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TRANSITION PLANNING GROUP

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January 31, 1977

EXECUTIVE

FG185

FG1-4

TO: Stuart Eizenstat, Al Stern, David Rubenstein, Barry Blechman, Dick Steadman

FROM: Nick MacNeil

SUBJECT: NASA Recommendations

Summary

1. NASA's priorities are on the development end of R & D, not the basic research end. NASA directs our R & D resources toward centralized big technology, maintaining the defense R & D orientation of the aerospace industry.

2. The Shuttle has become the end, rather than the means, because NASA space policy has been shaped by the Office of (Manned) Space Flight. The Offices of Space Science, Applications, and Aeronautics Technology get the funds that are left over.

3. Alternative directions for space technology may be neglected because
   (a) the Administrator's power to hire and fire top management inhibits effective dissent
   (b) important NASA managers are from Defense and the aerospace industry
   (c) NASA's budget is supported and approved by a space constituency.

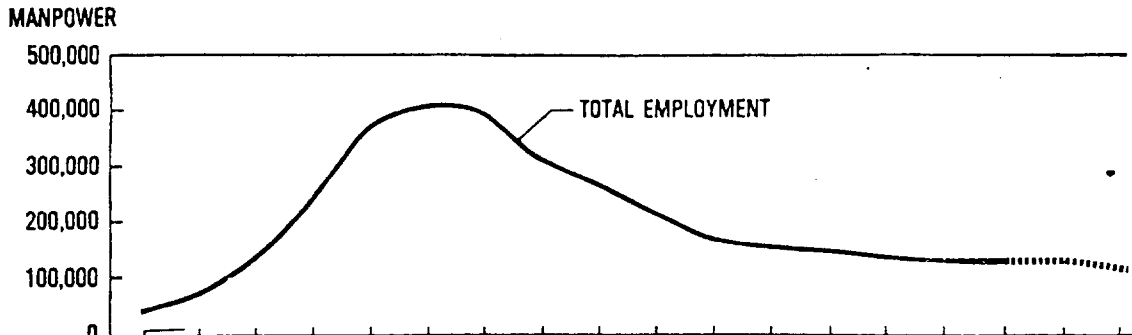
~~NASA At A Glance~~

See Section 1, Budget History; Figures 1 and 2, Organization Chart and R & D Allocations; Annex B, Space Centers.

CONTENTS

1. Budget History

Perhaps the agency's growth, retraction, and resiliency can best be seen in its level of employment since 1962.

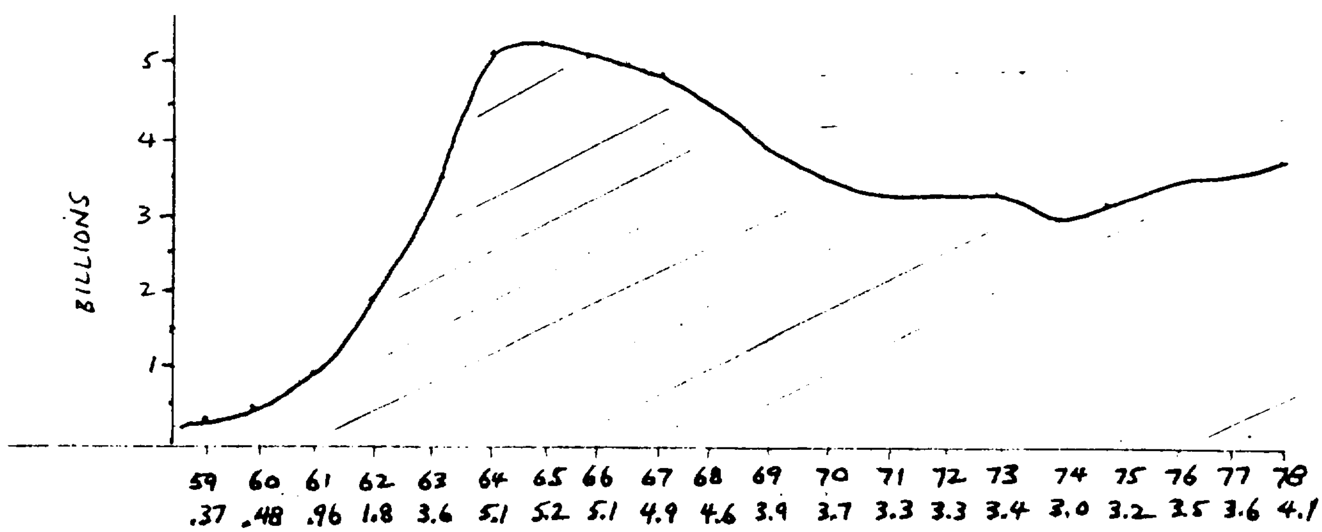


	JUNE 1960	JUNE 1961	JUNE 1962	JUNE 1963	JUNE 1964	JUNE 1965	JUNE 1966	JUNE 1967	JUNE 1968	JUNE 1969	JUNE 1970	JUNE 1971	JUNE 1972	JUNE 1973	JUNE 1974	JUNE 1975	JUNE 1976	SEPT 1977
TOTAL EMPLOYMENT	46.786	74,577	137,656	246,304	379,084	409,900	393,924	306,926	267,871	218,345	167,803	149,609	144,968	134,055	125,054	127,755	131,016	121,016
CONTRACTOR EMPLOYMENT	38,500	57,500	115,500	218,400	347,100	376,700	360,000	273,200	235,400	186,600	136,580	120,130	117,540	108,100	100,200	103,400	106,700	97,200
NASA EMPLOYEES	10,286	17,077	22,156	27,904	31,984	33,200	33,924	33,726	32,471	31,745	31,223	29,479	27,428	25,955	24,854	24,355	24,316	23,316

In real year dollars NASA funding is 70% what it was in its peak year, and increasing.

NASA APPROPRIATIONS

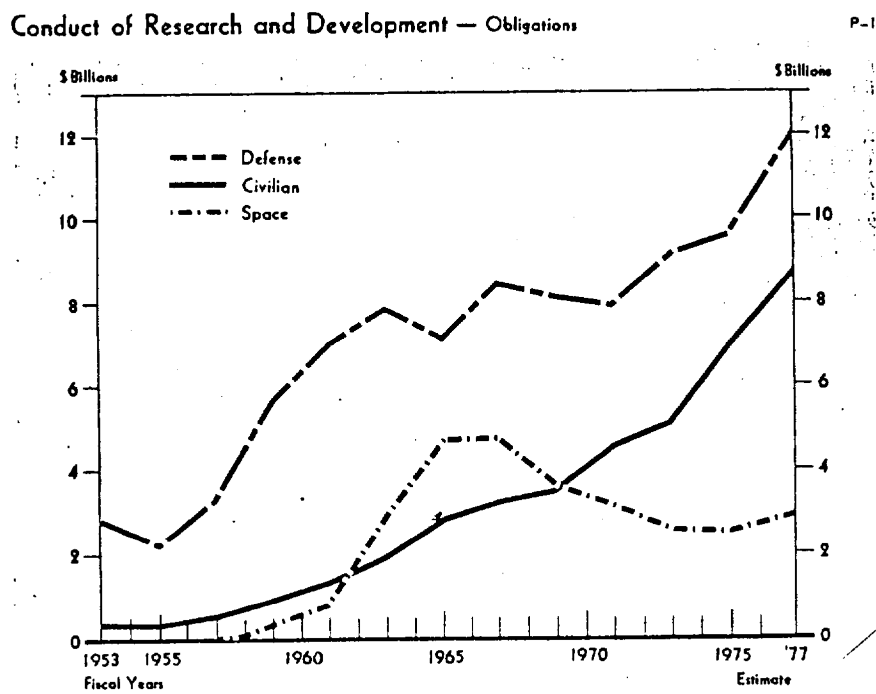
in year by year dollars



The shaded area above represents about $70 billion.
The U.S. Interstate Highway System has cost about $60 billion.

