunar surface. The orbital experiment will make it possible to tie our ground observations to the moon as a whole.

The crew was simply great. The evident understanding of the scientific objectives speaks highly of their intelligence, their dedication, and, equally important, their excellent training. With this mission, scientific exploration of the moon matured. All involved have my heart-felt congratulations and my deepest thanks."

Dr. Larry A. Haskin
Professor of Chemistry,
University of Wisconsin
Vice-Chairman, Lunar Sample Analysis
Planning Team
Principal Investigator, Lunar Sample Program

"The Astronauts were very efficient and conservative in their efforts, which clearly reflects not merely the special interest of Scott and Irwin in the scientific aspects of their mission but also shifts in emphasis in Astronaut training. It was important to have Astronauts who understood the essence of the scientific needs of the mission to the point that they could make good decisions themselves while on the surface; it was also important that a group of groundbased scientists representing a range of disciplines could still influence their sampling activities....
The opportunity for our representatives in Houston to be consulted during the surface activities about the suitability of or necessity at a given site for the collection of comprehensive samples was very important....
I have always been impressed that NASA could coordinate vastly complex hardware and so many people in order to get men to the moon and back. Now I am thanking you and your organization at MSC for also successfully coordinating our scientific needs deeply enough into mission planning to bring them to fruition on the lunar surface."

Dr. G. J. Wasserburg
Professor of Geology and Geophysics,
California Institute of Technology
Principal Investigator, Lunar Sample Program
Member, National Academy of Sciences and
National Research Council
Member, The U. S. National Committee for Geochemistry

"Apollo 15 has initiated an advanced series of lunar missions with extraordinary success. This mission represents a quantum jump to a new state in lunar exploration. The skill and dedication of the astronauts in carrying out this endeavor in exploration and science is coupled with a major increase in mobility and versatility which will yield much more fruit in future lunar missions."

Dr. James R. Arnold
Professor of Chemistry
University of California, San Diego
Principal Investigator, Apollo Gamma Ray
Spectrometer
National Academy of Science

"The orbiting geochemical package on Apollo 15 represents the achievement of a dream of many years: mapping the chemical composition of a broad and representative part of the lunar surface. This was accomplished with a group of sensors (Gamma Ray, X-Ray, and Alpha Particle) mounted in the Service Module, which were in use through the period of lunar orbit, and on the way home. It is remarkable that we are learning much about the chemical composition of the backside of the moon, where samples will probably not be collected for decades. It is equally remarkable that we can obtain typical, or average composition over large regions, for example a mean for Mare Crisium, rather than that of samples from a local point.

This milestone has many implications for the future of lunar and planetary research. We can look forward to accurate chemical maps over the whole moon, including the polar regions where volatiles may be concentrated, and to mapping of Mars, Mercury, and the Asteroids."

Dr. Isidore Adler
Senior Scientist, Theoretical Studies Branch
Goddard Space Flight Center
Principal Investigator, Apollo X-Ray Spectrometer

"I find this probably the most exciting thing that has ever happened to me scientifically." Three things strike me as very significant."

1. "We are getting chemical information about a large portion of the moon, far larger than one could hope to get by just going to the surface."

2. "We are getting chemical and physical information about the backside of the moon which is probably inaccessible by any other means."

3. "We have demonstrated very effectively, the power of this remote sensing technique and its significance to remote analysis of planetary surfaces, and perhaps its use in geochemical prospecting."

Dr. Gary V. Latham
Senior Research Associate
Lamont-Doherty Geological Observatory
Principal Investigator Passive Seismic Experiment

"With the successful installation of a geophysical station at Hadley Rille, the Apollo Program has for the first time achieved a network of stations on the lunar surface; a network that is absolutely essential for the location of natural events on the moon. The establishment of this network is perhaps the most important milestone in the geophysical exploration of the moon. The first event to be recorded on all three stations was man-made: the impact of the LM ascent stage near the Apollo 15 station. The now familiar rumble generated by this impact spread slowly outward and reached the Apollo 15 station in 28 seconds and the Apollo 12 and 14 stations, 1,100 km to the south in about seven minutes. The fact that this small source of energy was detected at such great range strongly supports the hypothesis that meteorite impacts are being detected from the entire lunar surface.

The SIVB impact from mission 15 extended the depth to which lunar structure can be determined by seismic methods to nearly 100 km. From these additional data, it now appears that a change in composition may occur at a depth of 25 km beneath the surface. If so, this would be strong evidence for the presence of a lunar crust, equivalent to the crust of the earth, and of about the same thickness."

Dr. Paul Gorenstein
Senior Staff Scientist
Space Research Division
American Science and Engineering
Principal Investigator, Apollo Alpha
Particle Spectrometer

"Apollo 15 presented our first opportunity for an extensive study of the chemistry of the lunar surface. We have surveyed an area amounting to over 1,000,000 square miles with the Gamma-ray, X-ray, and Alpha Particle Spectrometers from the orbiting Command and Service Modules. We have successfully mapped the chemical composition of a substantial portion of the surface including regions on the farside of the moon. In particular, we have obtained the first compositional data on the backside. Significant differences in chemical composition between Maria and highland regions have been observed.

Within the regions surveyed by Apollo 15, we will be able to locate possible areas of unusual chemical composition, high radioactivity concentration, or sites of outgassing phenomena.

During the trans-earth coast, the X-ray spectrometer observed previously discovered X-ray objects deep in our galaxy. The X-ray emissions from these objects do not penetrate our atmosphere, so are observable only from space. By pointing the instrument at several of these objects for periods of up to one hour, we obtained the longest coverage to date. Ground based optical and radio observatories in the Soviet Union and Europe participated in simultaneous observation with Apollo 15 of two objects whose time varying light and radio emissions are detectable at the earth. Hence, we succeeded in obtaining unique and important data in the area of galactic X-ray astronomy. We have the data necessary for assessing the potential of the moon and near-lunar environment as a base for X-ray astronomy."

Mr. William L. Sjogren
Member, Technical Staff, Tracking and
Orbit Determination Section
Jet Propulsion Laboratory
Principal Investigator, Apollo S-band Transponder
Gravity Experiment

"The data from Apollo 15 science will no doubt be continually bearing fruit for the next several years. The simultaneous, concentrated effort of so many disciplines will provide a unified understanding of the moon. This understanding is basic, for man must eventually leave this earth and inhabit other planets and solar systems. Man will not die like his mindless animal ancestors from eon to eon, for his search for truth and knowledge will certainly continue his existence. Preliminary results from Apollo 15 science has been very illuminating. Gravity, seismic, chemical, thermal, and magnetic data are tying together beautifully. Some first farside data, other than photography, are now available. Correlation between these results will provide definite theoretical models of the moon. We can then appreciate what can and cannot be done with the moon to further our understanding of the other planets and of the earth itself."

Dr. Johannes Geiss
Director, Physikalisches Institut,
University of Berne
Principal Investigator, Solar Wind Composition Experiment

"Congratulation to NASA for a mission of great scientific significance. The rocks collected with expertise by the Apollo 15 astronauts should reveal the sequence of events which formed Mare Imbrium and the Apennine Mountains during the early history of the moon. The record of the first billion years of the earth's history was essentially destroyed by its own geological activity. Investigations on the Hadley rocks together with geologic-geophysical observations should enable us for the first time to draw firm conclusions about this early epoch in the history of the solar system, and about the process of formation of planetary bodies.

Apollo 15 has demonstrated the essential role man plays in the exploration and scientific investigation of the very complex solid bodies in the solar system.

Our Solar Wind Composition Experiment has collected solar matter over a period twice as long as in earlier Apollo missions. Consequently, we expect to obtain precise data on abundances in the sun of rare isotopes such as Neon-21 and Argon-38. By comparing isotopic and elemental abundance results from different missions we study acceleration and fractionation processes in the solar atmosphere. Presently we interprete the observed difference between the helium isotope abundances of meteoritic and solar matter as due to nuclear processes inside the sun. The difference between the neon isotopic composition in the sun and in the earth's atmosphere is due to gas losses from the latter. Since the Solar Wind is one of the principal sources of gas in the lunar atmosphere, our experiment establishes the rates of input to the lunar surface of gases which are found in the atmosphere of the moon.

I wish to thank you for the cooperation NASA has generously extended to our institute."

Dr. John H. Hoffman
Associate Professor
Division of Atmospheric and Space Sciences
University of Texas at Dallas
Principal Investigator, Apollo Lunar Orbital
Mass Spectrometer

"Apollo 15 has given us an opportunity to observe the lunar atmosphere for the first time with an instrument designed to determine the composition and abundance of the gases associated with the moon. Preliminary results show an unexpectedly large population of gas molecules at lunar orbit altitudes. Many kinds of gases, from water vapor and carbon dioxide to many hydrocarbon molecules are observed.

In addition, the data covers a significant fraction of the moon's surface, and gives us an opportunity to search for volcanic type events that release gases into the atmosphere. One such event may already have been observed on the backside.

The Apollo 15 flight, with its abundant scientific return will certainly provide a much deeper understanding of the solar system, and hopefully is the beginning of a detailed scientific investigation of the moon."

JUL 3 0 1971

MEMORANDUM FOR

Mr. Peter Flanigan
Dr. Edward David

I have been trying to think through where we are and where we might want to be going on the question of international cooperation in space and our own planning for the post-Apollo space program. It seems to me that most of the discussions on these subjects going on in the bureaucracy have gotten mired down in a narrow perspective and far too much detail.

I suppose my thoughts basically boil down to two propositions and a rather simple proposal:

Propositions:

1. Launch assurances are the main issue with the Europeans; if the United States is going to give away launch assurances on a significant basis, we should get far more credit for the country and President than the current scenarios would permit. This should be announced and played as the really significant U.S. initiative it is.

2. With the passing of the moon landing goal, we have not been able to find any useful rationale or planning framework to guide NASA in planning the space program. We very much need to find some such device to guide planning and establish expenditure restraints.

Proposal:

Put NASA launch operations (include launch vehicle design and procurement) on a commercial accounting basis within NASA; this presumably would involve some kind of trust fund or industrial fund that would take full account of investment, operating costs, depreciation, etc. Have the President announce that NASA launch operations are being put on a commercial-type basis and that these services will be made available to the nations of the world and to private business on nondiscriminatory economic basis. The general pitch would be that the United States was putting space launch services on a stable, regular basis for the economic, social, and scientific benefit of mankind.

This clearly needs some more thought to fill out the scope and the posture that would maximize our various objectives, but I believe something like this has great promise. If you agree, I propose that we establish a small Executive Office working group to explore the idea a bit more before getting NASA and State all excited.

Clay T. Whitehead

Clay T. Whitehead

cc: Mr. Whitehead (2)
Subject File
Chron File

CTWhitehead:ed/jm/ec:7/27/71

Post Apollo

JUL 3 0 1971

MEMORANDUM FOR

Mr. Peter Flanigan
Dr. Edward David

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Clay T. Whitehead

cc: Mr. Whitehead (2)
Subject File
Chron File

CTWhitehead:ed/jm/ec:7/27/71

nasa

June 29, 1971

To: Dick Speier

From: Tom Whitehead

These are the things you asked to borrow. Please return as soon as you have read it.

Attachments: NASA papers: (1) Introduction to NASA Presentation on Post-Apollo
(2) Technology Transfer in the Post-Apollo Program
(3) Alternatives to Post-Apollo Participation

"The Artist's Guide to His Market" by Betty Chamberlain -- books belongs to Speier.

NASA

Tuesday 6/22/71

9:50 Professor Rathjens of MIT called again.

Mr. Whitehead spoke with him.

OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON

June 21/4:50

Eva-

Professor Herrington and Professor Rathjens of MIT called. They wanted to speak with Mr. Whitehead and if he was not available Walt Hinchman. I delayed action by saying that Mr. Whitehead was away from his desk, but I would see if Mr. Hinchman was available. Walt had departed for Geneva. They are doing a Domestic Satellite Study for NASA and wishes to discuss that subject. Mr. Whitehead said he would speak to them or Dr. Mansur would -- they are to call back in the morning.

timmie

Monday 4/26/71

NASA
MEETING
4/27/71
10 a. m.

8:55 Stephen Bull's office called to invite you to the swearing-in ceremony for Mr. Fletcher in the President's office tomorrow (4/27) at 10 a. m.

9:55 We have accepted the invitation.

NASA

Thursday 4/15/71

4:55 We understand that Dr. James C. Fletcher of Brigham Young University has been confirmed by the Senate to be the Nasa Administrator -- but has not yet been sworn in.

(Has a sporadic schedule but we can check with Miss Covert (13) 36931 if we need to know his schedule.)

cc: Dr. Mansur

NASA

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON, D.C. 20504

Date: April 9, 1971

Subject: GE Contractual Support

To: G. F. Mansur

The following is submitted in response to your memo of March 26, 1971, on the GE Support Contract:

a. Since spectrum/orbit utilization considerations in connection with the WARC have been essentially completed, it is timely for NASA to "take over" and support directly any additional studies they feel necessary.

b. The enclosure was forwarded to NASA to terminate the contract so far as OTP is concerned, return the monies proposed for follow on efforts and, in effect, get OTP out of the area.

c. The foregoing letter was coordinated in advance with OEP (J.R. O'Connell and G. Choiniere) and NASA (Dick Marsten's personnel).

d. Upon formal acceptance by NASA, the contract will be amended to terminate OEP/OTP contractual obligations to GE and turn over further actions to NASA.

e. The views expressed in your March 26 memorandum are understood, concurred in, and will be borne in mind in the future.

Will

W. Dean, Jr.

Enclosure

cc. C.T. Whitehead ✓
W. Hinchman
F. Urbany

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON, D.C. 20504

April 8, 1971

Dr. Richard B. Marsten
Director Communications Programs
NASA Headquarters
Code SC
Washington, D. C. 20546

Dear Dr. Marsten:

As you are aware, your Office, the FCC, and this Office have for over two years jointly funded and participated in Contract No. OTP-SE-69-102 with the General Electric Company. To date, this contract has yielded excellent results which have been documented in five volumes.

The basic purpose of the Contract was to provide inputs and methodology to the U. S. Government for assessing factors and values affecting spectrum/orbit utilization by communication satellites in stationary orbit. Since execution of the basic contract in February 1969, five amendments to the contract have been executed providing additional funds and tasks. One of the primary objectives of the study concerning the preparation for Agenda Item #5 at the forthcoming WARC has been generally achieved. Therefore, we are of the opinion that it is now timely for NASA to perform any additional study in this area directly with General Electric.

Of the $248,973 expended on the contract to date, the funding has been divided as follows: FCC, $50,000; OTP, $91,100; and NASA, $107,873. This amount covers all work performed by General Electric through Task XIV of the contract, and has been paid the contractor.

NASA recently transferred $70,000 to OTP to fulfill additional tasks on this contract, namely the providing of support to NASA on (1) a satellite spacing study and proposed experiment; and (2) evaluation of the orbital utilization properties of the domestic satellite proposals made to the FCC. This work is currently being performed by General Electric under Amendment #5 of subject contract.

Amendment #5 (attached) of the contract provides funds to cover the study through Task XIV. It further describes the technical requirements for Tasks XV through XVIII, and also includes the costs for each task as well as estimated completion date for each. Funding for Tasks XV through XVIII was predicated upon receipt of NASA funds and was to be made to GE on an incremental basis at the same level of funding to be provided by NASA. Based on previous level of effort, the estimated cost of Tasks XV through XVIII as described in the Amendment is $90,511, which would complete the contract as now written.

The $70,000 recently received from NASA was for the purpose of funding, in part, those tasks identified in Amendment #5 with the understanding that no effort would be expended by GE beyond this amount. $10,000 of this $70,000 was expressly for Task XVIII.

As indicated above, it is our desire to transfer the contract to NASA for completion of the work outlined in Amendment #5, and at the same time return to NASA the aforementioned $70,000 to cover partial payment of the remaining tasks to be completed.

Technical and administrative monitoring responsibilities of the study would also be transferred to NASA.