Viewing the past in 1977 dollars, as NASA does, current funding is 1/3 what it was in 1965. The following graph compares NASA trends with military R & D, and civilian non-NASA R & D.

Note that this graph understates NASA's budget (because it puts $400 million for aeronautics and space applications in Civilian R & D) and does not indicate military space programs (only about a third of which are funded from military R & D). See Annex C, Military Space Programs.



2. <u>Current Programs</u>

a. The "Dominant Mission" Concept

The reason for the sharp decrease in the agency's budget was that NASA had essentially completed the mission for which the budget had been increased. But the dominant mission concept has been carried over to the Shuttle.

The organization chart (Figure 1) puts Space Flight on a par, on the one hand with Science, Applications, and OAST, and on the other hand with the management of the agency's facilities and its overhead. (It is not clear, in fact, that Space Centers do not bypass the Associate Administrator for Center Operations and go directly to Space Flight, Space Science, and so on.) Figure 2 shows the relative power of the R & D offices. It can be assumed that the executive ability of officials will be commensurate with the size of the budgets they administer.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

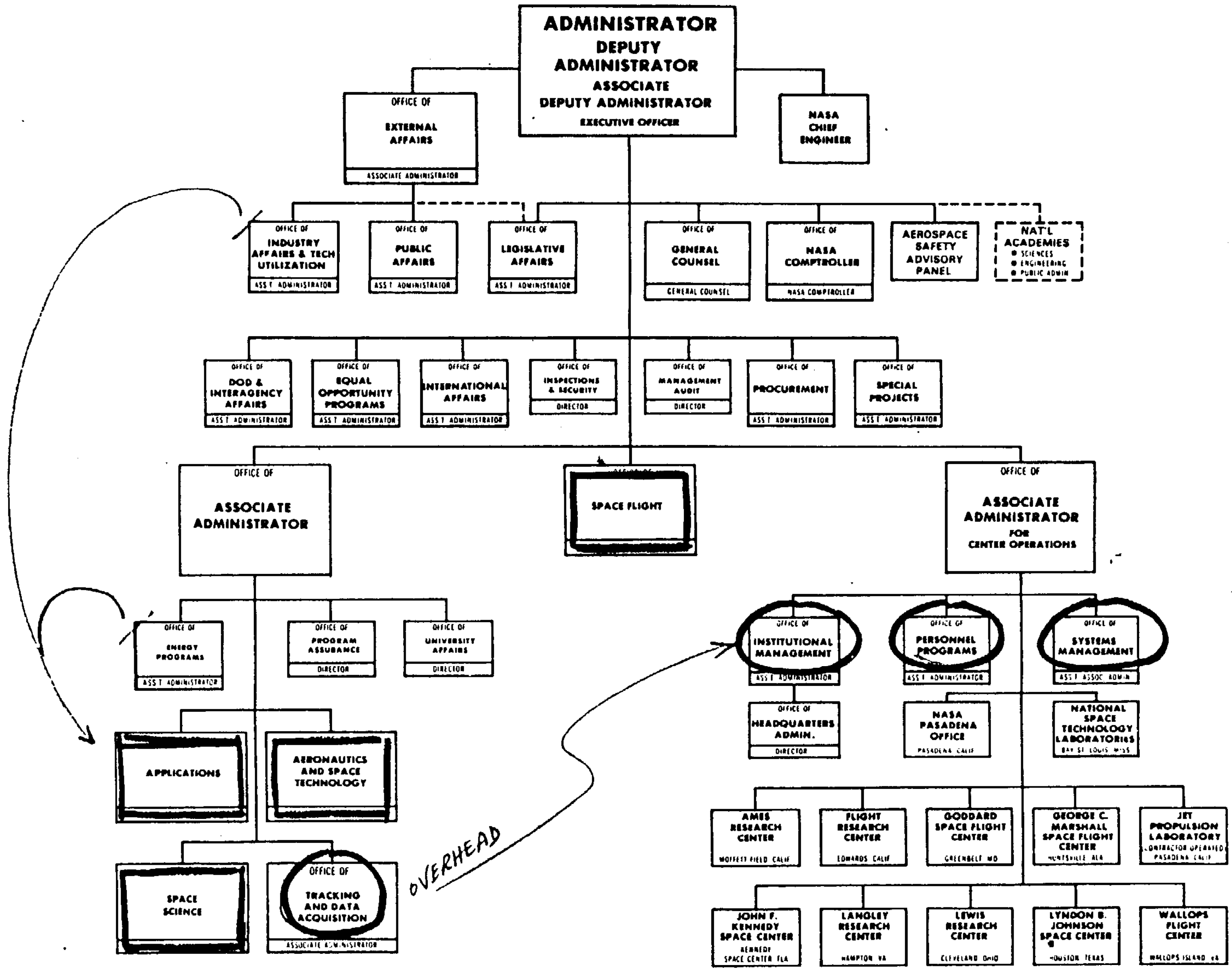


FIGURE 1

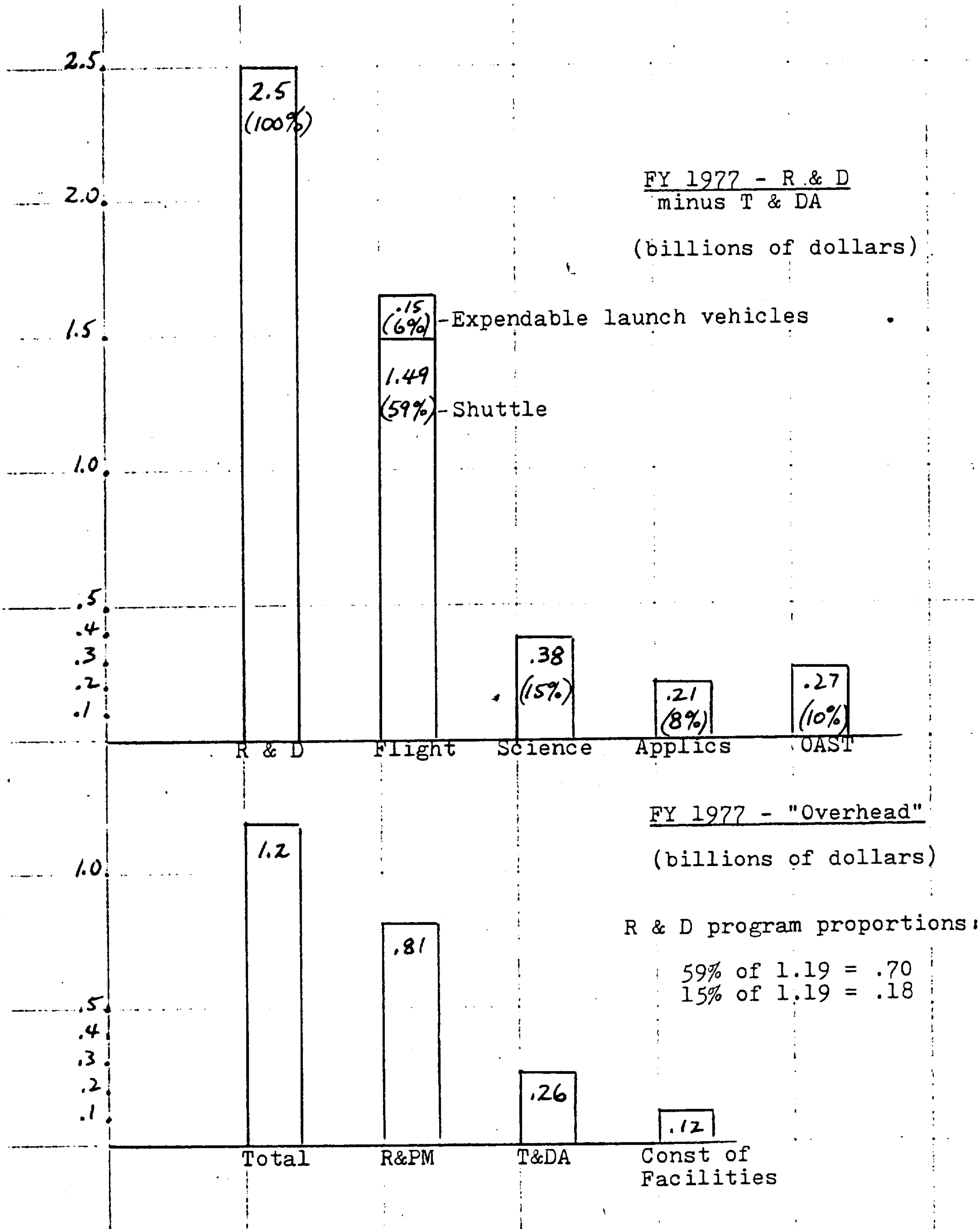

FY 1977 - R & D
minus T & DA
(billions of dollars)
2.5
2.0
1.5
1.0
.5
.4
.3
.2
.1
2.5 (100%)
.15 (6%) -Expendable launch vehicles
1.49 (59%) -Shuttle
.38 (15%)
.21 (8%)
.27 (10%)
R & D
Flight
Science
Applics
OAST
FY 1977 - "Overhead"
(billions of dollars)
R & D program proportions:
59% of 1.19 = .70
15% of 1.19 = .18
1.0
.5
.4
.3
.2
.1
1.2
.81
.26
.12
Total
R&PM
T&DA
Const of Facilities

FIGURE 2

b. Overhead

In Figure 1, Tracking and Data Acquisition appears as R & D, although it is essentially overhead.

Funds for Construction of Facilities and Research and Program Management are distributed among NASA's 12 major facilities, the largest of which are listed in Annex B. Overhead raises at least three issues:

--the possibility that high costs of R & D overshadow the spending of smaller amounts (see marked sections of Construction of Facilities breakdown)
--the extent to which overhead justifies program, particularly when overhead is parceled out in widespread bases
--the extent to which overhead resources match program priorities.

To illustrate: the following table shows 42% of 1977 R & PM goes to Space Flight. But Space Flight accounts for 60% of NASA's R & D budget. Should overhead components be roughly proportional to the size of the programs they are meant to support? If so, then non-Shuttle R & D programs account for a disproportionate share of overhead costs.

But if, over the years, on an agency-wide basis, Shuttle overhead accounts for about 60% of R & PM, then the Shuttle costs a great deal more than the R & D budget alone would indicate -- unless the Shuttle overhead not shown in NASA R & PM is contractor overhead, paid from the NASA R & D budget.