Upon your acceptance of these conditions, we will amend the contract limiting our technical and contractual obligations to General Electric as follows: (1) Tasks I through XIV, and (2) funding of $248,973.

A copy of the contract and amendments thereto is attached for your information. Additional documentation, as required, will be made available to your office upon request.

Sincerely,

W. Dean, Jr.
W. Dean, Jr.
Director
Frequency Management

Attachments

ROUTING AND TRANSMITTAL SLIP

		ACTION
1 TO *(Name, office symbol or location)* Frank Osborn	INITIALS	CIRCULATE
	DATE	COORDINATION
2	INITIALS	FILE
	DATE	INFORMATION
3	INITIALS	NOTE AND RETURN
	DATE	PER CON-VERSATION
4	INITIALS	SEE ME
	DATE	SIGNATURE

REMARKS

These are my thoughts for the NASA letter.
Roy has seen and concurs.

Do NOT use this form as a RECORD of approvals, concurrences, disapprovals, clearances, and similar actions.

FROM *(Name, office symbol or location)*	DATE
Gaston	PHONE

OPTIONAL FORM 41
AUGUST 1967
GSA FPMR (41CFR) 100-11.206

GPO : 1967 O—300-455 (8-H) 5041-101

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON, D.C. 20504

April 5, 1971

WD 4/5/71

MEMO FOR: Will Dean

From: Frank Urbany

Attached is a draft letter prepared by Choiniere re contract OTP-SE-69-102 with GE. I am satisfied with the thrust of the letter which will terminate OTP responsibility for Tasks I through XIV in the amount of $248,973.

If the letter is satisfactory with you, perhaps you could have Don staff it through NASA prior to sending it over.

Attachment

THE NEXT DECADE IN SPACE

A Report of the

Space Science and Technology Panel

of the

President's Science Advisory Committee

EXECUTIVE OFFICE OF THE PRESIDENT

OFFICE OF SCIENCE AND TECHNOLOGY

March 1970

Sent to Dr. Lyons 4/1/71

NASA

FOR IMMEDIATE RELEASE — FEBRUARY 27, 1971

Office of the White House Press Secretary

The President today announced his intention to nominate James C. Fletcher to be Administrator of the National Aeronautics and Space Administration. He will succeed Thomas O. Paine who resigned effective September 15, 1970.

Fletcher has been President of the University of Utah and College of Eastern Utah since 1964. In 1960 he organized the Space General Corporation, a subsidiary of Aerojet-General Corporation, serving as its President from 1960 to 1962 and Chairman of the Board from 1962 to 1964. Fletcher was the organizer and President of Space Electronics Corporation, serving from 1960 to 1962.

A former Associate Director of the Guided Missile Laboratory at Ramo-Wooldridge Corporation, Fletcher has served as a consultant to the Office of the Secretary of Defense, to the Arms Control and Disarmament Agency and the President's Science Advisory Committee. He is a member of the Air Force Science Advisory Board and the Naval Warfare Panel.

Born June 5, 1919 in Millburn, New Jersey, Fletcher earned his under graduate degree at Columbia University in 1940 and his Ph. D., California Institute of Technology in 1948. He is married and has four children and resides in Salt Lake City, Utah.

# # #

Nason

February 24, 1971

George:

This is the draft letter from Low to Bondi. Tom Nelson specifically calls your attention to the parenthetical statement in the final paragraph on page 2. He says you ought to consider very carefully what that means.

State Department (Bert Rein) is sending you comments on the aerosat program late today or first thing tomorrow. Nelson requests that you not sign off on this draft of Low's letter to Bondi until you have seen State's comments on the aerosat program. Nelson would like very much to talk with you personally this evening or tomorrow.

Signed

Steve

cc: Mr. Whitehead (2)
Mr. Doyle

SEDoyle/ec/24Feb71

2/10/71

To: Dr. David

From: Tom Whitehead

FYI as discussed.

2/6/71 memo to Flanigan re NASA

nasa

2/10/71

To: Dr. David

From: Tom Whitehead

FYI as discussed.

2/6/71 memo to Flanigan re NASA

February 8, 1971

To: Jon Rose

From: Tom Whitehead

Here is the NASA memo. I will have a shorter memo on the private sector area Tuesday or Wednesday before I come over to meet with Pete.

Attachment

cc: Mr. Whitehead

CTWhitehead:jm

6 FEB 1971

MEMORANDUM FOR MR. PETER FLANIGAN

This Administration has never really faced up to where we are going in Space. NASA, with some help from the Vice President, made a try in 1969 to get the President committed to an "ever-onward-and-upward" post-Apollo program with continued budget growth into the $6-10 billion range. We were successful in holding that off at least temporarily, but we have not developed any theme or consistency in policy. As a result, NASA is both drifting and lobbying for bigger things -- without being forced to focus realistically on what it ought to be doing. They are playing the President's vaguely defined desire for international cooperation for all it's worth, and no one is effectively forcing them to put their cooperative schemes in any perspective of whether they are good or not so good, what are their side effects, and are they worth the candle. For the last two years, we have cut the NASA budget, but they manage each year to get a "compromise" of a few hundred million on their shuttle and space station plans. Is the President really going to ignore a billion or so of sunk costs and industry expectations when he gets hit for the really big money in a year or two?

I will try to be constructive by sketching out a few thoughts on the subject that might suggest what we should do about all this.

NASA is -- or should be -- making a transition from rapid razzle-dazzle growth and glamor to organizational maturity and more stable operations for the long term. Such a transition requires wise and agile management at the top if it is to be achieved successfully. NASA has not had that. (Tom Paine may have had the ability, but he lacked the inclination -- preferring to aim for continued growth.) They have a tremendous overhead structure, far too large for any reasonable size space program, that will have to be reduced. There will be internal morale problems of obvious kinds. The bright young experts attracted by the Apollo adventure are leaving or becoming middle-aged bureaucrats with vested interests and narrow perspectives. (Remember when atomic power was a young glamor technology? Look at AEC now and you see what NASA could easily become.)

There needs to be a sense of direction, both publicly and within NASA. The President's statement on the seventies in space laid the groundwork, but no one is following up. What do we expect of a space program? We need to define a balance of science, technology development, applications, defense, international prestige and the like; but someone will have to do that in a way that really controls the program rather than vice-versa. In particular, we need a new balance of manned and unmanned space activity, for that one dimension has big implications for everything else. We need a more sensible balance of overhead expenditures and money for actual hardware and operations; the aerospace industry could be getting a lot more business than they are, I suspect, with the same overall NASA budget if we could get into all that overhead.

NASA is aggressively pursuing European funding for their post-Apollo program. It superficially sounds like the "cooperation" the President wants, but is this what the President would _really_ want if we really thought it through? We have not yet decided _what_ we want our post-Apollo program to be or how fast it will go, but if NASA successfully gets a European commitment of $1 billion, the President and the Congress will have been locked into NASA's grand plans because the political cost of reneging would be too high. I assume the President wants space cooperation as a way of building good will and reducing international tensions. But it does not follow that _all_ joint ventures will have that effect. INTELSAT, for example, is a fully cooperative space venture and less political than the post-Apollo effort now envisaged would be, but most would agree it has been more of a headache than a joy and has created new tensions and contentions rather than good will and constructive working relationships. Finally, the U.S. trade advantage in the future will increasingly depend on our technological know-how. The kind of cooperation now being talked up will have the effect of giving away our space launch, space operations, and related know-how at 10 cents on the dollar. It does seem to me that taking space operations out of the political realm and putting it more nearly in the commercial area would diminish international bickering and give U.S. high technology industries the advantages and opportunities they deserve; this may or may not prove fully feasible, but the point is, no one in this Administration is seriously trying to find out.

The key thing missing, I think, is management attention to these issues. We need a new Administrator who will turn down NASA's empire-building fervor and turn his attention to (1) sensible straightening away of internal management and (2) working with OMB and White House to show us what broad but concrete alternatives the President has that meet all his various objectives. In short, we need someone who will work with us rather than against us, and will seek progress toward the President's stated goals, and will shape the program to reflect credit on the President rather than embarrassment. We need a generalist who can understand dedicated technical experts rather than the opposite. But we also need someone in the Executive Office who has the time, inclination, and authority to coordinate policy aspects. Separate handling of political, budget, technical, and international aspects of NASA planning here means that we have no effective control over the course of events because all these aspects are interrelated.

We really ought to decide if we mean to muddle through on space policy for the rest of the President's term in office or want to get serious about it.

Clay T. Whitehead

cc: Mr. Whitehead

CTWhitehead:jm 2/6/71

6 FEB 1971

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We really ought to decide if we mean to muddle through on space policy for the rest of the President's term in office or want to get serious about it.

Clay T. Whitehead

NASA

18 JAN 1971

Mr. Wade St. Clair
Director, Public Services Division
Code SG, FOB 6, Room 6107
National Aeronautics and Space Administration
400 Maryland Avenue, S. W.
Washington, D. C. 20546

Dear Mr. St. Clair:

Clay T. Whitehead, Director of this Office, has received a letter of invitation dated January 12, 1971, from George M. Low, to view the launch of Apollo 14 on Sunday, January 31, 1971. Mr. Whitehead is out of the city on an extended trip. In telephone consultation with him, he indicated that other commitments will make it impossible to attend the launch. He had received a prior general invitation in addition to the letter invitation of January 12. I am enclosing both.

Mr. Whitehead has asked me to inquire whether or not it would be possible for his sister, Miss Nancy Whitehead, Legislative Assistant to Senator Robert Dole of Kansas, to receive an invitation to view the launch in Mr. Whitehead's place. I have checked with Senator Dole's office and, to my knowledge, no other staff member of that office will be attending. Miss Whitehead lives in Washington and, if possible, Mr. Whitehead hopes that she could be provided with transportation.

I am directing this reply to you at the suggestion of Mr. Roscoe Monroe. If I may be of any further assistance, please let me know. My telephone number is 395-5800.

Sincerely,

Signed

Stephen E. Doyle
Special Assistant to the Director

cc: Mr. Whitehead
Mr. Doyle

SEDoyle/ec/18Jan71

NASA

REWRITTEN:CTWHITEHEAD:dc
Mr. Whitehead
Dr. Mansur Olsson: Subj RF

Honorable George M. Low
Acting Administrator
National Aeronautics and Space
Administration
Washington, D. C. 20546

January 11, 1971

Dear Mr. Low:

The Administration has completed a policy review on aeronautical telecommunications via satellites for international civil aviation. The Administration's position in this matter is contained in the attachment, "Statement of Government Policy on Satellite Telecommunications for International Civil Aviation Operations."

The Government policy provides a broad framework of objectives, technical and operational arrangements, management arrangements and economic arrangements to guide the Executive Branch agencies during the year ahead. Among other things, the policy affirms the lead management agency role of the Department of Transportation and establishes supporting roles for the Department of State and the National Aeronautics and Space Administration.

We believe the Government policy represents an effective approach to achieving the communications necessary for continued safety and improved efficiency of international air travel. We also believe that the United States has the opportunity to continue its leadership role in civil aviation by aggressive implementation of the enunciated policy. The National Aeronautics and Space Administration has an important role in supporting the implementation program.

We plan to supplement the policy statement in the near future with more specific program guidelines. Meanwhile, the attached policy statement will be used by the Executive Branch in reorienting its efforts in this field, including subsequent United States participation in international meetings.

I would like to express our appreciation for your agency's contributions to the policy review.

Sincerely,

Clay T. Whitehead

Encl.

NASA

December 23, 1970

Honorable George M. Low
Administrator
National Aeronautics and
Space Administration
Room 7137
400 Maryland Avenue, S. W.
Washington, D. C. 20546

Dear Mr. Low:

As discussed with George Mansur last week, I am forwarding for your comment the draft policy statement on satellite communications for overseas civil aeronautical operations.

We would appreciate receiving your comments by December 31st.

Sincerely,

Clay T. Whitehead

Enclosure
cc: Dr. George Mansur
Col. Olsson
Steve Doyle

ctwhitehead:ed

Whitehead

October 13, 1971

GENERAL CRITERIA

1. The U.S. should continue as a peaceful spacefaring nation and structure its programs to enhance our position and image of world leadership.

   a. Conduct a balanced program of exploration, science, and application.

   b. Conduct a visible and reasonably continuous program of manned space flight.

   c. As a minimum, our program should be planned to maintain our favorable image vis-a-vis the USSR.

   d. Provide opportunities for international cooperation.

2. The space program should be made up of projects each of which:

   a. contributes to the advancement of technology;

   b. lends iteself to evolutionary development, allowing proof of principal, reduction of technical risk, lower cost of space operations, and demonstration of payoff along the way, as well as permitting fruitful use in case of termination at some step in a multi-step development;

   c. is not so large as to cause imbalance in a fixed-budget space program, nor because of its size, should it become the major driver of the space program as a whole.

3. Our efforts should keep options open for international cooperation.

   a. The concept of international cooperation should be based on the assumption that arrangements will be reciprocal and mutually beneficial, bearing in mind that our world leadership will require that we compete with as well as cooperate with other nations in space.

   b. Only those projects should be undertaken which are sufficiently straightforward in both a technical and management sense that we are reasonably certain they will increase rather than injure our mutual friendship.

   c. We should put ourselves into a position that would permit US-USSR cooperation, while recognizing the necessities of having political flexibility and reciprocity of prestige.

   d. There should be sufficient mission flexibility so that important elements of our program do not become dependent on cooperative arrangements.

4. Management factors to be considered.

   a. Shape institutional base to programs, not vice versa.

   b. Work towards efficient consolidation of management and base.

5. The space program should stimulate and enhance the practical benefits from space operations.

a. Continue the rapid development of new uses and innovations in space.

b. Projects and technological areas should be pursued that have potential commercial or operational application. When commercial or operational viability is demonstrated, the program should be transferred to the user or to the commercial sector of the economy.

6. A productive science program should be continued for its benefit to the advancement of human knowledge and for the prestige that accrues to the U.S.

Science conducted in space should be judged in relation to the U.S. science program as a whole.

October 20

GENERAL CRITERIA

In summary, the U.S. should continue as a peaceful spacefaring nation and structure its programs to enhance our position and image of world leadership.

a. Conduct a balanced program of exploration, science, and application, which also contributes to the advancement of technology.

b. Conduct a visible and reasonably continuous program of manned space flight.

c. As a minimum, our program should be planned to maintain our favorable image vis-a-vis the USSR.

d. Opportunities for the option of innovative international cooperation should be assessed.

More specifically:

1. The space program should be made up of projects each of which:

   a. lends itself to evolutionary development, allowing proof of principal, reduction of technical risk and reduced cost of space operations, and demonstration of payoff along the way by producing useful results at several intervals in a multi-step development;

b. is not so large as to force future imbalance in a fixed-budget space program, nor because of its size, should it become the major driver of the space program as a whole.

2. Management factors to be considered.

a. Shape institutional base to programs, not vice versa.

b. Work towards efficient consolidation of management and base.

c. The present NASA structure was appropriate to Apollo, but could be more responsive to future directions if realigned along the lines: (1) launch operations and booster development, which would work toward being a self-supporting service; (2) exploration and space science; (3) development of new, non-commercial space applications; and (4) research in new space-oriented and aeronautical technology.

3. The space program should stimulate and enhance the practical benefits from space operations.

a. Continue the rapid development of new uses and innovations in space.

b. Projects and technological areas should be pursued that have potential commercial or operational application, but which are not at the stage of being cost-effective. When commercial or operational viability is demonstrated, as determined outside NASA, the program should be transferred to the user or to the commercial sector of the economy.

4. A productive exploration and science program should be continued from space for its benefit to the advancement of human knowledge and for the prestige that accrues to the U.S.

   a. Exploration missions relate to national image and should be funded by NASA.

   b. Space science should be selected and judged in relation to the U.S. science program as a whole, and the experiment and recurring costs should be funded through NSF.

   c. To reduce the cost of space science, NASA should develop an experiment bus.