CONSTRUCTION OF FACILITIES
AND RESEARCH AND PROGRAM MANAGEMENT

FY 77 Estimate
(millions of dollars)

Program Activities	C of F	R & PM	Function	R & PM
Space Flight	39.8	348.1	Personnel	612.4
Science	8.7	114.2	Travel & Transp.	19.7
Applications	----	87.1	Rent	61.7
Space Research	.7	75.3	Supplies	13.9
Aero Research	28.9	146.2	Equipment	2.5
Support	45.8	43.1	Other	103.9
	124.0	814.0		814.0

CONSTRUCTION OF FACILITIES

Summary

FISCAL YEAR 1977

Item	Amount	
1. Modification for high enthalpy entry facility, Ames Research Center	$1,220,000	
2. Modification of flight simulator for advanced aircraft, Ames Research Center	1,730,000	
3. Construction of supply support facility, Ames Research Center	1,540,000	
4. Construction of addition to flight control facility, Hugh L. Dryden Flight Research Center	750,000	
5. Construction of addition to lunar sample curatorial facility, Lyndon B. Johnson Space Center	2,800,000	store the moon rocks
6. Construction of airlock to spin test facility, John F. Kennedy Space Center	360,000	
7. Modifications for utility control system, John F. Kennedy Space Center	2,445,000	
8. Construction of addition for aeroelastic model laboratory, Langley Research Center	730,000	
9. Construction of data reduction center annex, Langley Research Center	2,970,000	
10. Construction of refuse-fired steam generating facility, Langley Research Center	2,485,000	
11. Modification of refrigeration system, electric propulsion laboratory, Lewis Research Center	680,000	
12. Rehabilitation of combustion air drying system, engine research building, Lewis Research Center	1,490,000	
13. Large aeronautical facility: construction of national transonic facility, Langley Research Center	25,000,000	
14. Space Shuttle facilities at various locations as follows:		
(a) Construction of Orbiter processing facility, John F. Kennedy Space Center	3,750,000	39.5 millio Shuttle
(b) Modifications to launch complex 39, John F. Kennedy Space Center	19,855,000	
(c) Modification for solid rocket booster processing facilities, John F. Kennedy Space Center	9,700,000	
(d) Construction of Shuttle/Carrier aircraft mating facility, John F. Kennedy Space Center	1,700,000	
(e) Modifications for crew training facilities, Lyndon B. Johnson Space Center	780,000	
(f) Rehabilitation and modification of Shuttle facilities, at various locations	1,760,000	
(g) Modification of manufacturing and final assembly facilities for external tanks, Michoud Assembly Facility	1,930,000	
15. Space Shuttle payload facilities at various locations as follows:		
(a) Modifications to operations and checkout building for Spacelab, John F. Kennedy Space Center	3,570,000	4.3 millio Shuttle
(b) Modifications and addition for Shuttle payload development, Goddard Space Flight Center	770,000	
16. Rehabilitation and modification of facilities at various locations, not in excess of $500,000 per project	17,875,000	35.5 millio Miscellaneous
17. Minor construction of new facilities and additions to existing facilities at various locations, not in excess of $250,000 per project	5,125,000	
18. Facility planning and design not otherwise provided for	12,655,000	
Total	123,670,000	