5. Our efforts should keep options open for international cooperation.

   a. International cooperation projects must be individually judged on the bases of answers to the following questions: (1) is the projected benefit clearly and demonstrably worth the cost, recognizing that the value of space cooperation depends strongly on the matter of visibility; (2) are we committing ourselves inadvertently to more than the particular project; and (3) is an appropriate balance being maintained between our national and our international space activities?

b. The concept of international cooperation should be based on the assumption that arrangements will be reciprocal and mutually beneficial, bearing in mind that world leadership will require that we compete with as well as cooperate with other nations in space.

c. Only those projects should be undertaken which are sufficiently straightforward in both a technical and management sense that we are reasonably certain they will increase rather than injure our mutual friendship. Generally speaking, visible undertakings such as joint payload or exploration missions, including manned missions, are much preferred to joint engineering projects which involve management problems and technology transfer.

d. We should put ourselves into a position that would permit the US-USSR cooperation, while recognizing the necessities of having political flexibility and reciprocity of prestige.

e. There should be sufficient mission flexibility so that important elements of our program do not become dependent on cooperative arrangements.

NASA PROGRAM -- MINIMUM TECHNOLOGY

Budget Authority	'73	'74	'75	'76	'77	et seq.
NASA Ongoing Program (billions)	3.1	2.6	2.3	2.3	2.3	2.3
Manned Flight (millions)						
1. Joint Docking	22	100	86	15		
2. Second Skylab	50	250	500	400	300	
3. Space Station	50	300	700	1,100	1,300	
4. T III M	50	100	60*	*	*	
5. Big 'G'	50	150	250	270	220	
TOTAL (billions)	3.3	3.5	3.9*	4.1*	4.1*	

* Plus recurring costs depending upon usage.

ATTACHMENT I

Space Shuttle Objectives, Benefits and Viability.

The Space shuttle system (in its various manifestations as they have evolved over the past several months) represents a technical synthesis which, to a remarkable degree, integrates into a single vehicle system and proposed mode of operation the means for potentially achieving improvements and advances relevant to virtually all foreseeable future space program objectives including:

1) Reduction in recurring launch costs at all projected levels of unmanned activity not involving sharp reductions from present levels.

2) Attainment of a capability for recovery and reuse of payloads, thereby making possible long-term savings in payload costs.

3) Attainment of a versatile capability for on-orbit adjustment, maintenance, modification, replenishment, and refurbishment of unmanned space vehicles, which must be viewed, not merely as a cost saving potential, but also as opening the way to new and different space activities and new ways of conducting present activities.

4) Retention of a large payload launch capability to earth orbit after phasedown of the Saturn/Apollo launch and support complexes, which may be of future importance to either the civil or military programs.

5) Provision of an option for support of future lunar program activities and with assembly in space techniques, for future large planetary missions.

6) Attainment of a capability for transportation of men to and from space stations in a relatively undemanding and unstressful environment at relatively low recurring cost.

7) Acquisition of a low-orbit space rescue capability for space stations and other manned programs.

All of these benefits can be obtained in greater or less degree by developing systems other than the shuttle but it is difficult, if not impossible, to devise a single system other than the shuttle which would so adequately provide all of them. Further, by virtue of the fact that the shuttle is a system designed around man as an operator, it is difficult to conceive of a better way to achieve ready, safe, and easy access to space activity by man. Thus, the merit of the shuttle development is greatly enhanced if there is the expectation of a future space program in which frequent and extensive manned activity is an essential feature.

If an enthusiastic, optimistic, and expansionary view is taken of the probable growth of the nation's military and civilian space programs over the next twenty years and particularly if continuing growth in the manned program (e.g. space stations, lunar and planetary exploration, and the evolution of, as yet, undefined roles for man in space) is envisioned, the development of the space shuttle as proposed by NASA is undoubtedly the most important and valuable major new space program which could be undertaken at this time. However, both the investment and economic risk in the program are high and the payoffs may only materialize in the more distant future if space activities, and particularly manned activities, reach or exceed levels currently anticipated. A sustained sense of national commitment to the program and its objectives will be necessary to assure continuing support during the long period of high expenditures for development, facilities and production before any real payoff is obvious.

NASA

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

DEPUTY DIRECTOR

December 17, 1971

To: Tom Whitehead

From: George Mansur

Apparently you won't be in tomorrow and your commitments to respond to the space shuttle inquiries are not known to me. Shall I follow up? The arguments on space shuttle are long, but I think the result is that the options on bay size are very limited.

Specifically, if one adopts the reusable tug principle for transfer from earth orbit to synchronous orbit and return without staging and without payload, a tug weight of 40,000 pounds is required with dimensions approximately 13 by 35. To place 3,000 pounds in synchronous orbit and retreive 3,000 pounds from synchronous orbit will require a tug weight of about 52,000 pounds with dimensions of roughly 14 x 50.

The only other option is to discard the reusable tug and the ability to retreive space craft from synchronous orbit by using a throw away transfer booster such as Centaur. (Centaur today is $8 million per fueled vehicle.)

NASA claims that the difference in development costs between a 10 x 30 or 14 x 50 shuttle is only about $600 million because the difference between the two is structural and both require the same control subsystem. IDA, on the other hand, on the basis of parametric studies claims that the cost differential is substantially larger.

One final fact which I shall check out in the morning is the DOD has a high usage mission requiring a 60 foot payload.

The choice is difficult, but considering the lower cost per pound in orbit, my view is that the trend should be toward the larger bay size even thoug the $600 million additional development costs may be on the low side. (I guess $1 billion.)

P.S. In discussions with the Department of Defense this morning, DOD concludes that the existing economic analyses of the space shuttle are suspect. There are two views in the DOD:

1. Packard and Foster both have a gut feel that the space shuttle is good and that the larger shuttle is desirable. This feeling persists not on economic grounds, but on the belief that given a suitable vehicle many more uses will evolve.

2. Benington of DDR&E personally believes that the smaller shuttle without tug is more sound economically even though it will handle only about 30 percent of the DOD missions and the remainder would have to be handled by expendable boosters such as Titan. All believe that the opposition (foreign) is spending significantly more on research and development, and the U.S. must support a high technology program in that area.

Benington also notes that the DOD has not been asked for their formal opinion on space shuttle and is curious as to why.

December 2, 1971

To: Jon

From: Tom

FYI. The chart attached to Pete's copy of the memo lays out the issues discussed at the top of page 4 of Bill Anders' memo, as we discussed.

Attachments

Memo to Peter Flanigan dtd 12/2 re NASA programs - Attachments

December 2, 1971

MEMORANDUM FOR MR. FLANIGAN

As you know, I get involved occasionally with Jim Fletcher, Don Rice, Bill Anders, and Ed David on the future NASA program. The following brief comments are offered for whatever use you may want to make of them.

We succeeded when we first came into office in averting NASA's high flying plans for space stations and Mars trips, and in bringing the budget down to a more realistic level consistent with the President's wishes. It was, however, our intention not to continue to erode NASA's budget indefinitely, but to induce them to come up with a sound, forward-looking evolutionary space program for the coming decade that would not lock the President into excessively large budgets now or in the future.

Over the last few months, OMB and NASA have been bickering, principally about the space shuttle. I held a series of meetings bringing the various Executive Office groups together and met with Jim Fletcher, I hope to some constructive effect. Most recently, Jim has done what I believe to be an outstanding job of devising a space shuttle concept that is consistent with reasonable budget levels and sensible technology, and still builds for the future. Without burdening you with all of the ins and outs of how we got from there to here, the debate is now focused around two shuttles both using the same system design concept, but one capable of carrying 60,000 pounds payload, the other 35,000 pounds. The larger shuttle is somewhat more expensive to develop, but has lower operating costs. I tend to believe the larger shuttle is the more prudent course, but the differences are so small that the choice should reasonably be left to NASA's discretion. However, I suspect OMB will try to push fairly hard for the smaller version. NASA might buy this as a last choice, but the impact on their morale and that of the aerospace industry would be unnecessarily negative -- especially since Jim has been so responsive to our concerns. (Attached is a sheet I asked Bill Anders to prepare which tells more than you ever wanted to know about the shuttle configurations; the two marked with asterisks are the ones I have referred to.)

Aside from the shuttle, the only significant issues remaining are the hiatus of manned space flights between now and 1976 when the shuttle would first be tested. I believe Jim Fletcher's idea for three to four manned missions for that interim period between Skylab and Shuttle are well reasoned and well worth the money involved. I also think that a decision on Apollos 16 and 17 should be made with more careful Presidential deliberation than OMB is likely to initiate. To the best of my knowledge, Henry Kissinger has not been significantly involved in the debate on these issues, and I believe he should be.

Finally, I am disturbed that nobody is developing for Henry or the President really sensible initiatives for international cooperation in space. This is to a large extent behind Henry's interest in the ridiculous proposals thrown up by the bureaucrats, such as space shuttle cooperation and aerosat. You might consider, with some blessing from Henry, turning Fletcher loose on the subject together with OMB and OST to get something moving in this area. Otherwise, I don't see it happening, and I think that would be unfortunate.

I am attaching a list of six items that looks fairly sensible for international cooperation and also have some public appeal; summary in the works. Others are just bouncing around.

Clay T. Whitehead

Attachments

CTWhitehead:lmc
cc:
DO Records
DO Chron
Mr. Whitehead (2)
Dr. Mansur

- New initiative for a wide range of scientific satellite experimentation.
- Expanded cooperation in the Earth Resources Satellite program.
- Establishment of International Space Science Centers.
- An Apollo/Soyuz docking in space in 1975.
- Invitations to foreign astronauts to participate in the next generation of manned flights.
- Broader launch commitments for other nations.

ASSISTANT DIRECTOR
OFFICE OF MANAGEMENT AND BUDGET

October 19, 1971

Enclosed is your personal copy of a program options paper on space. Please do not reproduce. Copies will not be provided in the Director's Review books.

Don Rice

Distribution:
Mr. Shultz
Mr. Weinberger
Mr. Anders
Mr. Cohn
Dr. David
Mr. Harper
Mr. Niskanen
Mr. Whitehead

THE U.S. CIVILIAN SPACE PROGRAM -

A LOOK AT OPTIONS

October 14, 1971

Table of Contents

Summary

Summary

I. An Overview - NASA's Program and Funding Picture

- With the successful completion of the Apollo manned lunar landing, NASA's ongoing program has been phased down by 64% from its FY 1966 peak (constant FY 1966 dollars).

- NASA is seeking approval for new space programs for the future, principally the manned reusable space shuttle earth-to-orbit transportation system.

- Because of overall constraints, NASA will be hard-pressed in the FY 1973 budget to continue all of its currently approved programs.

- Major new initiatives, such as the shuttle, will be very difficult to obtain.

- FY 1973 budget decisions should be consistent with a longer range view of our national objectives in space.

- While the President's March 7, 1970, statement outlines a number of objectives for a "balanced" space program, a great deal of flexibility remains concerning the pace and specific content of the future space program.

- Although competition with the Soviets has diminished in importance in the last decade, it is still a factor to be considered.

- The Soviets are continuing to conduct an orderly, well planned and balanced manned and unmanned space program emphasizing manned, orbiting space stations.

- Criteria for evaluating the various program options are as follows:

    - Budget impact
    - Employment impact
    - Impact on institutional base
    - Scientific return
    - Practical applications
    - International prestige
    - International cooperation
    - Capability to conduct manned space flight
    - Advancement of technology
    - Economic analysis

II. Manned Space Flight

- Key issue is the future role of man in space.

  - Unmanned program could capture most of the scientific and practical benefits of space for less cost.

  - Historically, primary reasons for man in space has been the international technological image of the U.S.

  - Are our historical reasons for man in space still sufficient to justify keeping man in space? If so, how much extra should the U.S. be willing to pay for manned flight relative to an unmanned program which could produce comparable scientific and practical benefits?

Current Manned Space Program

- Apollo manned lunar

  - Strong scientific support for completing last two missions.

  - Relatively minor impact on the budget, employment, international prestige, and NASA's institutional base.

- Skylab experimental space station

  - Contributes to better understanding of man's ability to live and work in space.

  - Low priority science.

  - High near-term employment impact (about 20,000 jobs).

  - Large savings possible ($820M over three years).

- Cancellation of remaining Apollo/Skylab manned missions and elimination of manned space flight base.

  - High near-term employment impact (55,000 on 12/72).

  - Loses Apollo scientific data.

  - Essentially eliminates existing U.S. manned space flight capability.

Using Present Capabilities to Continue Manned Space Flights

- Use of existing Apollo spacecraft in earth orbit.

  • Cheapest manned space flight option for the 1970's ($2.5B NASA annual funding peak after FY 1974).

  • Possible rendezvous with Soviet space laboratory.

  • Little value for scientific data and practical applications.

  • Marshall Space Flight Center could be shut down in FY 1974.

- Use of a Second Skylab.

  • $2.9B NASA annual funding peak after FY 1974.

  • Could carry improved science and applications packages.

  • Little gain over unmanned science and applications satellites.

  • Marshall Space Flight Center could be shut down in FY 1974.

- 1979 Space Station.

  • $3.6B NASA annual funding peak after FY 1974.

  • Would enhance international technological image.

  • Scientific data probably not greater than return from unmanned satellites.

  • No change in NASA institutional base.

Future Space Transportation System

- Space shuttle seen by NASA as key to future.

  • Could reduce cost of operating in space by recovering satellites and reusing launch vehicles.

  • Could encourage greater exploitation of space in 1980's and beyond.

  • Could be used for sortie missions.

- $12-16B investment cost in 1970's a major barrier to shuttle.
  - Near-term budgetary problem (requires about $3.5-4.2B total annual NASA budget by FY 1976).
  - Serious question on cost effectiveness.
- Economically shuttle appears unattractive when 10% discount rate used.
  - Requires assumption of doubling the rate of mission launches in the 1980's over the current launch rate.
  - Unfavorable results on any one of a series of other assumptions would also make shuttle more uneconomical (e.g., investment cost overrun, higher than planned operating costs).
  - Shuttle does offer possibility of a productive role for man in space - as pilot in a future space transportation system which would service unmanned as well as manned spacecraft.
- Expendable rockets (e.g., improved Titan III) could launch same space payloads as shuttle.
  - Would require 5% of shuttle investment cost.
  - Future operating costs would be increased over shuttle estimates.
  - Payload recovery would either be foregone or a new unmanned recovery system developed.
  - Marshall Space Flight Center could be shut down in FY 1974.

III. Program Options for the Unmanned Space Program

Grand Tour of the Outer Planets

- Unique opportunity for gravity-assisted missions to outer planets in 1976-79 (8-year vs. 40-year trip time).

- Spacecraft alternatives

  - TOPS - highest scientific return, but highest total cost ($1B).
  - NASA recommended spacecraft - acceptable decrease in scientific return and 25% cost saving ($750M).
  - Outer Planets Explorer - reduced capability after extensive modifications and relatively small savings ($650M).
  - Modified Pioneer - serious performance limitations ($500M).

- Mission alternatives

  - Baseline program (Jupiter/Saturn/Pluto and Jupiter/Uranus/Neptune - two trips each) - provides highest scientific return at highest cost ($750M).
  - Reducing number of missions - savings relatively slight for each trip deleted.
  - Cancel Grand Tour - reduces scientific return but allows more balance in planetary program through use of smaller spacecraft to inner as well as outer planets.

<u>Viking Mars Lander/Orbiter</u>

- Will advance knowledge of Mars, especially relating to possible existence of life.
- Already deferred once in budget. Project well along now. However, no hardware fabricated.
- Alternatives

  - Baseline - 2 orbiters and 2 landers ($850 M)
  - Eliminate orbiters ($560 M)
  - Cancel one set of orbiters and landers ($500 M)
  - Defer missions ($1.3 B)
  - Cancel ($132 M)

- Alternatives to the baseline plan could reduce scientific return and increase risk of failure.

High Energy Astronomical Observatory (HEAO)

- FY 1972 start will observe the universe in X-ray and gamma ray regions (total cost $210-280M).
- Assigned high priority by OST.
- Project not time sensitive - could be deferred.
- Project could also be reduced in scope allowing more resources for other astronomy projects.

IV. Summary of Program Options

- Table makes it possible to estimate the FY 1972-77 budgetary effects of combinations of program options.

V. An Illustrative Future Space Program

- Major features
    - Annual funding level below $3B after FY 1973.
    - Completes Apollo/Skylab missions.
    - Postpones shuttle indefinitely.
    - For manned flight, concentrates on earth orbital operations first with Apollo spacecraft and later with a second Skylab.
    - Expands unmanned science and applications programs.
    - Marshall Space Flight Center shut down.
- Assumptions
    - No major funding increase for space justified.
    - Unmanned program provides science and applications benefits.
    - Manned program primarily for international technological image.

VI. Conclusions

- No obvious solutions for future space program - depends upon relative value assigned various criteria.

- An unmanned program could capture science and applications benefits at less cost, but would not enhance our technological image or manned space flight capability.

- Alternatives for manned space flight in 1970's.

    - Terminate and concentrate on unmanned science and applications (less than $2B per year).

    - Continue manned flight with expendable rockets, primarily to preserve technological image and capability (less than $3B per year).

    - Invest in shuttle - economically doubtful, but offers hope that a productive role can be found for man as integral part of space transportation system ($3.5-$4.0B per year).

- Relative priority of space in terms of future annual funding levels crucial to decision.

- FY 1973 budget decisions should be consistent with longer range view of space programs.

- After preferred program alternative selected, NASA's institutional base should be resized accordingly.

I

I. An Overview - NASA's Program and Funding Picture

Background

With the successful accomplishment of the manned lunar landing (Apollo), NASA has achieved its major initial objective. NASA is now completing the remainder of the Apollo program--Apollo 16 and 17 and the Skylab experimental space station, which uses Apollo hardware in earth orbit. With the impending completion of the Apollo/Skylab program by the end of CY 1973, NASA is seeking new space programs which will provide challenge, benefits, and workload for the future. The objective of this paper is to analyze alternative strategies for the space program and to provide a framework for decision-making. Section I provides a summary of historical trends in NASA's programs and manpower, describes Presidential guidance, and suggests criteria for judging the options presented in subsequent sections.

Overall Budgetary and Employment Trends

Table I illustrates the extent of phasedown of NASA program activities since NASA's peak in the mid-1960's:

Table I-A

	FY 1966	FY 1967	FY 1968	FY 1969	FY 1970	FY 1971	FY 1972
Budget ($B)							
Budget Authority ...	5.2	5.0	4.6	4.0	3.7	3.3	3.3
Outlays	5.9	5.4	4.7	4.3	3.8	3.4	3.2
Outlays in constant 1966$	5.9	5.1	4.1	3.4	2.8	2.3	2.1
Employment (thousands)							
Direct contractor ..	327	237	196	152	99	80	83
Support Service contractor (in-house) ..	33	36	39	35	31	28	26
Civil Service	34	34	33	32	31	30	28
Total Employment	394	307	268	219	161	138	137

The full extent of the phasedown in NASA's program is best illustrated by the trend of outlays in constant 1966 dollars. The implications of these trends for NASA's programs and manpower requirements are discussed below.

Program Trends

Table I-B provides a breakdown of NASA's program trends since FY 1966 (outlays in millions of dollars):

	1966	1970	1971	1972
Manned Space Flight	(3,485)	(1,857)	(1,543)	(1,317)
Apollo manned lunar	3,218	1,552	1,020	718
Skylab experimental space station/Apollo applications	19	290	465	485
Gemini manned orbital ..	219	-	-	-
Space shuttle	-	-	45	83
Life sciences, space station, and advanced missions	29	15	13	31
Space Science and Applications (unmanned)	(658)	(533)	(505)	(593)
Science (e.g. astronomy, planetary)	449	305	275	300
Applications (e.g. communications, earth resources)	102	97	120	163
Launch vehicles	107	131	110	130
Advanced Research and Technology	(291)	(284)	(260)	(228)
Space research	255	200	167	136
Aeronautical research ..	36	84	93	92
Tracking and Data Acquisition	272	291	285	262
Other R&D	36	27	17	14
Construction of Facilities	572	54	50	43
Research and Program Management (Civil Service)	619	707	721	723
Total Outlays	5,933	3,749	3,380	3,180

Within the Manned Space Flight category, the most apparent change has been the decline in the Apollo lunar program from $3.2 B in FY 1966 to $.7 B in FY 1972. This trend will continue with the last two Apollo missions scheduled for March 1972 and December 1972. The spending on the Skylab experimental space station is increasing to meet its scheduled initial launch in April 1973. With the completion of the Skylab program in December 1973, the U.S. manned program is scheduled to commence a hiatus of about 4-5 years depending upon when and if the space shuttle is developed.

The space shuttle would be a manned reusable space transportation system, with an investment cost of about $12-16 B. which could reduce the cost of space operations beginning in 1979. Despite strong pressure from NASA and the increased funding shown on the table, the Administration has not yet endorsed the space shuttle. The 1972 budget provides for proceeding with development of the engine, the longest lead time component, and for design of the airframe. The decision on whether to develop the shuttle airframe is supposed to await the results of technical and economic studies now being completed. NASA is currently requesting $228 M in FY 1973 for development of the airframe for the shuttle orbiter. Because of the magnitude of the investment required, the space shuttle is by far the single largest issue for the FY 1973 budget and for the future space program.

As shown in the above table, the unmanned Space Science and Applications category has grown gradually since FY 1968 although it is still below the FY 1966 level. In this category, the real trend is best shown by the budget authority for FY 1972 which is $750 M and likely to grow in FY 1973. This increase reflects the initiation of several large unmanned scientific programs, such as the Grand Tour of the outer planets, the Viking program to land an unmanned spacecraft on Mars, and the High Energy Astronomical Observatory (HEAO). Funding for applications has also increased gradually with the development of improved unmanned earth resources, communications, and weather satellites which can provide tangible benefits for people on Earth. The applications programs, which are frequently cited by NASA as justification for the space program, account for only about 5% of NASA's funding.

Within the Advanced Research and Technology category emphasis has shifted from space research to aeronautical research. This reflects NASA's decision to provide aeronautics with the level of support it enjoyed in the 1950's before funds were diverted to the space program. Any analysis of the future funding levels for aeronautics is beyond the scope of this paper.

The other significant change is in the Construction of Facilities appropriation which has decreased from $572 M in FY 1966 to $43 M in FY 1972.

NASA Manpower Trends 1/

The NASA institutional base was sized to the requirements of the Apollo program which peaked at $5.9 B of outlays in FY 1966. As shown on Table I, since FY 1966 there has been a 46% decrease in budget outlays and a 64% decrease in outlays expressed in constant FY 1966 dollars. While the number of direct contractor personnel has decreased by 75% since FY 1966, the number of in-house NASA personnel (civil service and support service contractor) has only been reduced by 20% since 1966 (including 1,500 positions in the FY 1972 budget and an additional 850 positions as a result of the President's recent cutback in Federal employment).

NASA maintains that more than 70% of the decrease in outlays from FY 1966-1972 occurred on major hardware procurements which do not generate large in-house manpower requirements (only about 1 manyear per $200 K). NASA concludes that, when an adjustment is made for the relatively low manpower requirements associated with major hardware procurements, its phase-down of personnel is in balance with the outlay reduction since FY 1966. However, NASA has not yet made a very convincing case.

The extent of any further reduction in NASA's in-house manpower should really depend upon the future of the space program, particularly manned space flight. For example, a decision to move forward on the reusable space shuttle would make it more difficult to justify the shutdown of one of the manned space flight centers. In each of the options described in the subsequent sections the potential impact on NASA's in-house manpower requirements is included.

1/ See Attachment I-A for summary of NASA manpower by Center.

Outlook for FY 1973

In the FY 1972 budget, Apollo 17, Skylab, and Viking were continued, the Grand Tour and HEAO were initiated, and the Shuttle program was increased. Continuation in FY 1973 of the programs contained in the FY 1972 budget would require about $3.2B (outlays) in FY 1973, assuming the space shuttle and the NERVA nuclear rocket program were held to the FY 1972 level. The FY 1973 Planning Ceiling is $2,975M (outlays).

NASA has submitted a "Minimum Recommended" budget for FY 1973 which attempts to hold FY 1973 spending to about the FY 1972 level ($3,181M outlays). Although NASA would prefer a higher level if overall conditions permitted, NASA believes that its minimum requirements for FY 1973 are $3,385M of BA and $3,225M of outlays. The new starts requested by NASA in its Minimum Recommended budget (totaling about $25M of FY 1973 outlays) are (a) a 1974-75 joint docking mission with the Russians using an Apollo spacecraft; (b) two unmanned applications satellites; and (c) three aeronautics projects. NASA would cancel the Orbiting Solar Observatory (OSO I-K) and delay HEAO and one mission and the Grand Tour of the outer planets. The Space Shuttle program would be slipped by six months, reducing FY 1973 requirements to $228M of BA and $93M of outlays.

To reach the FY 1973 Planning Ceiling, NASA would reluctantly take the following actions:

	FY 1973 Outlays ($ M)
NASA Minimum Recommended Budget............	3,225
· Cancel the Space Shuttle	- 93
· Cancel Apollo 16 and 17	-109
· Cancel the Grand Tour	- 20
· Other reductions	- 28
OMB Planning Ceiling	2,975

The cancellation of the Space Shuttle and Grand Tour would be made on the basis that these programs could not be supported in future years at any budget level close to the OMB Planning Ceiling.

Obviously, some very difficult program choices will be required if the FY 1973 Planning Ceiling is to be met. More importantly, however, the 1973 budget review should focus on the long range implications of the decisions so that the future space program can be directed at meeting national objectives rather than be the products of a series of short term, ad hoc decisions.

Runout Cost of NASA's Ongoing Programs (Table I-C)

Table I-C shows the runout costs of NASA's ongoing programs, assuming no new starts in FY 1973 and no additional funding for the Space Shuttle beyond FY 1972. Starting in FY 1974, Space Science and Applications and Advanced Research and Technology are projected at about the current level of activity. Table I-C provides a base for possible changes depending on the program options selected in Chapters II and III (budget authority in millions of dollars):

	1972	1973	1974	1975-77
Manned Space Flight	(1,285)	(1,006)	(578)	(248)
Apollo	601	133	-	-
Skylab	545	529	261	-
Space shuttle	100	-	-	-
Operating base	(In Apollo)	298	271	202
Life sciences and advanced missions	39	46	46	46
Space Science and Applications	(741)	(857)	(800)	(800)
Physics & Astronomy	110	123	130	145
(HEAO)	(20)	(33)	(57)	
Lunar & Planetary	297	343	350	285
(Grand Tour)	(15)	(28)	(120)	
(Viking)	(176)	(230)	(170)	
Applications	188	204	170	190
Launch Vehicle Procurement	146	187	150	180
(Viking)	(11)	(26)	(15)	
(Grand Tour)	-	(1)	(7)	
(HEAO)	(2)	(9)	(8)	
Advanced Research & Technology	(237)	(210)	(220)	(225)
Space research	127	90	100	100
Aeronautical research ..	110	120	120	125
Tracking and Data Acquisition	264	260	259	259
Technology Utilization ..	5	5	5	5
Construction of Facilities	53	50	30	30
Research & Program Management	731	708	708	708
Total BA	3,315	3,096	2,600	2,275
Outlays	(3,181)	(3,100)	(2,600)	(2,300)

Presidential Guidance

NASA has received guidance in the form of a March 7, 1970, statement by the President, which focuses on the future space program. Recognizing that many critical problems here on this planet make high priority demands on our resources, the President's statement stressed that with the entire future and the entire universe before us, we should not try to do everything at once. Within this context, the President's statement emphasized the need for a "bold yet balanced" space program.

The President's statement proposed three general purposes as guides for our space program:

- Exploration - man's insistence on venturing into the unknown.
- Scientific knowledge - a greater systematic understanding about ourselves and our universe.
- Practical application - turning the lessons we learn in space to the early benefit of life on Earth.

The President's statement calls for working toward the following specific objectives:

1. Continuing to explore the moon (e.g. Apollo).
2. Exploring the planets and the universe with unmanned spacecraft (e.g. Grand Tour of the outer planets).
3. Reducing substantially the cost of space operations (e.g. "We are currently examining ... the feasibility of re-usable space shuttles as one way of achieving this objective").
4. Extending man's capability to live and work in space (e.g. Skylab experimental space station).
5. Hastening and expanding the practical applications of space technology (e.g. unmanned earth resources satellites).
6. Encouraging greater international cooperation in space (e.g. applications satellites and astronaut crews).

Despite pressure from NASA and the Space Task Group report, the President did not make any commitment to a manned Mars landing by a specific date, to a space shuttle, or to a manned lunar program after Apollo. The President's statement also did not specify any pace or annual level of funding for the space program. Thus, the President's statement allows a great deal of flexibility for planners of a specific space program guided by the general purposes and objectives outlined in the statement.

Observations on Objectives

The contrast between President Nixon's statement and former President Kennedy's 1961 address on space provides an interesting illustration of the change in the attitude of the national leadership towards the space program. In contrast to President Nixon's call for a balanced and orderly space program, former President Kennedy's address conveys a sense of urgency, international competition with the Soviets, and the battle "between freedom and tyranny."

With the passage of time and the achievement of successful programs, the importance of international competition and world opinion seems to have diminished. The current emphasis is on capturing the scientific and practical benefits of our space technology in a systematic way. And yet, the significance of international competition in space is not over. If scientific knowledge and practical applications were our only objectives, an unmanned program would be sufficient. However, with the Soviets steadily continuing their manned space program, would the U.S. be willing to terminate manned space flight? If the U.S. continues to have a manned space program, what should be the objectives of that program? The alternative answers to these questions are analyzed in the balance of this paper.

The Soviet Space Program

The Soviets are continuing to conduct an orderly, well planned, and balanced manned and unmanned space program which has the following characteristics:

- Major emphasis in the 1970's on the development of manned, orbiting space stations.
  - The current Salyat space laboratory is said to be a step in the direction of a long-lasting (10 year), multi-manned (12-20 men), multi-purpose base-station.
  - Space stations are believed by the Soviets to provide the means to solve scientific issues and to advance geology, meteorology, agriculture, forestry, fishing, and oceanology.
- For the present, Soviet exploration of the moon is relying upon unmanned vehicles. However, a Soviet manned flight to the moon in the 1970's is not ruled out.
- While the Soviets will continue to launch unmanned planetary spacecraft (especially to Venus and Mars), they appear to have no plans for a grand tour of the outer planets.
- The Soviets currently appear to be placing new emphasis on the importance of practical applications than they have in the recent past (e.g., communications, meteorology, earth resources).
- The Soviets apparently have no plans for anything like a reusable space shuttle.

The Soviet rate of launch has been increasing as that of the U.S. has been decreasing. However, this trend reflects at least in part the U.S. development of longer-lived, heavier, and more sophisticated payloads which decreases the number of launches required. The launch records are as follows:

	1966	1969	1970	1971 (6 months)
U.S. launches	78	41	31	18
U.S.S.R. launches	44	70	81	39

Criteria for Selecting Options

The following criteria have been selected for evaluating the various program options presented in this paper:

- Budgetary impact - Providing budget year and total systems costs.
- Employment impact - Providing budget year and peak year estimated employment effects.
- Impact on institutional base - Estimating the number of in-house personnel that might be affected by the program option chosen.
- Scientific return - Providing scientific information which increases man's knowledge of the universe.
- Practical applications - Extending the beneficial applications of space flight in such areas as communications, meteorology, and earth resources.
- International prestige - Providing the U.S. and the President with increased prestige and influence because of other nations' perception of our technological capabilities.
- International cooperation - Providing opportunities for breaking down barriers through cooperative effort with other nations in space.
- Capability to conduct manned space flight - Preserving the technological capability to be able to conduct manned program options which, while not clearly defined now, may be important to the President at some future time.
- Advancement of technology - Pursuing technological objectives that drive the rest of R&D process in industry and in universities and maintaining some large engineering design and management team capabilities.
- Economic analysis - Providing where available the results of economic analysis.