Figure 3

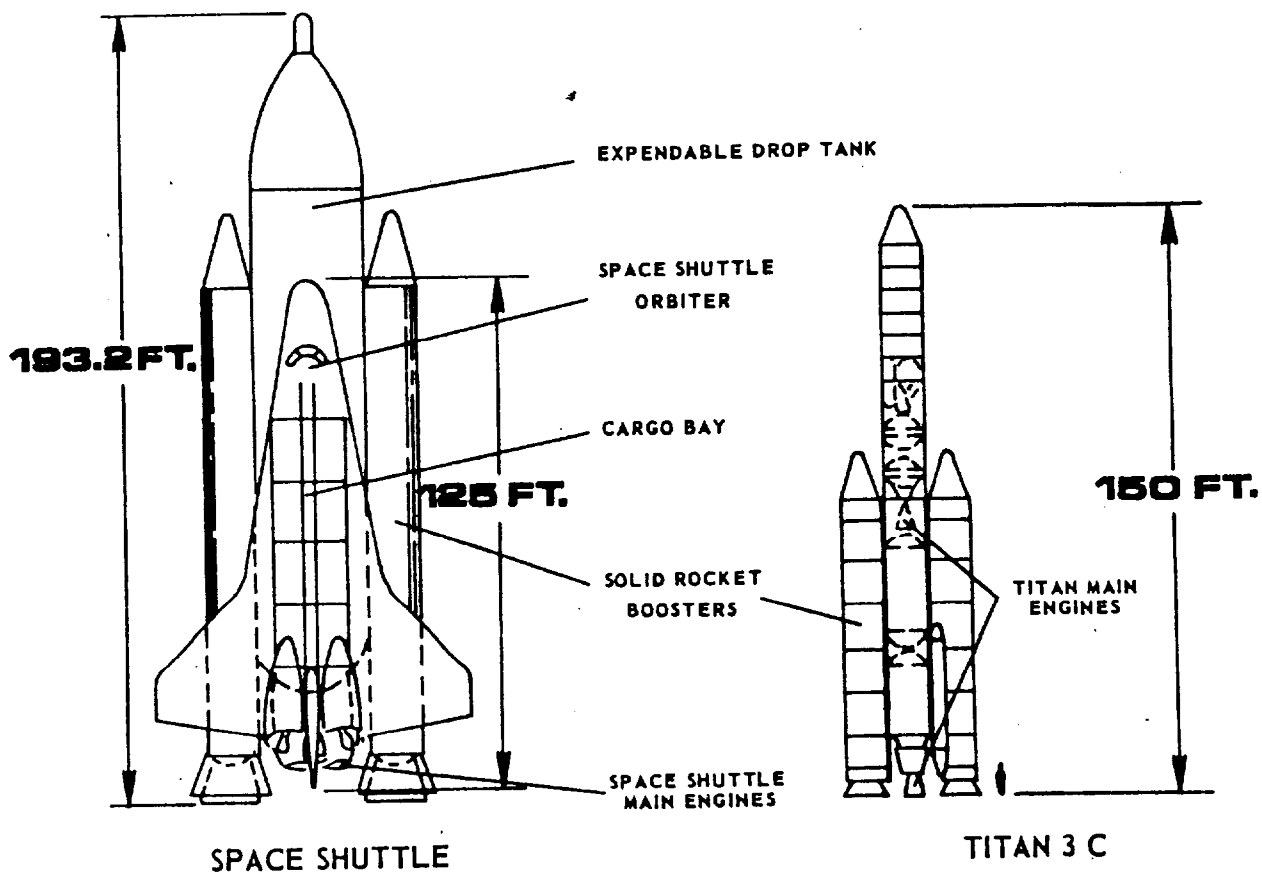
c. The Shuttle, or "Space Transportation System"

The components of the Shuttle program are between 2 and 5 orbiters or Shuttles, two booster motors and an external tank to launch the Shuttle, the Spacelab, the Space Tug, and the Interim Upper Stage (IUS).

The Air Force will build the IUS to boost payloads into outer geosynchronous orbit until NASA completes the Space Tug for this purpose.

The Shuttle will lift 65,000 lbs into 150-mile East-West orbit, or 32,000 lbs into 100-mile North-South orbit. Though the Shuttle is reusable, each flight would cost about $13 million in 1976 dollars. In addition to lifting and retrieving payloads, and servicing them in-orbit, the Shuttle can be used in "sortie mode"; i.e., it can be an orbiting platform itself, staying up one week, or up to one month with necessary modifications.

Note that the Shuttle cannot service or retrieve satellites from more than one orbit on the same launch. Note too that the satellite must be maneuvered by remote control to permit the Shuttle to take it out of orbit.



d. Program Projections

Remember that the spending shown in FY 1978 Runout (Figure 4) and New Starts (Figure 5) does not really taper off. New layers are added each coming year.

Total proposed spending on major programs is shown in the linear projections that follow. But first a breakdown of the formal R & D categories.

There are four program areas: Flight, Science, Applications, and OAST. OAST is the Office of Aeronautics and Space Technology; the "A" represents the "A" of NASA (and its predecessor NACA). Since the orientation of R & D in OAST is not as clear, as controversial, or as costly as R & D on the space side, it will not be discussed here. Thus we are left with Flight, Science, and Applications.

National Aeronautics and Space Administration

FY 1978 BUDGET ESTIMATES
($ in Millions)

FY 1978 PROGRAM RUNOUT

BUDGET AUTHORITY	FY 1976	T. P.	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Research & Development								
Space Shuttle	1,206.0	321.0	1,288.1	1,302.7	1,115.4	680.8	343.9	135.9
Space Flight Operations	188.7	48.4	202.2	297.6	360.4	508.7	594.0	592.1
Expendable Launch Vehicles	165.9	37.1	151.4	138.5	95.4	45.2	25.6	20.8
Subtotal FLIGHT	1,560.6	406.5	1,641.7	1,738.8	1,571.2	1,234.7	963.5	748.8
Physics and Astronomy	159.3	43.5	166.3	234.1	270.2	266.9	264.0	235.7
Lunar & Planetary Expl	254.2	67.5	191.9	170.3	216.2	225.9	152.1	84.4
Life Sciences	20.6	5.4	22.1	36.4	51.1	58.5	63.8	67.9
Subtotal SCIENCE	434.1	116.4	380.3	440.8	537.5	551.3	479.9	388.0
Space APPLICATIONS	178.2	47.7	198.2	224.8	242.8	226.4	163.0	135.5
Multi-Mission Modular S/C	-0-	-0-	-0-	25.0	40.0	21.0	2.5	-0-
Space Research & Tech.	74.9	19.3	82.0	115.0	114.7	112.9	110.4	110.2
Aeronautical Res. & Tech.	175.4	43.8	190.1	245.6	302.1	311.6	264.4	198.5
Subtotal OAST	250.3	63.1	272.1	360.6	416.8	424.5	374.8	308.7
Tracking & Data Acquisition	240.8	63.4	255.0	284.3	312.8	384.7	376.0	374.8
Technology Utilization	7.5	2.0	8.1	10.0	10.0	10.0	10.0	10.0
Energy Technology Applic.	5.9	1.5	6.0	8.5	10.5	5.0	5.0	5.0
Subtotal R&D	2,677.4	700.6	2,761.4	3,092.8	3141.6	2,857.6	2,374.7	1970.8
Construction of Facilities	82.1	10.7	118.1	195.6	200.0	161.0	125.0	110.0
Research & Program Management	792.3	220.8	813.0	818.5	818.5	818.5	818.5	818.5
TOTAL NASA	3,551.8	932.1	3,692.5	4,106.9	4160.1	3,837.1	3,318.2	2899.3
Additional Requirement								
Procurement of Fourth and Fifth Shuttle Orbiter				46.5	141.4	213.3	278.4	291.2
GRAND TOTAL	3,551.8	932.1	3,692.5	4,153.4	4301.5	4,050.4	3,596.6	3190.5