II

II. Manned Space Flight

Introduction

This chapter is divided into four sections as follows:

A. The Role of Man in Space - Briefly reviews the role of man in space and raises questions about whether our historical reasons for having man in space are still valid.

B. Cancelling Elements of the Current Manned Space Program - Defines and analyzes the options for the remainder of the Apollo/Skylab missions.

C. Using Present Capabilities to Continue Manned Space Flight - Defines and analyzes alternative manned space flight programs for the 1970's (e.g. Apollo spacecraft in earth orbit, Second Skylab, Space Station).

D. The Future Space Transportation System - Defines and analyzes alternative future space transportation systems ranging from continued use of current expendable rockets to the development of reusable space shuttles.

A. Key Issue - The Role of Man in Space

The key issue which will have greatest impact upon the costs and benefits of the specific space program formulated for the 1970's and 1980's is the future role of man in space. As described below, an unmanned space program could achieve virtually the same scientific and practical applications benefits from space for less than $2 B per year compared to $3-4 B per year for a manned program. About half of NASA's in-house personnel and the manned spacecraft tracking network support the manned program. (See Attachment II-A)

It is difficult to conceive of any specific task for man in space which could not be satisfactorily performed unmanned for less money. Man's ability to make observations and to take corrective actions when something goes wrong have been cited as justification for his presence in space. However, unmanned systems can be designed which would generally allow man to make most observations and to take corrective actions from ground control rooms.

If this is the case, why do we have a manned space program? Historically, the primary reason for man in space was a desire for the U.S. to overcome the international impact of early Soviet successes and to demonstrate technological superiority with a spectacular achievement. Another important factor relating to a manned space program concerns the desire to preserve the President's flexibility by maintaining the technological capability to conduct manned space flight (e.g. to counter a defense-related surprise by the Soviets).

The principal questions for the future of the space program are a) whether the historical reasons for manned space flight are still sufficient to justify man in space and b) how much extra should the U.S. be willing to pay for manned flight relative to an unmanned program which could produce comparable scientific and practical benefits?

In the following sections it is important to bear in mind the evolving role of man. In Apollo man operates the spacecraft and performs a wide range of support for the scientific instrumentation. He would continue to perform this role in Skylab, Apollo spacecraft in earth orbit, and the space station. However, in the space shuttle, man would primarily be the pilot of a space transportation system. While the shuttle could also be used in a sortie mode with scientists on board, NASA believes that the most productive role for man is as an integral part of a transportation system for unmanned and manned payloads.

B. Cancelling Elements of the Current Manned Space Program

Introduction

This section analyzes alternative ways to curtail approved on-going elements of the Apollo-Skylab program. A brief background statement of the objectives of lunar exploration is presented. The options are described and then analyzed. Implications for the NASA institutional base are analyzed.

Background

Two general factors should be understood when addressing these near-term options. One is the composition and interrelationship of the manned space flight support capability; the other is the basic purpose of lunar exploration.

Manned Space Flight Base - Both Apollo lunar and Skylab missions use the same launch hardware and flight support personnel. Except for the Skylab workshop components, all hardware is complete pending flight check-out. Given the designed operational mode for the Saturn V and Apollo spacecraft, little near-term opportunity exists to make substantial operational reductions while continuing flight operations. In summary, major savings are not achieved through cancellation of individual missions but by phase-down of the Saturn V launch capability. Details of current manned flight costs are provided in Attachment II-A.

Lunar exploration - While the U.S. has unmanned visits to other planets, the only U.S. exploration of the moon is conducted with manned Apollo missions. The moon is of greater scientific interest than other planets because:

- its proximity to earth affects tides, and probably continental drift and seismic behavior. Therefore, the moon is the most important other body (other than the sun) in the solar system.
- its size in relationship to the earth is much greater than the relationship between other planets and their satellites.

- its mass, density, shape and chemical composition are proportional to the earth; hence, the moon is an excellent laboratory for studying terrestrial behavior.

- its lack of atmosphere has preserved primordial features which provide historical data on past terrestrial, lunar, and solar behavior.

Description of Apollo 17

Apollo 17, the last scheduled manned visit to the moon, is scheduled for launch in December 1972. Apollo 17 has been assigned more unique experiments than any other Apollo mission due to the cancellation of Apollo 18 and 19 on which many of these experiments would have been carried. The tentative target of Alphonsus crater would provide data from new lunar terrain. Unique experiment to investigate the theory that gravity is a wave phenomenon is probably the only scientific experiment in the Apollo program of potential Nobel Prize calibre. The Lunar Sounder, also unique, would determine the precise shape of moon and crust composition, which is important to understanding the composition of lunar core. Scientists would also obtain data on the internal temperature of moon to compare with Apollo 15 and 16 data. Other data should verify layering in soil to contribute to the theory of lunar evolution. Apollo 17 also provides the first opportunity for a geologist-astronaut to visit the moon. All crews to date have been pilot-astronauts.

Description of Apollo 16

Launch is scheduled for mid-March 1972 and the landing target is Descartes crater. This first mission to the lunar highlands would provide data on the oldest events on the moon. The highlands represent a major part of the frontside of the moon and almost the entire backside. Therefore, missions through Apollo 15 are not representative of most of the lunar surface. Apollo 16 would verify soil layering detected on Apollo 15 and obtain second soil core samples and temperature measurement. These data from the highlands would provide insight into lunar processes which in turn provide understanding of how continents and ocean basins are formed. Both volcanic and earthquake phenomena could be better understood. Measurements on "wobble" of moon and laser distance triangulation between earth and moon will contribute to understanding terrestrial continental drift and the theory of earthquake development. The astronauts would also set up a unique ultraviolet telescope which would take advantage of the moon's stability to record stellar observations on film.

Description of Skylab Experimental Space Station

Skylab is a three-man experimental space station, scheduled for initial launch in April 1973, which has the objective of achieving a better understanding of man's ability to live and work in space. Skylab was conceived in 1966 to exploit the Apollo spacecraft and Saturn rockets in earth orbit. In contrast to Apollo, which is a small 13,000 pound cockpit for three men, Skylab is a 190,000 pound three-man laboratory with complex solar telescopes (the Apollo Telescope Mount), biomedical test equipment, physics experiments, technology experiments to exploit zero gravity, improved crew life support and maneuvering devices, several sophisticated camera and imaging systems to provide detailed photographs for use in preplanned terrestrial experiments in forestry, hydrology, agriculture and other disciplines, and crew living and exercise. Also, in contrast to Apollo which has only flown as far north as South Carolina, the Skylab orbit will cover the entire U.S.

The current plan is to launch the unmanned Skylab on a Saturn V on April 30, 1973. On May 1 the first manned mission (designated Skylab 2) will be launched to rendezvous with Skylab in a 245 mile orbit. The first mission, which will last 28 days, will concentrate on understanding the biomedical effects of weightlessness with secondary tasks using the camera systems and other experiments. On July 28 the second manned mission (Skylab 3) will be launched for a 56-day mission to focus on astronomy experiments with the ATM and other science experiments. The final 56-day manned mission (Skylab 4) will be launched on October 23, and its primary emphasis would be the exploitation of the earth resources camera system with secondary tasks of astronomy, science, and technology.

There is substantial disagreement about the value of the scientific and technical results of the Skylab experiments other than their contribution to understanding of the man-machine interface. During review of the FY 1972 budget the Office of Science and Technology placed a low priority on Skylab compared to completion of the Apollo lunar science program.

Analysis of Options (See Table II-A)

Table II-A presents data to assist the analysis of the Apollo/Skylab program options according to the criteria. The major effects of the program options are summarized below:

- Apollo cancellation options - High priority scientific experiments would be foregone. There would be relatively minor impact on the budget, employment, international prestige, and the institutional base.

- Cancel Skylab - Relatively low priority science and applications experiments would be foregone. There would be a major impact on the budget, employment, and international prestige.

- Cancel Apollo 16, 17, and Skylab - Since this option would essentially terminate the existing U.S. manned space flight capability, this option would have the greatest impact upon all of the criteria. It would mean a dependence on the unmanned space program which would provide equivalent scientific return and practical applications, but less international prestige.

Table II-A

Program Options for Apollo/Skylab

Criteria		Cancel Apollo 17 BA	Cancel Apollo 17 Outlays	Cancel Apollo 16 & 17 BA	Cancel Apollo 16 & 17 Outlays	Cancel Skylab BA	Cancel Skylab Outlays	Cancel Apollo 16, 17 & Skylab BA	Cancel Apollo 16, 17 & Skylab Outlays
Budgetary Impact ($M) (direct program - does not include impact on institutional base described below and costed in Table II-F)	1972	-5	-2	-20	-10	-120	-60	-180	-120
	1973	-84	-79	-113	-109	-465	-460	-650	-625
	1974					-261	-300	-325	-325
Contractor employment impact	6/72		-800		-3,800		-12,000		-24,000
	12/72		-5,400		-6,200		-18,400		-32,000
Impact on institutional base		None		None		Depends on decisions re future manned flight (see Tables II-B & II-E)		CY 73 - Close Marshall Space Flight Center (Ala) and Manned Spacecraft Center (Tex). Reduce Kennedy Space Center (23,000 employees).	
Scientific loss		. Unique gravity experiment . Unique lunar core composition experiment . Only geologist-astronaut		In addition to Apollo 17 losses: . Only lunar highlands mission (oldest events) . Soil layering and samples . Lunar telescope		. Biomedical effects of 56 days in space . Solar telescope		Same effects as listed for each option.	
Impact on Apollo lunar stay time		-26%		-52%		NA		-52%	
Practical applications loss		NA		NA		. Earth resources experiments		. Skylab earth resources experiments	
OST ranking of experiments		High priority		High priority		Low priority		Apollo = High priority Skylab = Low priority	
International prestige		Little effect-capability already demonstrated		Little effect-capability already demonstrated		No scheduled U.S. competition with Soviet orbital program from 1973-1979		No U.S. competition with Soviet manned space program	

Criteria	Cancel Apollo 17 BA	Outlays	Cancel Apollo 16 & 17 BA	Outlays	Cancel Skylab BA	Outlays	Cancel Apollo 16, 17 & Skylab BA	Outlays
Duration of hiatus in manned flight (assuming shuttle flight early CY 1979)	5 years		5 years		6 years		Indefinite	
International cooperation	Curtail additional scientific data exchanges		Curtail additional scientific data exchanges		Cancel several foreign experiments		Same effects as listed for each option	
Capability to conduct manned space flight (Interval between Saturn rocket launches in months)	13		21		9		Indefinite loss of capability	
Advancement of technology	No effect (technology already in hand)		No effect		No effect		No effect	

C. Using Present Capabilities to Continue Manned Space Flight

Introduction

This section analyzes alternative future manned flight programs for the 1970's. The spectrum of alternatives presented ranges from the use of existing Apollo spacecraft to a program with an operational space station late in the decade.

Background

The following manned hardware from the Apollo/Skylab program is essentially fabricated and available for use after Skylab:

- Launch vehicles

  2 Saturn V
  4 Saturn 1 B

- Spacecraft

  6 Command modules
  2 Lunar modules
  1 Skylab experimental space station

Description of Apollo Spacecraft Options

- Single joint docking mission with Soviets - Mission would launch a modified Apollo spacecraft in 1974-75 to rendezvous and dock with the Russian Salyut space station. U.S. spacecraft would subsequently conduct a 7-14 day earth resources photo mission. Benefits would be largely diplomatic, since the mission would not provide any earth resources data that could not be acquired by unmanned satellites.

- Three Apollo-type earth resources and orbital science missions - In addition to the joint docking mission, two subsequent missions would use two-man crews in Apollo spacecraft to conduct astronomy and physics, zero-gravity manufacturing and materials experiments, evaluate astronaut ability to perform on-orbit repair, conduct earth surveys, and perhaps allow foreign or female astronauts. Program could launch one mission per year in 1975-77 without building new hardware.

Description of Second Skylab (1976)

A second Skylab would be about 14 times as large as an Apollo spacecraft, permitting longer duration flights, increased experiments, and more sophisticated experiments. Since a duplicate of the first Skylab would produce little new knowledge, improvement would be needed in both the quality and quantity of science and applications. An improved Skylab would have the following capabilities: artificial gravity mode, substantially enhanced manufacturing capabilities, a stellar (vice solar) astronomy package, an automated earth resources film cannister return system, and compatible docking ports for a possible rendezvous with a Soviet spacecraft.

<u>Description of a Space Station</u>

A Space Station would be designed with the capability to function between five and 10 years (vice 1.5 years for Skylab). With a 6-man crew, it could conduct 24-hour operations not feasible with Skylab. A Space Station would be able to conduct experiments in bioscience, medicine, and earth resources not planned on Skylab. A station could also make advances in space manufacturing of vaccines, high purity medication, lightweight metals, and optical glass.

Advances would be made in medicine, biology, and metallurgy. Scientific data return would not be appreciably greater than unmanned data return. In the Space Station the realization of applications is enhanced beyond simple observations of the earth by the ability to conduct major on-board manufacturing experiments.

<u>Analysis of Options</u> (See Table II-B)

Table II-B presents data to assist the analysis of the program options for post-Skylab manned space flight. The major effects of the program options are summarized below:

- <u>Apollo Spacecraft</u> - Least costly of program options for manned space flight. Experiments of low priority. International prestige and cooperation could be enhanced with joint flight or flights with Russians. Marshall Space Flight Center could be closed in FY 1974. Further actions reducing the manned space base would depend upon future program decisions regarding manned space flight.

- <u>Second Skylab</u> - Intermediate option in terms of budgetary impact. Larger spacecraft permits better experiments than possible in Apollo spacecraft. However, even improved experiments would be only marginally better than possible with unmanned spacecraft. The Marshall Space Flight Center could be shut down in FY 1974.

- <u>Space station</u> - The most costly of the program options. While it would enhance international prestige, the scientific return would be of low priority. There would be no change in the NASA institutional base.

Table II-B

Program Options for Post-Skylab Manned Space Flight

		Apollo Spacecraft: Single Joint Docking BA	Apollo Spacecraft: Single Joint Docking Outlays	Apollo Spacecraft: 3 Missions BA	Apollo Spacecraft: 3 Missions Outlays	Second Skylab BA	Second Skylab Outlays	Space Station BA	Space Station Outlays
Budgetary impact ($M) (direct program - does not include impact on institutional base described below and costed in Table II-F)	FY 1973	22	13	60	35	50	30	50	30
	1974	100	70	110	90	250	170	300	200
	1975	86	90	200	165	500	400	700	540
	1976	15	45	190	190	400	440	1,100	940
	1977	-	5	40	120	300	360	1,300	1,220
Contractor employment impact	12/72	300		1,600		1,300		1,300	
	Peak year	4,500		9,000		22,000		58,000	
Impact on institutional base		FY 74 - Close Marshall Space Flight Center (Ala) (8,600 employees)		FY 74 - Close Marshall Space Flight Center (Ala) (8,600 employees)		FY 74 - Close Marshall Space Flight Center (Ala) (8,600 employees)		Keep present Center staffing	
Scientific experiments		. Astronomy and earth physics		. Astronomy and earth physics		. Biomedicine . Astronomy		. Biomedicine . Astronomy	
Practical applications experiments		. Earth resources photos		. Earth resources photos . Simple zero gravity manufacturing		. Earth resources		. Earth resources experiments . Advanced space manufacturing (vaccines, metals, glass)	
OST ranking of experiments		Low priority		Low priority		Low priority		Low priority	
International prestige		Brief space spectacular		U.S. program would be less than that of USSR		U.S. program about equal to USSR plans		U.S. program would be more sophisticated than USSR's	
Duration of hiatus in manned space flight		1-2 years		1-2 years		3 years		5 years	

	Apollo Spacecraft Single Joint Docking BA	Apollo Spacecraft Single Joint Docking Outlays	Apollo Spacecraft 3 Missions BA	Apollo Spacecraft 3 Missions Outlays	Second Skylab BA	Second Skylab Outlays	Space Station BA	Space Station Outlays
International cooperation	. Joint flight with Russians		. Joint docking with Russians . Possible flights with foreign astronauts		. Joint docking with Russians . Possible flights with foreign astronauts		. Possible international crews	
Capability to conduct manned space flight - man months in earth orbit (1972-80)	2		5		36		180	
Advancement of technology	No effect (technology already in hand)		No effect		Some new technology to improve science and applications return		Significant advances (lightweight computers, communications, life support)	

Implications for the 1980's

Longer range and far more costly alternatives exist which should be mentioned because they have been actively considered by NASA in the recent past. A manned trip to Mars is, of course, the most ambitious undertaking possible in the 1980's. Such a trip would probably be preceded by either a lunar orbiting space station or temporary (30-day) manned lunar base. Nuclear propulsion in the form of some derivative of NERVA would be required.

A space base, with an international crew of up to 100 men, would be a possibility for the late 1980's. Another manned system would be a polar orbiting, or a synchronous orbiting, space station for earth resources, communications, and meteorology.

While the Apollo-type missions are alternatives for the 1970's, a different class of missions would be required to exploit manned space in the 1980's.

Implications for a Reusable Shuttle

All of the options reviewed can be conducted with existing launch vehicles if a continued manned program were desired. However, the true value of looking at these manned program alternatives is that they are representative of the types of manned activity that could be conducted with alternative space transportation systems. Only the need to resupply a Space Station begins to justify investing in a reusable shuttle capability. In a sense, a commitment to a shuttle is an implicit commitment to a subsequent space station program.

D. The Future Space Transportation System

Introduction

In order to reduce the cost of space operations in the 1980's and beyond, NASA strongly supports investing at least $12B in the development of the space shuttle transportation system during the 1970's. The space shuttle recommended by NASA would be a manned, reusable, two-stage (with expendable external propellant tanks) system which could carry NASA, DOD, and commercial payloads to and from earth orbit.

This section analyzes the options for future space transportation systems ranging from continued use of expendable rockets to the development of reusable space shuttles.

Objective

The objective of the future space transportation system is to reduce the total investment and operating costs (launch vehicles plus payloads) of space operations. The future space transportation system should be looked upon as a means of achieving space program objectives in the most efficient way rather than as a goal in itself.

Definition of options

Alternative space transportation systems are as follows:

1. Baseline shuttle - A manned, reusable two-stage (with expendable external propellant tanks) system which could be operational by 1979. The shuttle consists of the orbiter which carries satellites or manned modules to and from low earth orbit and the booster which provides the liftoff thrust for the orbiter. Development options are as follows:

   a. Concurrent development - Development of the orbiter and booster would proceed concurrently (total investment about $12-16B).

b. Phased development - Development of the orbiter would proceed in FY 1973 while development of the booster would be deferred. From 1978-1983 the orbiter would be launched by interim expendable rockets such as the S-I-C or the Titan III (total investment about $13-16B).

2. Minimum technology shuttle (Mark I/II) - A manned reusable, two-stage system which would rely upon state-of-the-art technology to the maximum possible extent during the initial phase (Mark I) (e.g., J-2-S engines vice high pressure engines in the orbiter; current technology avionics). Technology advances would be incorporated during a later phase (Mark II). Development of the orbiter and booster would proceed concurrently. Mark I would extend from 1978-83 (total investment about $11-13B).

3. Expendable boosters - Expendable rockets, such as the Saturn I B or the Titan III, which are used to launch manned or unmanned spacecraft and satellites. Options include:

   a. Current expendables - Boosters currently being produced (investment $ .2B plus $1.3B for Big Gemini to resupply Space Station).

   b. New expendables - Growth versions of the Titan III (total investment about $ .6 plus $1.3B for Big Gemini).

4. Deferral of program decision until FY 1974 - This option would allow more time for study of alternatives and advancement of technology.

Economic Analysis of the Options

Potential cost savings - When developed, the shuttle has the potential for reducing the cost of space operations by:

- Recovering satellites for refurbishment or updating (65% benefits).
- Reusing launch vehicles (30% of benefits).
- Relaxing payload size/weight constraints which currently increase design and fabrication costs (5% of benefits).

Cost savings analysis - Table II-C presents a cost savings analysis in which each of the space transportation system options are compared to new expendable rockets (Titan III derivative). Lines 2-8 show the sensitivity of the cost savings to changes in assumptions. A 10% discount rate is used unless otherwise indicated.

- Hypothetical shuttle - This option (which would have the most cost-effective combination of non-recurring and recurring costs) has been included to show a best case option for the shuttle. The hypothetical shuttle has similar characteristics to several configurations which have been considered by contractors and which might be examined further if a program decision were deferred until FY 1974.
- Baseline - Line 1 is based upon a mission model requiring an expendable rocket launch rate of 59 per year (compared to the projected 1972-77 U.S. average of 39 per year). Line 1 assumes that the shuttle development schedule will be met and that actual shuttle costs will equal NASA estimates (e.g., $12B for Baseline Shuttle, concurrent development).
- Discount rate - Cost savings are highly sensitive to the discount rate. The baseline rate is that used by DOD (10%). Lines 2 and 3 show the effect of varying the rate.

- Delay in shuttle operational readiness - In order to maintain equal capability, later phase-in dates require the purchase of additional current expendables, thereby decreasing shuttle savings. Either development schedule may not be met or performance problems could ground the shuttle for several years. Line 4 shows this effect.

- Mission model changes - Lower launch rates reduce the savings from all alternatives. NASA and DOD have recently revised downward their projected launch rates. Line 5 shows the effect of reducing the mission model by 10% for all users. Line 6 shows the effect of decreasing DOD's launch rate by 25% (to a much more realistic level).

- Potential of cost overrun - The ratio of actual development costs to estimated costs for 12 systems built during the 1960's was 1.2. Line 7 shows the effect of increasing development cost estimate by 20%.

- Launch costs higher than NASA estimate - Line 8 shows the effects of doubling the launch costs for the shuttle options.

Conclusions from Economic Analysis - OMB staff conclusions are as follows:

1. At the 10% discount rate, all of the shuttle options save less systems cost than does the New Expendable (Titan III derivative).

2. Even if the discount rate is reduced to 8%, the two options being reviewed by NASA (Baseline - Concurrent and Mark I/II) show only marginal savings relative to the New Expendable.

3. Changes in any one of several assumptions would further reduce estimated savings for the shuttle options.

4. The uncertainties in the assumptions are such that all of the shuttle options would be likely to have a negative return (e.g., investment and operating costs are likely to grow and the mission model likely to decrease relative to NASA assumptions). See Attachment II for OMB staff evaluation of shuttle uncertainties.

5. Because shuttle savings are sensitive to the phase-in period, phased development of either the booster or of technology (e.g. Mark I/II) is not cost effective.

Table II-C

Cost Savings Analysis ($ Millions)[1]
Present Value of Savings Compared to Expendable Rockets[2]

	New Expendable Rockets	Baseline Shuttle: Concurrent Development	Baseline Shuttle: Phased Development	Minimum Technology (Mark I/II) Shuttle	Hypo-thetical Shuttle
Investment 1973-1985	$.6B	$12 to $16B	$13 to $16B	$11 to $13B	$9 to $11B
Line #					
1. Baseline (Shuttle phase-in 1978-81: 59 expendable launches per year)		-$1000	-$1900	-$1300	-$400
2. Decrease discount rate to 8%		500	-500	$0 to $200	1200
3. Increase discount rate to 12%		-1800	-2500	-2000	-1000
4. Shuttle phase-in 1978-83		-1500	-2200	-1600	-900
5. Mission model based on 54 expendable launches per year		-1100	-2000	-1400	-500
6. Decrease DOD launch rate by 25%		-1200	-2000	-1400	-500
7. Development cost estimates increased by 20%		-1300	-2200	-1600	-900
8. Double cost per launch		-1200	-2100	-1400	-600

1/ Preliminary OMB staff estimates. Calculated by time-phasing NASA estimates of total costs and applying 10% discount rate. (Cost of reusable space tug, operational in 1985, included.)

2/ Titan III derivative (sometimes called New Expendable) used for the analysis.

Analysis of Options According to the Criteria

Table II-D presents data to assist the analysis of the options for the future space transportation system. The major effects of each of the program options are summarized below:

- Baseline Shuttle (concurrent development) - This option would have the greatest near-term budgetary and contractor employment impact. It would also have the lowest cost per launch when developed. There would be no change in NASA's institutional base. Lower future year operating costs could lead to an increase in the rate of scientific and applications flights. There would be major advances in technology and a demonstration of the U.S. leadership in space capabilities. As shown on Table II-C, this option does not appear to be cost effective when compared to new expendable rockets.

- Baseline Shuttle (phased development) - This option would alleviate near-term funding peaks, but would have a greater total investment cost than the Baseline (concurrent development) option. Launch costs of $40M with an interim expendable booster would have a negative effect on cost-effectiveness. Otherwise, this option would be comparable with the Baseline (concurrent development) option.

- Mark I/II - This option would reduce near-term budgetary peaks and total investment costs below those of the Baseline Shuttle. The cost per launch would be double that of the Baseline Shuttle during Mark I and 22% higher than the Baseline Shuttle during Mark II. Because of decreased requirements for the booster, Marshall Space Flight Center could be reduced by 50% starting in FY 1974. As shown on Table II-C, the Mark I/II shuttle would be less cost-effective than the Baseline (concurrent) shuttle. Otherwise, this option would be comparable to the Baseline (concurrent) shuttle.

- New Expendable - This option would require only about 5% of the investment cost of the shuttle option and would require no funding in FY 1973. However, the cost per launch would be 1.3 - 7 times as much as the baseline shuttle depending on payload size. The Marshall Space Flight Center could be closed starting in FY 1974. This is the most cost-effective of the program options.

Because of the higher operating costs, this option would be less likely than the shuttle options to cause an increase in the rate of scientific and practical applications flights. This option does not retain the shuttle's ability to conduct 1-2 week sortie missions or to recover satellites for refurbishment. However, the Titan III would be able to launch all other payloads.

Preserving future options in FY 1973 - Deferring a decision on the Shuttle until FY 1974 is primarily a tactical option and has not been ranked against the criteria for selecting among transportation system options. This option would require a continuation of approximately the FY 1972 funding ($100M) and employment levels (3,000 positions). This option has the following advantages and disadvantages:

- Advantages
  - Avoids the need to make a decision before the fall of 1972 which would be apt to provoke criticism no matter what choice was made.
  - Reduces FY 1973 budget requirements.
  - Allows further study of other alternatives besides the current NASA preferred system.
  - Permits technology advances to be made on critical long lead time items.
- Disadvantages
  - Program already has been extensively studied and a sufficient basis for a FY 1973 decision probably will exist.
  - Strings along several aerospace firms which are making major contributions of their own resources in the hopes of receiving the contract.
  - Increases the hiatus in manned space flight from 5 to 6 years.

Table II-D

Options for the Future Space Transportation System

		Baseline Shuttle				Mark I/II Shuttle (Phased Technology)		New Expendable (Titan III series)	
		Concurrent		Phased					
		BA	Outlays	BA	Outlays	BA	Outlays	BA	Outlays
Budgetary impact ($M) (direct program - does not include impact on institutional base described below and costed in Table IV-A)	FY 1973	228	93	228	93	228	93	-	-
	1974	960	650	800	550	640	450	50	30
	1975	1,550	1,200	1,100	900	1,000	800	100	75
	1976	1,800	1,600	1,300	1,100	1,250	1,100	150	120
	1977	1,950	1,800	1,300	1,200	1,200	1,200	200	150
Total investment ($B)		12-16		13-16		11-13		0.6	
Cost per launch when developed ($M)		4.5		40.0 (interim) 4.5 (final)		9.0 (Mark I) 5.5 (Mark II)		$6M-30M depending on payload size	
Contractor employment impact	12/72	3,700		3,500		3,400		-	
	Peak year	85,000		55,000		50,000		4,500	
Impact on institutional base		Keep present Centers		Keep present Centers		FY 74 - Reduce Marshall Space Flight Center (5,000 employees)		Close one Center (9,000 employees) during FY 1974	
First manned orbital flight		1979		1979		1979		1977-78	
Sortie mission capability for scientists (1-2 weeks)		Yes		Yes		Yes		No	
Scientific/practical applications return		Lower operating costs could increase level of activity, esp. commercial		Same as concurrent		Same as concurrent		Less likely than shuttle to cause increase in level of activity	
International prestige		Demonstrates leadership in space capabilities		Same as concurrent		Same as concurrent		Would depend on nature of payloads	
Duration of hiatus in manned space flight		5		5		5		3-4	
Advancement of technology		Major (thermal protection systems, avionics, rocket engines)		Same as concurrent		Advances made at a slower pace than concurrent		Minor	

III

III. Program Options for the Unmanned Space Program

Introduction

This section analyzes program options for three major portions of the unmanned space program: The Grand Tour of the Outer Planets; The Viking Mars Lander and Orbiter; and the High Energy Astronomical Observatory (HEAO). These programs have been selected for analysis since they require the largest amounts of funding of any individual projects in the current unmanned space program.

Planetary Exploration - Grand Tour of Outer Planets

Objectives

Conducts exploratory scientific investigations of the outer planets--Jupiter, Saturn, Uranus, Neptune, and Pluto, the Asteroid Belt, and interplanetary space. The investigations will provide new knowledge about the origin, history, and dynamics of the solar system to better understand the evolution of the earth and its environmental processes.

Background

Because of the alignment of the outer planets from 1976 to 1979, a very rare opportunity (175 year) is available to conduct outer planetary missions by using three-planet gravity-assisted swingbys (Jupiter-Saturn-Pluto and Jupiter-Uranus-Neptune).

Definition of Spacecraft Options

1. Thermoelectric Outer Planets Spacecraft (TOPS) - This option would require development of subsystems of high reliability, long life and survivability, control and repair, and high data rate storage and return.

2. NASA-recommended spacecraft - This option would reduce the size and capability of several components, subsystems, and science instrumentation of the spacecraft. However, the spacecraft would have a good probability of being able to perform the missions.

3. Outer Planet Explorer - This option would require modifications of the Outer Planet Explorer and redundant equipment that would increase spacecraft weight and cost but would not have the same capability as the NASA-recommended spacecraft.

4. Modified Pioneer - The Pioneer could not carry all science instruments and would have no data storage, low data rate return (especially required for the TV imaging instrument) and limited power capacity.

Analysis of the Spacecraft Options (See Table III-A)

Table III-A presents data to assist the analysis of the spacecraft options for the Grand Tour. The major effects of the options are summarized below:

1. Thermoelectric Outer Planets Spacecraft (TOPS) - This option ranks highest against all the measures of scientific return listed on Table III-A. In addition, the advancement of technology would be the greatest. However, the budgetary impact would be the largest of all the options.

2. NASA-recommended spacecraft -- Although this option would decrease scientific return, NASA believes it would accomplish the major scientific objectives of the Grand Tour at 25% less cost than the TOPS option.

3. Outer Planets Explorer - This option would result in a major reduction in scientific return and in advancement of technology for only a 13% decrease in total costs relative to the NASA-recommended option.

4. Modified Pioneer - This option has inherent technical limitation which would severely limit the scientific return of the program in return for a 33% reduction in total costs relative to the NASA-recommended option.

Definition of Mission Options

1. Conduct baseline program - Two spacecraft would be launched in 1977 to Jupiter-Saturn-Pluto and two spacecraft in 1979 to Jupiter-Uranus-Neptune.

2. Delete the Jupiter-Saturn-Pluto Missions and fly current spacecraft to Jupiter and Saturn - Two spacecraft would be launched in 1979 to Jupiter-Uranus-Neptune. Saturn would be covered by Pioneer and Explorer spacecraft.

3. Cancel Grand Tour and rely on Pioneer and Explorer missions to Jupiter and Saturn - Rely upon Pioneer or Explorer class satellites to Jupiter and Saturn, which have been identified by the Space Science Board as priority planets in terms of their interest and accessibility.

<u>Analysis of Mission Options</u> (See Table III-B)

- Conduct baseline program - This option ranks high in terms of scientific return and advancement of technology. However, the budgetary impact would be the largest of all the options.