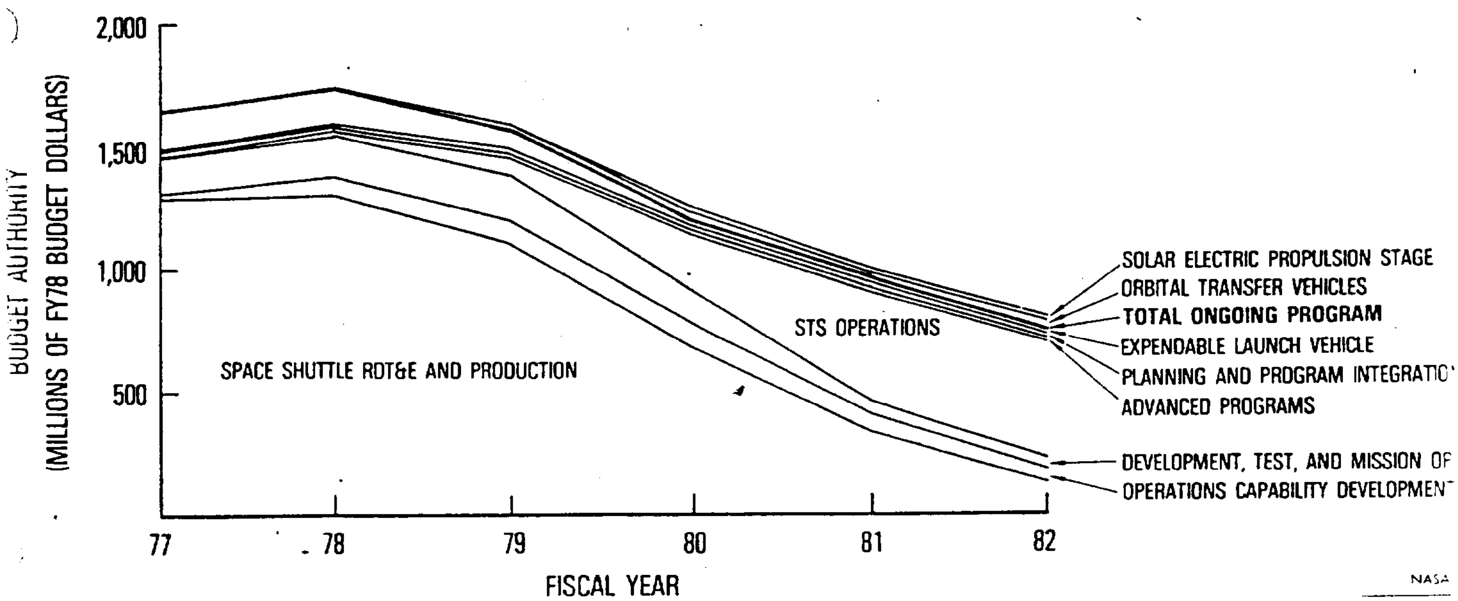
National Aeronautics and Space Administration

NEW STARTS IN FY 1978 BUDGET
($ in Millions)

RESEARCH AND DEVELOPMENT	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	Balance	Total
Space Flight Operations	15.0	---	---	---	---		
Space Industrialization ØB	15.0	---	---	---	---		15.0
Physics and Astronomy	36.0	79.4	92.0	95.7	66.8		
Space Telescope	36.0	79.4	92.0	95.7	66.8	65.1	435.0
Lunar and Planetary Exp.	47.8	122.6	139.4	75.3	21.6		406.7
Jupiter Orbiter Probe	20.7	78.7	102.0	61.4	18.9		281.7
Lunar Polar Orbiter	7.1	43.9	37.4	13.9	2.7		105.0
Mars Follow-on	20.0	---	---	---	---		20.0
Applications	14.0	60.0	72.0	34.0	15.0		
Landsat D	14.0	60.0	72.0	34.0	15.0	18.0	213.0
Multi-Mission Modular Spacecraft	25.0	40.0	21.0	2.5	---		88.5
Aeronautics	4.2	10.5	19.6	17.2	5.5		
Lift Cruise Fan Research Aircraft	4.2	10.5	19.6	17.2	5.5		57.0
Expendable Launch Vehicles	.4	17.3	6.5	---	---		
Landsat D	--	11.0	4.9	---	---		
Lunar Polar Orbiter	.4	6.3	1.6	---	---		
Tracking & Data Acquisition Support	2.6	4.9	9.9	7.1	10.2		
Total New Starts	145.0	334.7	360.4	231.8	119.1		

(1) Flight

	1975 Actual 000's	1977 Budget Estimate 000's
Space Shuttle..................	797,500	1,288,100
Space Flight Operations.........	298,800	205,200
Expendable Launch Vehicles......	139,500	151,400
Total.........................	1,235,800	1,644,700



(2) Science (Projections next three pages)

Programs	1975 Actual 000's	1977 Budget Estimate 000's
Physics and astronomy..........	136,315	165,800
Lunar and planetary exploration.	261,200	191,100
Life sciences..................	19,800	22,125
Total.........................	417,315	379,025