- <u>Delete Jupiter-Saturn-Pluto; fly current spacecraft to Jupiter and Saturn</u> - This option reduces scientific return while not greatly reducing overall program cost--e.g., eliminating one launch (25% of the program) saves about $75M (10% of costs). This is because most of the program cost is associated with R&D for new spacecraft concepts and payloads.

- <u>Cancel the Grand Tour program and rely on Pioneer and Explorer</u> missions to Jupiter and Saturn - This would have the least budgetary impact. The Space Science Board has suggested that as a fallback position lower cost missions of the Pioneer and Outer Planet Explorer class would be recommended. The major disadvantage of this option is that the opportunity for large scientific return and technology advance would be foregone.

Table III-A

Exploration of the Outer Planets - Spacecraft Options

		Thermoelectric Outer Planets Spacecraft (TOPS)		NASA-Recommended Spacecraft		Outer Planets Explorer		Modified Pioneer	
		BA	Outlays	BA	Outlays	BA	Outlays	BA	Outlays
Budget impact ($M)	FY 1973	40	25	29	20	25	18	20	15
	1974	160	110	127	90	110	80	85	60
	1975	200	185	162	145	140	130	110	100
	1976	160	160	128	130	110	115	85	90
	1977	110	135	87	110	70	95	60	75
Total cost (FY 72- ($M)		1,000		750		650		500	
Contractor employment impact	12/72	800		600		500		400	
	Peak year	9,000		7,000		6,000		5,000	
Scientific return									
. Experiment weight (lbs.)		220		130		200		119	
. Experiment power (watts)		104		78		56		38	
. Data return (bits/second from Neptune).		1,000		150		15		38	
International prestige		May eventually generate popular appeal		Same as TOPS		Same as TOPS		Same as TOPS	
International cooperation		Exchange of scientific data		Same as TOPS		Same as TOPS		Same as TOPS	
Advancement of technology		Long life (9 yr) systems; improved data handling and storage		Long life (9 yr) systems		Current technology		Current technology	

Table III-B

Exploration of the Outer Planets - Mission Options[1/]

		Baseline Program		Delete Jupiter-Saturn-Pluto; fly current spacecraft to Jupiter and Saturn		Cancel Grand Tour; fly current spacecraft to Jupiter and Saturn	
Missions	Jupiter-Saturn-Pluto (1977)	2		-		-	
	Jupiter-Uranus-Neptune (1979)	2		2		-	
	Jupiter-Saturn (1976-78)	-		2		2	
		BA	Outlays	BA	Outlays	BA	Outlays
Budgetary impact ($ M)	FY 1973	29	20	15	10	15	10
	1974	127	90	35	25	20	15
	1975	162	145	70	55	40	35
	1976	128	130	135	110	25	30
	1977	87	110	150	145	20	25
Total cost (FY 1972-79) ($M)		750		700		175	
Contractor employment impact	12/72	600		300		300	
	Peak year	7,000		6,800		1,800	
Scientific return		Covers 5 planets with NASA-recommended spacecraft		Covers 3 planets with NASA-recommended spacecraft. Pluto not visited. Saturn covered by Pioneer (reduced performance)		Covers only Jupiter and Saturn. Pioneer spacecraft (reduced performance)	

Mission trip time (years)

	Jupiter	Saturn	Uranus	Neptune	Pluto
Grand Tour	1.5	3.1	6.0	9.4	8.8
Direct missions to single planets	1.5	5.8	16.0	31.0	46.0

1/ Assumes use of spacecraft recommended by NASA in the FY 1973 budget unless otherwise specified.

Planetary Program - Viking Mars Lander/Orbiter

Objectives

Advance knowledge of Mars by conducting scientific investigations from orbit, in the atmosphere, and on the surface. Emphasis will be placed on obtaining biological, chemical, and environmental data related to the existence of life on the planet at present, in the past, or possibly in the future.

Background

- The Viking Mars landing missions will involve two orbiters and two landers. Both missions are scheduled to be launched in 1975.

- The Viking program was approved as a new start for FY 1969 with the first Mars landing scheduled for 1973. However, the program was rescheduled as a result of budgetary action for a first landing in 1975. The original cost estimate for the 1973 landing was $380 M including launch vehicles. The current estimate is about $850 M.

- During FY 1972 NASA is expected to complete detailed design and to conduct spacecraft and preliminary design reviews. Fabrication of the first developmental landers to be used in the testing program will begin.

Definition of Options

1. Conduct the baseline Viking program - The two missions would be conducted as planned.

2. Drop the orbiters from missions - This option would allow the program to proceed with the two landers.

3. Cancel one of the missions - In this option one orbiter/lander system would be deleted. In addition, a launch vehicle would be excluded. The purchase of spacecraft hardware, scientific instrumentation and systems integration would be reduced.

4. Defer missions - This option would stretch out the Viking program to the next Mars launch opportunity in 1977.

5. Cancel Viking - Under this option all work on the Viking missions would be terminated.

Analysis of options (See Table III-C)

1. Conduct baseline program - This option ranks highest in scientific return. In addition, the science data from this option will determine the priority of Mars in the planetary program and what future missions will be conducted there. This option would enhance the nation's international technological image by demonstrating that a landing on a distant planet can be accomplished. However, this option would not significantly advance technology. The budget impact of this option would be significant in FY 1973--$256 M in BA and about $180 M in BO; however, FY 1973 is the peak funding year and requirements decrease in future years.

2. Drop the orbiters from the missions - This option would permit savings of about $290 M from the total program and about $60 M in FY 1973 BA thus reducing the budget impact. However, a large amount of science return will not be possible. More significantly this option adds risk to the missions because one of the functions of the orbiter is to select the landing sites.

3. Cancel one of the missions - While this option would reduce the program's budget impact by approximately $350 M, risks are put into the program. Dual launches insure against launch or spacecraft failure and maximize scientific return. NASA would strongly object.

4. Defer missions - This option would have about a $60-80 M budget impact in FY 1973; however, future years could be increased by as much as $400-450 M. Viking was deferred in FY 1971 from 1973 to 1975. A deferral to FY 1977 would increase the program's development lifetime to eight years and increase costs to $1.3 B.

5. Cancel Viking - This option would reduce FY 1973 requirements by $250 M. This option ranks lowest in scientific return. In addition, the international image of the U.S. in the space program would be reduced--the Russians have missions underway and planned to Mars.

Table III-C

Planetary Exploration - Viking Mission Options

Criteria	Baseline Program	Drop Orbiters	Cancel One Mission	Defer Viking	Cancel Viking
Budgetary impact					
FY 1973 BA	256	190	180	60-80	-0-
FY 1973 outlays	180	150	130	50	45
Peak year outlays	256	190	180	225	45
Total cost	850-900	560-610	500-550	1.2-1.3B	132
Contractor employment impact					
12/72	6,600	6,700	6,000	5,500	-0-
Peak year	8,000	7,300	6,800	7,500	6,500
Scientific return	Data on possible life on Mars	Lose imaging and site selection capabilities	Jeopardize science if technical difficulty or launch abort	Delay data on life on Mars	Forego data on life on Mars
International prestige	Could have considerable popular interest	Same as baseline	Increases risk of failure	Little effect	Little else of popular appeal scheduled in 1975 period

Astronomy - High Energy Astronomical Observatory (HEAO)

Objectives

HEAO is designed to provide the scientific community with an astronomical observatory beyond the filtering effects of the earth's atmosphere. HEAO will observe the galaxy and the universe in the x-ray and gamma ray region of the electromagnetic spectrum. These observations are expected to yield new insight into the nature and evolution of the universe.

Background

- HEAO A and B have been approved as new starts for FY 1972. The total estimated cost for the two spacecraft including launch vehicles is $210-280 million (excludes tracking and data acquisition).

- HEAO A, scheduled for launch in 1975, is designed to do a full sky survey with relatively crude pointing for source and background radiation.

- HEAO B, scheduled to be flown in 1976, will have a finer pointing capability to permit larger duration observations of selected high energy sources.

- All other major NASA astronomy programs have been deferred in favor of HEAO. NASA's Astronomy Missions Board has carried HEAO as a top priority project for two years. The Space Science Board of the National Academy of Sciences has given strong advocacy for HEAO and recommends the program even under budget constraints. OST has vigorously supported HEAO.

Definition of options

1. Conduct the current program - Aside from the scientific objectives of the missions, NASA argues that this approach would maximize return on the mission by using a large spacecraft with a variety of experiments.

2. Defer the HEAO A and B Program - A deferral of this program would save $16 million in 1972 and $70 million (estimated in NASA cost run-out for spacecraft and launch vehicle) in 1973.

3. Reduce the scope of HEAO program - This option would include a spacecraft about half the size of the current spacecraft. In addition, substantial savings would be possible in science instrumentation. A smaller launch vehicle would be used.

Analysis of the options (See Table III-D)

1. Conduct the current HEAO A and B program - This option would rank high in the acquisition of scientific data. It would also have the greatest budget and employment impact.

2. Defer the HEAO program - This option would reduce the budget impact of HEAO in FY 1973 (quantified in Table III-D). In lieu of HEAO, programs could be approved within the total astronomy program, such as increased sounding rocket activities, airborne research (including newer high-flying aircraft), and ground-based facilities improvements and additions. There is no launch urgency surrounding the HEAO program. The delay would be in getting scientific return--a two-year deferral would mean a first launch in 1977. The strongest argument for HEAO has been that it will provide a national laboratory capability in space to study areas of energy spectrum that cannot be observed from the ground. The strongest argument advanced by ground astronomers against space astronomy and especially HEAO is that space observations are 100 times more expensive and that fewer scientists are involved.

3. Reduce the scope of HEAO program - This option would reduce the scientific return capability of the spacecraft. In the HEAO program celestial bodies would be studied in the x-ray and gamma ray regions simultaneously, thus permitting coordinated observations and mapping of the sky. This option would permit the total cost of the HEAO program to be reduced by about $85-130 million and reduce requirements in FY 1973 by $28 million in BA and $15 million in outlays. This option would maintain balance in the astronomy program by permitting increased studies in all regions of the energy spectrum (i.e. optical, infrared, radio, and high energy).

Table III-D

High Energy Astronomical Observatory (HEAO) - Program Options

Criteria	Baseline Program	Reduce HEAO	Cancel HEAO
Budgetary impact			
FY 1973 BA	42	20	-0-
FY 1973 outlays	25	15	-0-
Peak year outlays	55	40	-0-
Total cost	230-280	125-150	-0-
Contractor employment impact			
12/72	1,000	600	-0-
Peak year	3,000	1,500	-0-
Scientific return	. Largest and most sensitive experiments (one instrument 5,000 lbs) . 100x better resolution to study extra-galactic energy sources . First cosmic ray studies--to 100,000 BEV	Reduce scientific return by 30-40%	None
International prestige	Little effect	Little effect	Little effect
Advancement of technology	Mostly existing technology	Same as baseline	None

Note: This paper has not attempted to compare HEAO with ground-based astronomy projects. A separate analysis on this subject is being prepared by EST staff for the Director's Review.

IV

IV. Summary of Program Options

Table IV-A presents data which makes it possible to estimate the FY 1972-77 budgetary effects of combinations of program options for manned and unmanned space flight. The base against which the program options can be applied is Table I-C, which presented the runout costs of the current activity level for NASA's on-going programs.

The following summary table provides an illustration of how to use Table IV-A. Suppose one desired to construct a space program which would (a) cancel Apollo 17, (b) initiate a single joint docking mission with the Soviets, (c) proceed with the concurrent development of the baseline shuttle, and (d) conduct the Grand Tour with Explorer spacecraft. The calculation would be as follows:

	1972		1973		1974
	BA	BO	BA	BO	BA
NASA On-going Program..	3,315	3,181	3,096	3,100	2,600
A-1. Cancel Apollo 17..	-9	-5	-92	-60	
B-1. Joint docking mission..........	--	--	+22	+15	+100
C-1. Baseline shuttle (concurrent).....	--	--	+228	+93	+960
D-3. Outer Planets Explorer.........	--	--	-4	-3	-17
Revised Program........	3,306	3,176	3,250	3,145	3,643

Table IV-A presents data which allows similar projections to be made through FY 1977 ($4.2B peak in FY 1977 for the above case).

Case A-4 assumes the elimination of the current capability to conduct manned space flight and hence should not be used with subsequent manned flight options.

Three of the post-Skylab manned options assume the closure or reduction of the Marshall Space Flight Center (MSFC), Huntsville, Alabama. In making the projections from Table IV-A, care should be taken not to count the closure of this Center twice or to assume the closure of this Center if a shuttle option is selected (e.g., a combination of Case B-1 and Case C-1 should not be assumed to result in the closure of MSFC).

Space limitations have not permitted an analysis of the full range of possible program initiatives for space sciences and applications and aeronautics above the current rate of activity projected in the NASA On-going Program. NASA has projected increases in both of these programs which have been included in Section G of Table IV-A. Examples of space science and applications new starts include HEAO C&D, Earth Observation Satellites, and a Disaster Warning Satellite. Examples of aeronautics new starts include Conventional Take-off and Lift (CTOL) quiet engine and a low density short-haul experimental aircraft.

Table IV-A

Summary of Program Options
(millions of dollars)

	1972		1973		1974	1975	1976	1977
	BA	BO	BA	BO	BA	BA	BA	BA
NASA Ongoing Program[1/]	3,315	3,181	3,096	3,100	2,600	2,275	2,275	2,275
Manned Program								
A. Reductions in Apollo/Skylab								
1. Cancel Apollo 17	-5	-2	-84	-79				
2. Cancel Apollo 16 and 17	-20	-10	-113	-109				
3. Cancel Skylab	-120	-60	-465	-460	-261			
4. Cancel Apollo 16, 17, and Skylab and	-180	-120	-650	-625	-325			
eliminate manned capability	-40	-30	-215	-180	-380	-400	-400	-400
B. Post-Skylab Manned Options								
1. Joint docking mission	-	-	22		100	86	15	-
- Close one Center in 1974	-	-	-		-90	-165	-190	-190
2. Three Apollo spacecraft missions	-	-	60		110	200	190	40
- Close one Center in 1974	-	-	-		-90	-165	-190	-190
3. Second Skylab	-	-	50		250	500	400	300
- Reduce two Centers in 1974	-	-	-		-60	-90	-90	-90
4. Space Station	-	-	50		300	700	1,100	1,300
C. Space Transportation System								
1. Baseline shuttle (Concurrent) .... (No Center closure)	(In Ongoing Program)		228	93	960	1,550	1,800	1,950
2. Baseline shuttle (Phased) .... (No Center closure)	"		228	93	800	1,100	1,300	1,300
3. Mark I/II shuttle	"		228	93	640	1,000	1,250	1,200
(Reduce one Center)					-60	-90	-90	-90
4. New expendable (Titan III series)	-	-	-	-	50	100	150	200
(Close one Center in 1974)					-90	-165	-190	-190
D. Grand Tour								
1. Included in Ongoing Program (NASA-recommended spacecraft)	(15)	(8)	(29)	(20)	(127)	(162)	(128)	(87)
2. Thermoelectric Outer Planets Spacecraft (TOPS)	-	-	+11	+5	+33	+38	+32	+23
3. Outer Planets Explorer	-	-	-4	-2	-17	-22	-18	-17
4. Modified Pioneer	-	-	-9	-5	-43	-52	-43	-27

1/ See Table I-C. No funds for Shuttle except in FY 1972.

	1972 BA	1972 BO	1973 BA	1973 BO	1974 BA	1975 BA	1976 BA	1977 BA
5. Delete Jupiter-Saturn-Pluto missions (fly current spacecraft to Jupiter and Saturn)	-	-	-14	-10	-92	-92	+7	+63
6. Cancel Grand Tour (fly current spacecraft to Jupiter and Saturn)	-12	-6	-14	-10	-107	-122	-103	-67
E. <u>Viking</u>								
1. Included in Ongoing Program (Baseline)	(187)	(110)	(256)	(180)	(185)	(100)	(35)	(25)
2. Drop Orbiters	-20	-10	-66	-30	-64	-34	-16	-
3. Cancel one mission	-30	-18	-80	-60	-60	-40	-15	-10
4. Defer	-115	-80	-180	-150	+110	+250	+100	+75
5. Cancel	-87	-90	-256	-135	-185	-100	-35	-25
F. <u>HEAO</u>								
1. Included in Ongoing Program (Baseline)	(22)	(10)	(42)	(28)	(65)	(73)	(41)	(21)
2. Reduce HEAO	-9	-2	-22	-10	-15	-20	-10	-6
3. Cancel	-22	-10	-42	-28	-65	-73	-41	-21
G. <u>Other possible new starts</u>								
1. Space science and applications	-	-	75	50	75	75	75	75
2. Aeronautics	-	-	25	25	25	25	25	25

V

V. An Illustrative Future Space Program

The illustrative program would complete the remaining scheduled Apollo and Skylab manned space flights. This program would postpone the space shuttle indefinitely. However, the illustrative program would not preclude the possibility that eventually the shuttle might become more economically attractive and be initiated in the 1980's. In the meantime, the illustrative program concentrates upon manned orbital flight using expendable launch vehicles. From FY 1975-1978 Apollo Spacecraft would be utilized, followed by the development and use of modular space stations.

The unmanned science and applications programs would be expanded. The Grand Tour of the outer planets (NASA baseline), Viking, and HEAO A and B would be continued, followed by new science and applications satellites in future years (e.g. Large Space Telescope; Earth Observation Satellites).

The ranking of the illustrative space program according to the criteria is shown in Table II-D, under "New Expendable Rockets." Marshall Space Flight Center would be shut down.

The following assumptions would be implicit in the illustrative space program:

1. That, while space is still important, it is no longer of such high priority as to justify a major increase in funding levels (after FY 1973, funding held below $3 B).

2. That the unmanned portion of the space program will produce a wide range of benefits from space in terms of scientific knowledge and practical applications.

3. That the manned program with expendable rockets would be justified primarily from the standpoint of international technological image and maintenance of technological capability.

4. That NASA's institutional base should be reduced.

5. That the duration of the hiatus in manned space flight should be relatively brief (from 1974-1975).

transportation

The following table summarizes the illustrative future space program:

	1973	1974	1975-77
Manned Space Flight	(1,078)	(878)	(630)
Apollo (Complete)	133	-	-
Skylab (Complete)	529	261	-
Shuttle (Cancel)	-	-	-
Operating base	298	221	134
Manned program with expendable rockets (joint docking and second Skylab)	72	350	450
Life Sciences; advanced missions	46	46	46
Space Science and Applications	(857)	(850)	(875)
Science (Continue Grand Tour, Viking, and HEAO)	590	X625	X625
Practical Applications	267	225	250
Advanced Research and Technology	(210)	(220)	(225)
Space Technology	90	100	100
Aeronautics	120	120	125
Tracking and Data Acquisition	260	259	259
Technology Utilization	5	5	5
Construction of Facilities	50	30	30
Research and Program Management (Shutdown Marshall Space Flight Center and reduce Kennedy Space Center)	708	668	576
Total BA	3,168	2,910	2,600
(Outlays)	(3,150)	(3,000)	(2,650)

VI

VI. Conclusions

1. There are no easy or obvious solutions for what the future space program should be - the preferred program alternative depends upon the relative value assigned to each of the criteria presented in Chapter I.

2. An unmanned program could capture virtually as many science and applications benefits as a manned program, at roughly one-half to two-thirds of the cost.

3. However, an unmanned program would not greatly enhance our international technological image or maintain our manned space flight capability.

4. Thus, in terms of resources required, the major policy issue for the future space program is the role of man in space. The alternatives for manned space flight come down to three:

    a. Terminate manned flight and concentrate on capturing scientific and practical applications benefits from unmanned satellites (less the $2 B per year in the 1970's).

    b. Continue manned flight with expendable rockets with the realization that little direct programmatic benefit is likely to result but that our technological image and capabilities will be preserved (about $2.5-3.0 B per year in the 1970's).

    c. Invest in the shuttle which, while economically doubtful, offers the hope that a productive role can be found for man as an integral part of a transportation system designed to reduce the cost of space operations (about $3.5-4.0 B per year in the 1970's).

5. The relative priority of space versus other national needs, as expressed in the future annual level of funding anticipated for NASA, is obviously a crucial factor (e.g. if a $4 B per year peak is not considered realistic, the baseline shuttle should not be selected for development).

6. The FY 1973 budget decisions should be consistent with a well defined longer range view of the future space program.

7. Once the preferred program alternative has been selected, NASA's institutional base should be resized accordingly. The lower program options allow more opportunity for reducing NASA's base.

Attachments

Attachment I-A

NASA Manpower by Center

	FY 1972 Positions			
	Civil Service	JPL	Support Service	Total
Manned Space Flight				
Marshall Space Flight Center - Huntsville, Ala .	5,507	-	3,070	8,577
Manned Spacecraft Center - Houston, Tex	3,935	-	5,386	9,321
John F. Kennedy Space Center - Fla	2,544	-	6,260	8,804
Space Science and Applications				
Goddard Space Flight Center - Greenbelt, Md ...	4,187	-	5,881	10,068
Jet Propulsion Laboratory (JPL) - Pasadena, Calf ...	-	3,990		5,690
Wallops Station - Wallops Is., Va	462	-	352	814
Advanced Research and Technology				
Ames Research Center - Moffett Field, Calf	1,824	-	551	2,375
Flight Research Center - Edwards, Calf	508	-	217	725
Langley Research Center - Hampton, Va	3,596	-	1,241	4,837
Lewis Research Center - Cleveland, Ohio	3,879	-	387	4,266
Space Nuclear Systems Office (NERVA)	108	-	-	108
Headquarters	1,800	-	703	2,503
Total	28,350 1/	3,990	25,748	58,088 1/

1/ Does not include the recent reduction of 850 civil servants which has not been distributed by Center yet.

Attachment II

OMB Staff Evaluation of Shuttle Uncertainties

This paper attempts to give a best estimate of the important variables in the analysis.

Mission model

The launch rate implied by the baseline mission model should be revised downward.

- DOD launches - Recent projections of the number of DOD launches are about 20% lower due to:
  - Decreases in projected DOD space budget, and
  - Increasing productivity of satellites (unclassified source):
    - DOD recently launched one satellite designed for a mission that previously required two separate satellites.
    - The number of recoverable satellites dropped to five in 1970, yet the total days in orbit were nearly as many as DOD obtained in 1968 by using eight satellites.
- NASA: Science and Applications missions - There is evidence that cost estimates for the large satellites are too low. NASA spokesmen suggest that whereas the given budget employed by the model will purchase six Large Space Telescopes, it is more likely that three could be purchased. Reducing the numbers of these satellites reduces payload benefits estimated for the shuttle.

Payload savings

Savings in payload costs attributed to the shuttle are overstated.

- As stated earlier, savings previously estimated for DOD satellites have been revised downward.

- Savings resulting from relaxing weight and volume constraints are not unique to the shuttle (e.g. given different incentives, payload-designers of expendable launch vehicles could also use the criterion of minimizing the system cost (payload plus vehicle) rather than the current criterion of minimizing payload weight). Payload cost estimates associated with the Titan III system in this analysis reflect this new criterion.

- Shuttle payload costs were estimated by designing several new low-cost payloads and estimating the reduction in cost relative to expendable payloads. The ratio derived (low cost payloads/current expendable payloads) was then applied to the expendable payloads in the NASA/DOD baseline mission model. However, more detailed analysis (developing factors at the level of satellite subsystems) has shown initial estimates of payload saving to be overstated.1/

Vehicle cost estimates

Cost estimates for the shuttle configurations used in this analysis will probably increase.

- Between November 1970 and July 1971 contractor estimates of the non-recurring costs of the two stage system (which was the system examined in greatest detail during 1971) increased by 11% as the design became better defined.

- Actual systems costs during the past two decades have typically differed from estimated costs. From data (aircraft and spacecraft) for systems developed during the 1960's, it appears that the average ratio of actual R&D costs to estimated R&D costs is 1.2. The ratio increases with the level of technological advance sought and the lapse between the date of the cost estimate and that of the system's operational capability. Applying the average ratio to NASA estimates of shuttle R&D would reduce shuttle benefits.

- Shuttle operating costs were not estimated by using statistical methods. The method used resulted in a total launch/turnaround cost of $5.1 M (excluding space tug). The ground operations portion (e.g., maintenance, sustaining

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1/ NASA briefing 9/24/71

spares, and base support) was $2.7 M, approximately .5% of vehicle investment cost. This compares with .1% for aircraft operated by U.S. airlines and .5%-5% for military aircraft. Even if shuttle maintenance costs were to be .5%, some learning can be expected to take place before this level were reached. Incorporating these learning effects into the analysis would reduce shuttle benefits.

Shuttle phase-in period

Cost-effectiveness of the shuttle is quite sensitive to the date that it will be able to launch all satellites (excepting those launched by the Scout). This analysis assumes that the shuttle will be phased in over a three-year period and won't capture all traffic until 1981. Earlier capture is unlikely because:

- DOD would probably retain Titans for time urgent missions until shuttle reliability were demonstrated.
- NASA recently deferred the date of the First Manned Orbital Flight of the shuttle by six months to July 1979.
- Historically, development programs have not met targets, e.g. for a sample of 11 aircraft engines developed during the 1950's, the date which the engine passed the 50-hour test averaged 11 months beyond that originally predicted.

Economic life of the system

The analysis has employed an infinite time horizon when discounting the costs. At a 10% discount rate, this procedure is similar comparing the cost-effectiveness of the alternative systems for 50 years, rather than restricting it to 1978-1990. The time horizon of an analysis refers to the economic uselife of the system. It has been argued that expenditures on R&D never becomes uneconomic (i.e., scientific and technical knowledge produced will be used in developing subsequent systems). However, when using an infinite time horizon for public investment projects, it must be assumed that all conceivable and technically feasible alternatives are being evaluated at the time the project selection is made. The shuttle analysis which has been performed does not appear to have satisfied this condition. For example:

- Although development of new expendables (e.g. a pressure fed, cheaply produced, booster) has been analyzed for the phased development of the shuttle, it has not been analyzed as an alternative to current expendables, nor to the shuttle system itself.

- There appear to be alternatives to the shuttle which might capture some of hypothesized payload benefits:

  . The Soviets currently place some payloads in a recoverable cannister, the latter being mass produced.

  . One aerospace contractor has proposed building a robot satellite which would attempt to correct the direction of spin of ATS-5 which is now spinning clockwise rather than counterclockwise. This R&D project would cost about $30 M and would seem to hold some promise for future repair of satellites on orbit. Under the shuttle mode, the Large Space Telescope would be repaired on orbit by men controlling teleoperators from within the shuttle. A robot satellite might be able to operate in a similar manner. Furthermore, an unmanned reusable space tug, which could recover satellites from synchronous orbit, would require some of the technical characteristics of a robot satellite.

<u>Qualitative uncertainties</u>

- Effecting low cost operations for a space shuttle would require significant departures from NASA's historical experience. Although it has been envisioned that the shuttle would be launched under "airliner-type" operations, NASA has historically been an R&D agency, treating each launch as if it were unique. This procedure implies high operations costs.

- The hypothesized standardization of payload design may lag the shuttle operational date. For example:

  . There are currently 17 different tape recorders used in NASA spacecraft, yet NASA spokesmen estimate that three tape recorders would be adequate to cover the range of requirements.

  . NASA spokesmen currently state that there are components which are triple-redundant to spacecraft yet these components have never failed. Hence, it appears that some savings could be made for expendable-launched satellites.

Cost of the Manned Space Flight Program - Emphasis on the NASA in-house capability.

Data on the following pages shows that $1,715 million in FY 1972 budget authority is devoted to manned space flight. Of this, $985 million is in support of the NASA centers and their capability to safely launch and recover on-going Apollo-type missions. The remaining costs are for development of unique Apollo science hardware, the Skylab workshop, telescope, spacecraft and launch vehicles, space shuttle engine and technology, and space station planning.

The bulk of the institutional costs are carried under "Flight Support" and "Center Operations" which are ill-defined because NASA has historically categorized them as Apollo support. The following observations can be made:

Flight Support

- NASA plans to phase out all of this contracted work after completion of Skylab.
- NASA has done little to consolidate in-plant factory support for Apollo spacecraft and Saturn launch vehicles. The launch vehicle in-plant situation is particularly expensive ($75 million).
- Apollo spacecraft support at Houston ($50 million) is redundant of capabilities at the Cape and at the factory in Los Angeles. Simulator and automatic checkout activities are also redundant.
- Lunar Module work will drop by over $30 million after Apollo 17.
- Cape Kennedy civil service engineering oversight of contracted work may be excessive. However, they are the core of the Nation's launch system design team.
- Cape Kennedy and the Air Force Eastern Test Range have many duplicative activities. However, consolidation studies have achieved little success.

Operating Base

- NASA plans to reduce the funding of the Operating Base as follows:

FY 1972	FY 1973	FY 1974	FY 1975
535	535	525	440

- Mission Control Center capability is under-utilized, even with upcoming Skylab.
- Check-out equipment and spacecraft simulators at Houston, Los Angeles, New York, and Cape Kennedy are redundant.
- Astronaut training and support, including their fleet of 40 T-38 aircraft, is excessive in the face of the reduced level of manned space flight activities.
- Marshall in-house support for Skylab is more than 2,500 positions. NASA does not attribute costs of civil service or support service personnel to programs they support. Consequently, true cost of Skylab is several hundred million dollars higher than the budget would indicate.

Manned Flight Base
Total Manned Space Flight Funding (1972 BA)

	R&D	RPM	C of F	Total
Apollo science	40			40
Skylab hardware	535			535
Flight support 1/................	275	95		370
Center operations 1/..............	295	235	5	535
Shuttle technology	100		20	120
Other R&D	30			30
Tracking activities 1/............	80	5		85
	1,355	335	25	1,715

1/ Costs of institutional base

Detail of Flight Support:

Activity	Location(s)	1972 BA
Apollo spacecraft factory	Los Angeles	12
Apollo guidance factories	New York, Los Angeles	11
Lunar Module factory	Long Island	14
NASA Labs and Apollo checkout	Houston	50
Saturn 1st stage factory	New Orleans	24
Saturn 2nd stage factory	Los Angeles	29
Saturn 3rd stage factory	Los Angeles	21
Subtotal hardware		(179)
Apollo spacecraft checkout	Cape Kennedy	13
Lunar Module checkout	Cape Kennedy	17
Checkout equipment support	Cape Kennedy	8
Subtotal spacecraft checkout		(38)
Saturn 1st stage checkout	Cape Kennedy	19
Saturn 2nd stage checkout	Cape Kennedy	7
Saturn 3rd stage checkout	Cape Kennedy	12
Saturn guidance checkout	Cape Kennedy	11
Related launch vehicle checkout	Cape Kennedy	8
Subtotal launch vehicle checkout		(60)
Cape Kennedy civil service salaries ...		48
Cape Kennedy facility costs, Air Force reimbursement		47
Total flight support		370

Detail of Operating Base

	1972 BA
Manned Spacecraft Center (Houston)	
Checkout, test, quality control	21
Automatic checkout support	8
Logistics (spacecraft movement)	7
Mission Control Center	35
Astronaut training and support	30
Civil Service salaries	79
Related operating costs	27
Subtotal Houston	(207)
Marshall Space Flight Center	
Engine contractors, Mississippi Test and Los Angeles	22
Huntsville support service contractors	65
Civil Service salaries	104
Related operating costs	26
Subtotal Marshall	(217)
Kennedy Space Center	
Air Force reimbursement and support services	53
Launch instrumentation, computer center	22
Subtotal Cape Kennedy	(75)
Other	
Headquarters systems integration contractor; NOAA support	7
Contract administration	8
Advanced development	12
Construction and maintenance of facilities	5
Total Operating Base	535