FIGURE 6. ASTROPHYSICS PROGRAM FUNDING

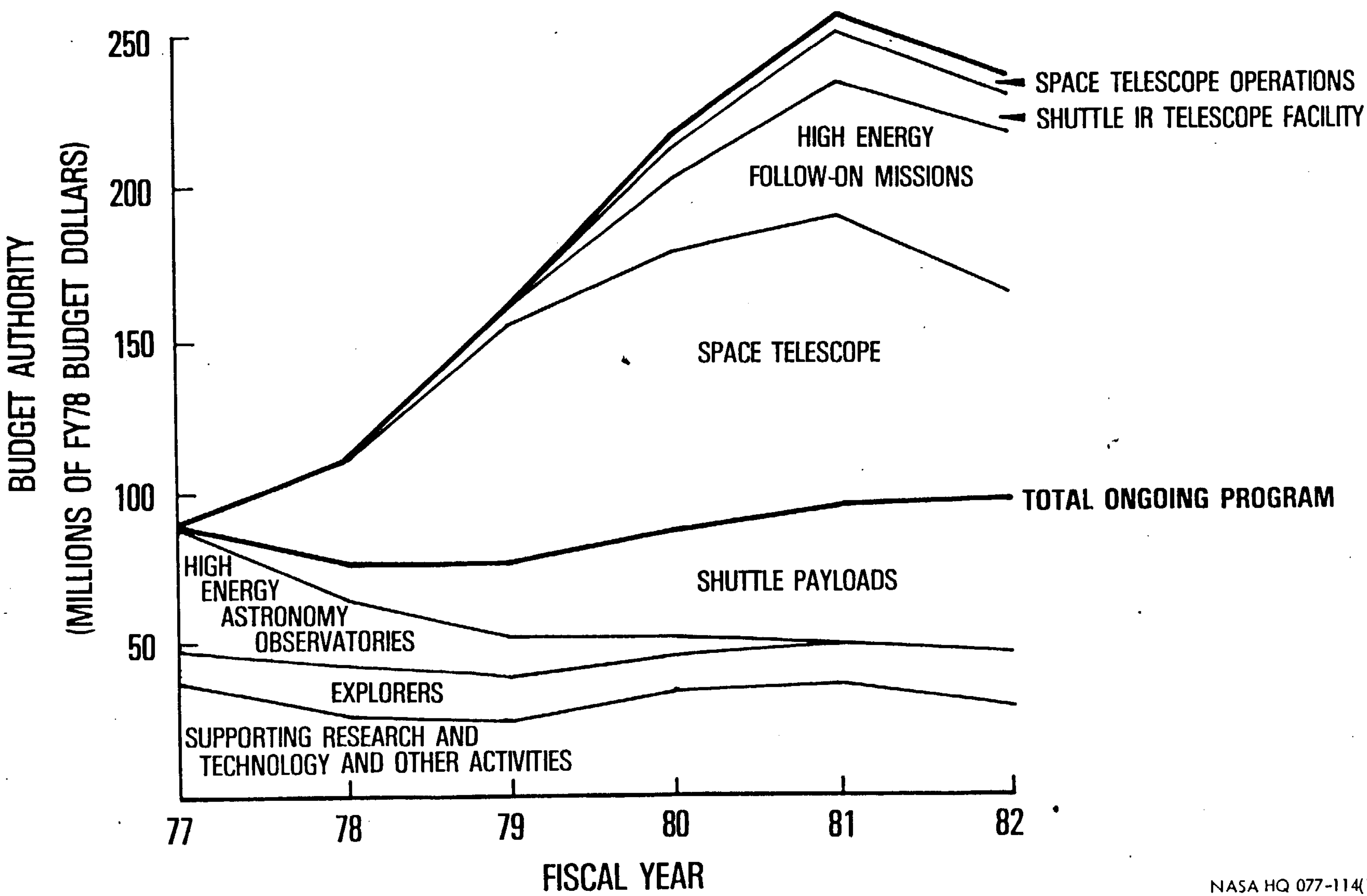


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FIGURE 7. SOLAR TERRESTRIAL PROGRAM FUNDING

(ASTROPHYSICS)

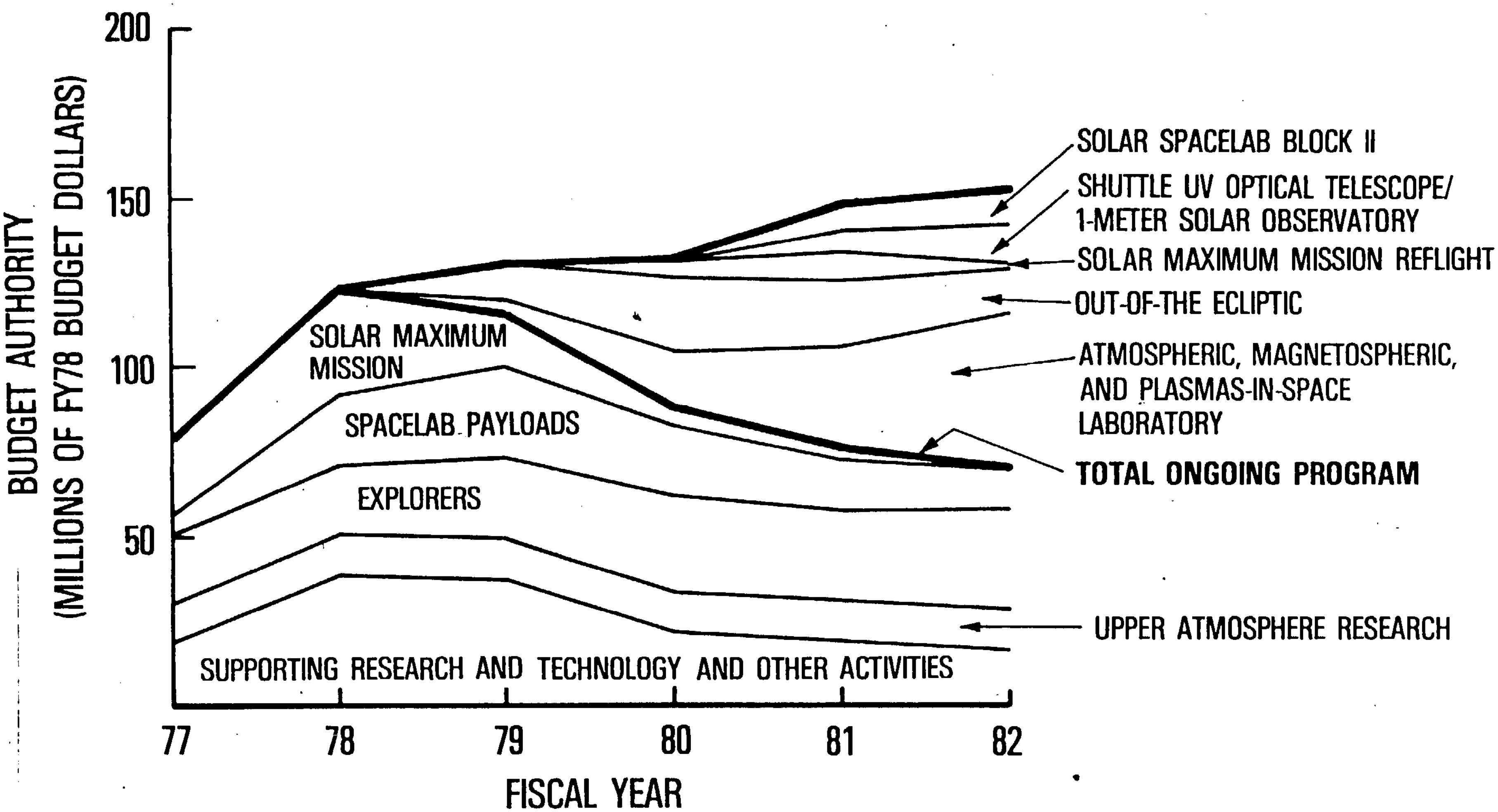

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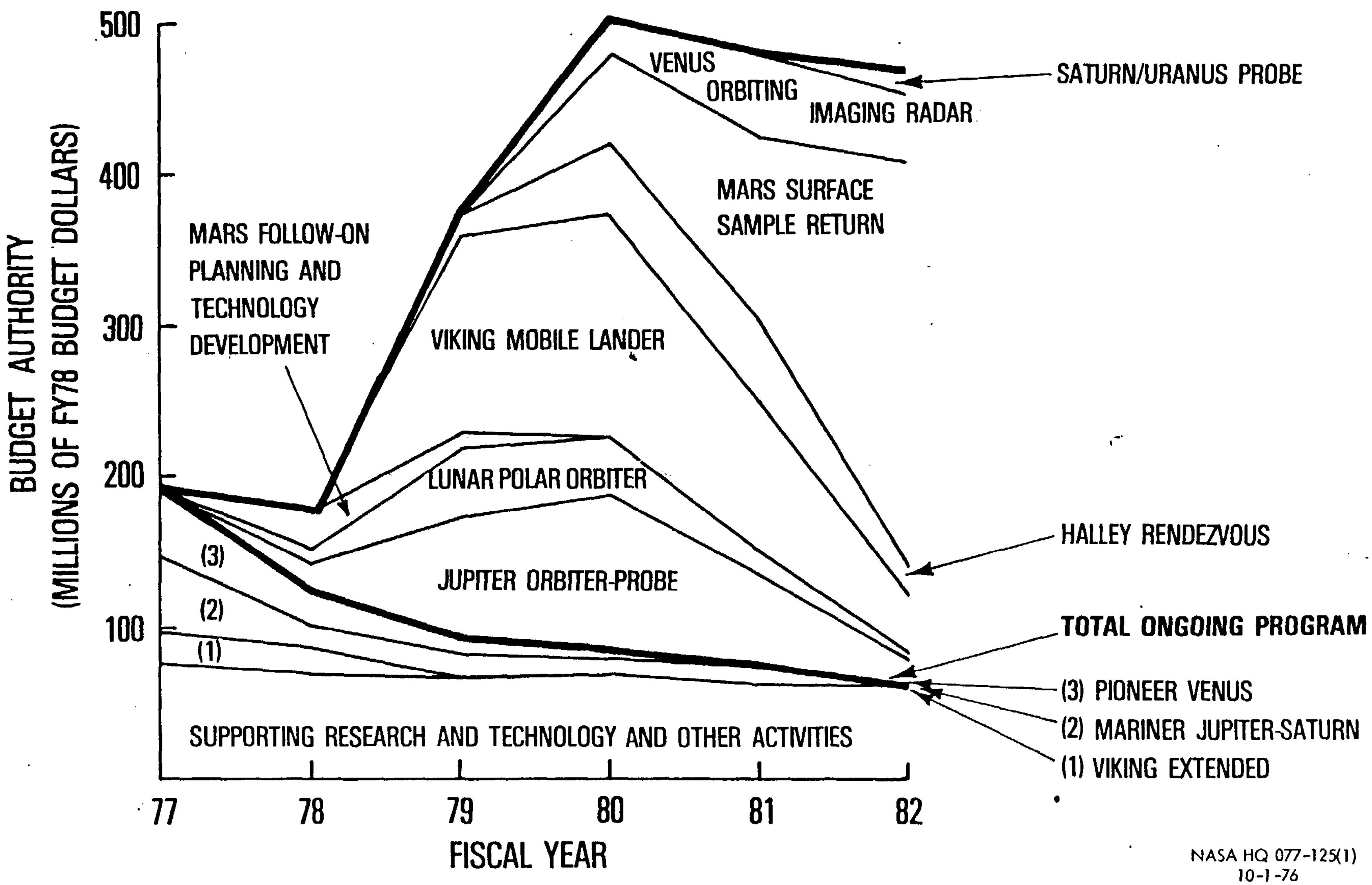
FIGURE 8. LUNAR AND PLANETARY PROGRAM FUNDING



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(3) Applications (Projection next page)

The following table omits Technology Utilization and Energy Technology, which belong conceptually in Applications.

	1975 Actual 000's	1977 Budget Estimate 000's
Earth resources detection and monitoring	58,687	67,300
Earth dynamics monitoring and forecasting.	9,600	4,600
Ocean condition monitoring and forecasting	15,600	30,600
Environmental quality monitoring	26,400	26,100
Weather and climate observation and forecasting	42,073	36,300
Materials processing in space	4,600	9,200
Space communications	12,000	10,600
Information management	3,200	3,200
Applications explorer missions	2,588	10,300
Total	174,748	198,200

NASA plans to spend more than three times as much on experimental communications satellites. Operational satellites are paid for by the users.

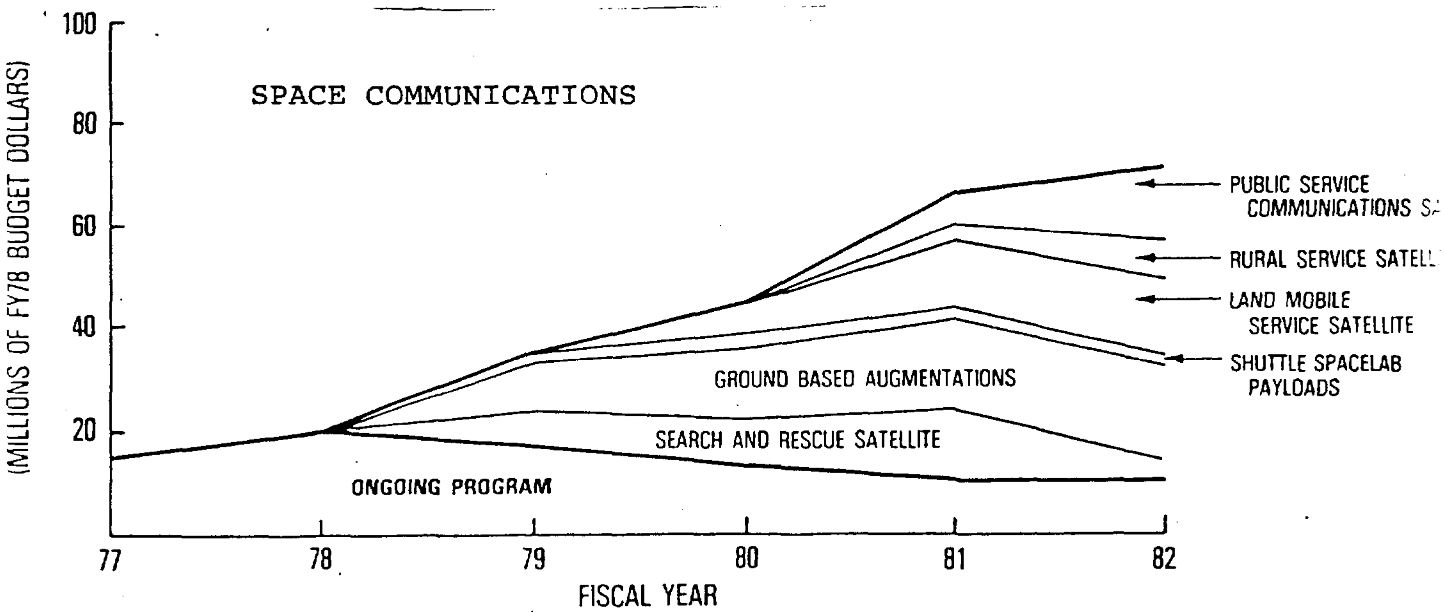
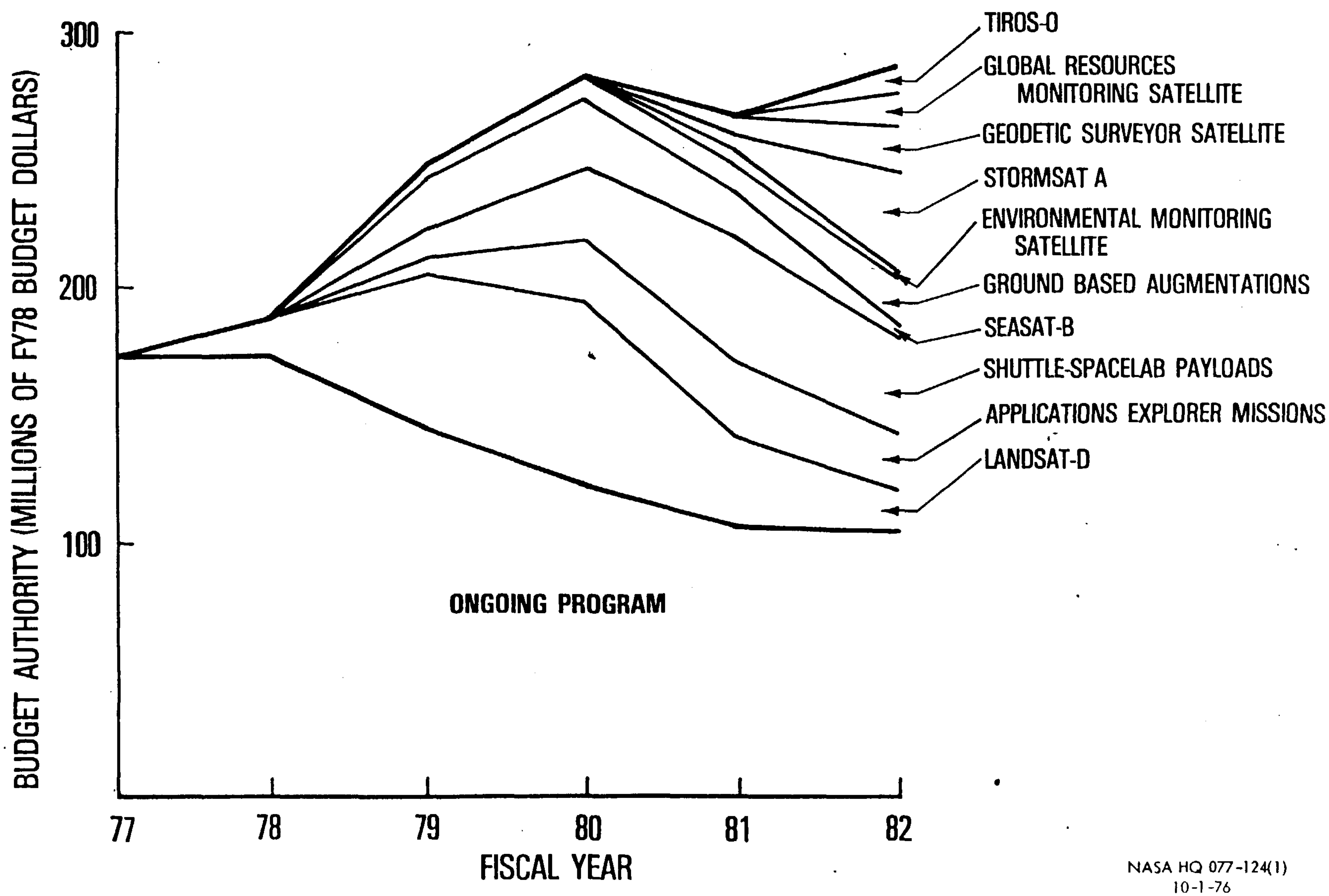


FIGURE 9. GLOBAL RESOURCES AND ENVIRONMENTAL INFORMATION PROGRAM FUNDING



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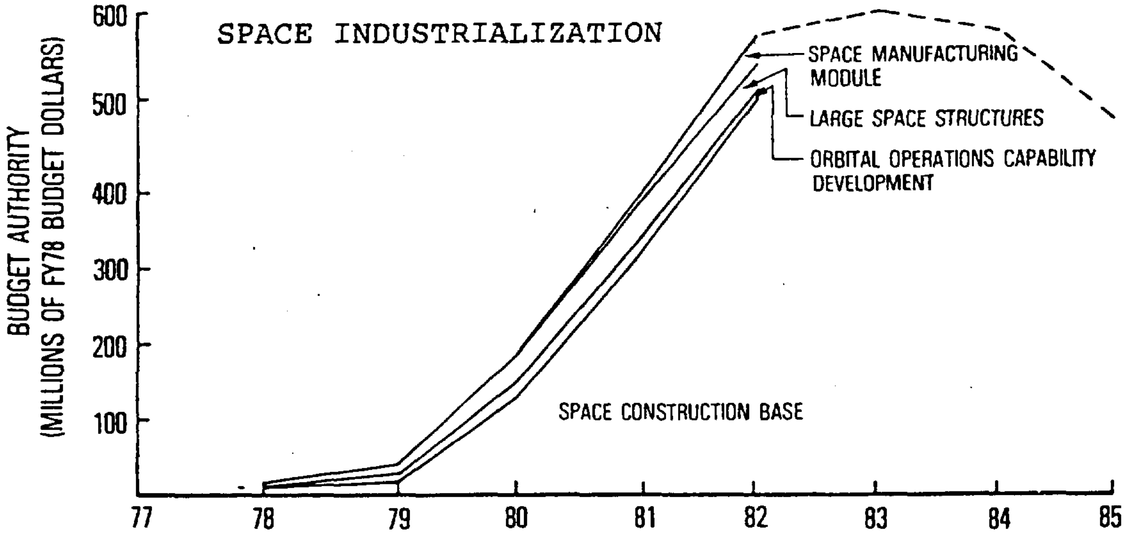
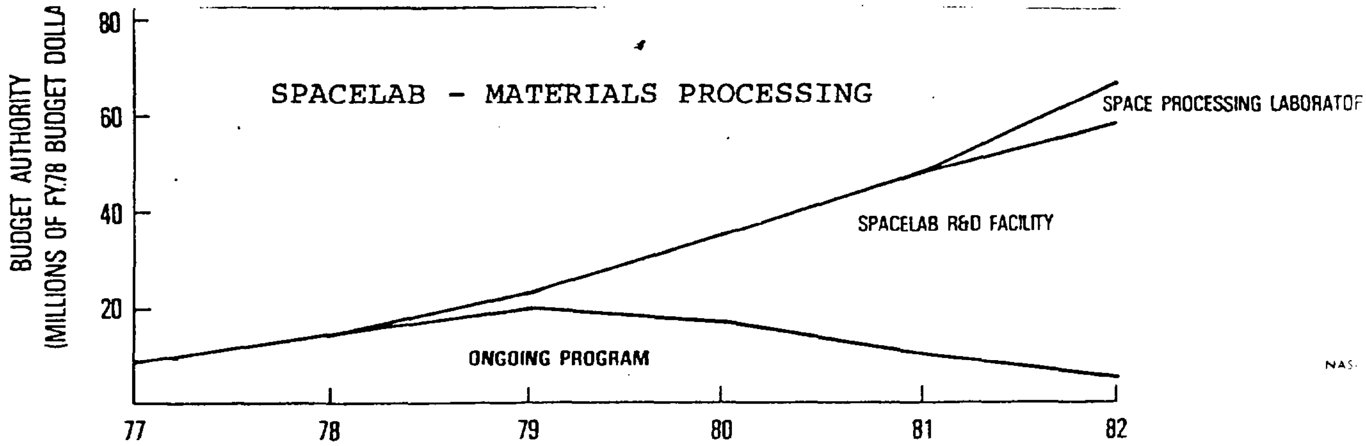
(4) Shuttle-dependent Applications

The following projections show NASA's determination to find uses for space and the Shuttle. The overall agency outlook, on the following page, tends to further blur the distinction between NASA-chosen objectives and NASA-chosen means of achieving them.





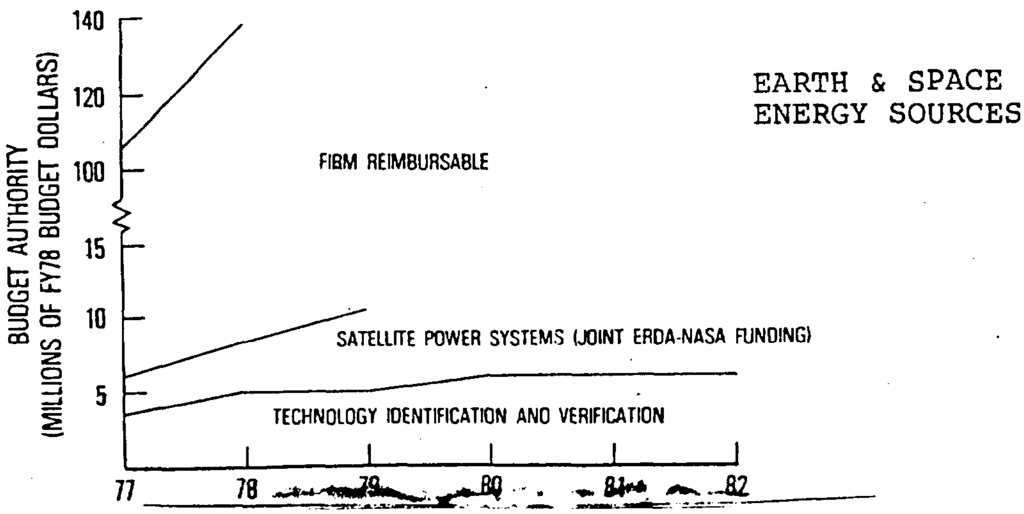
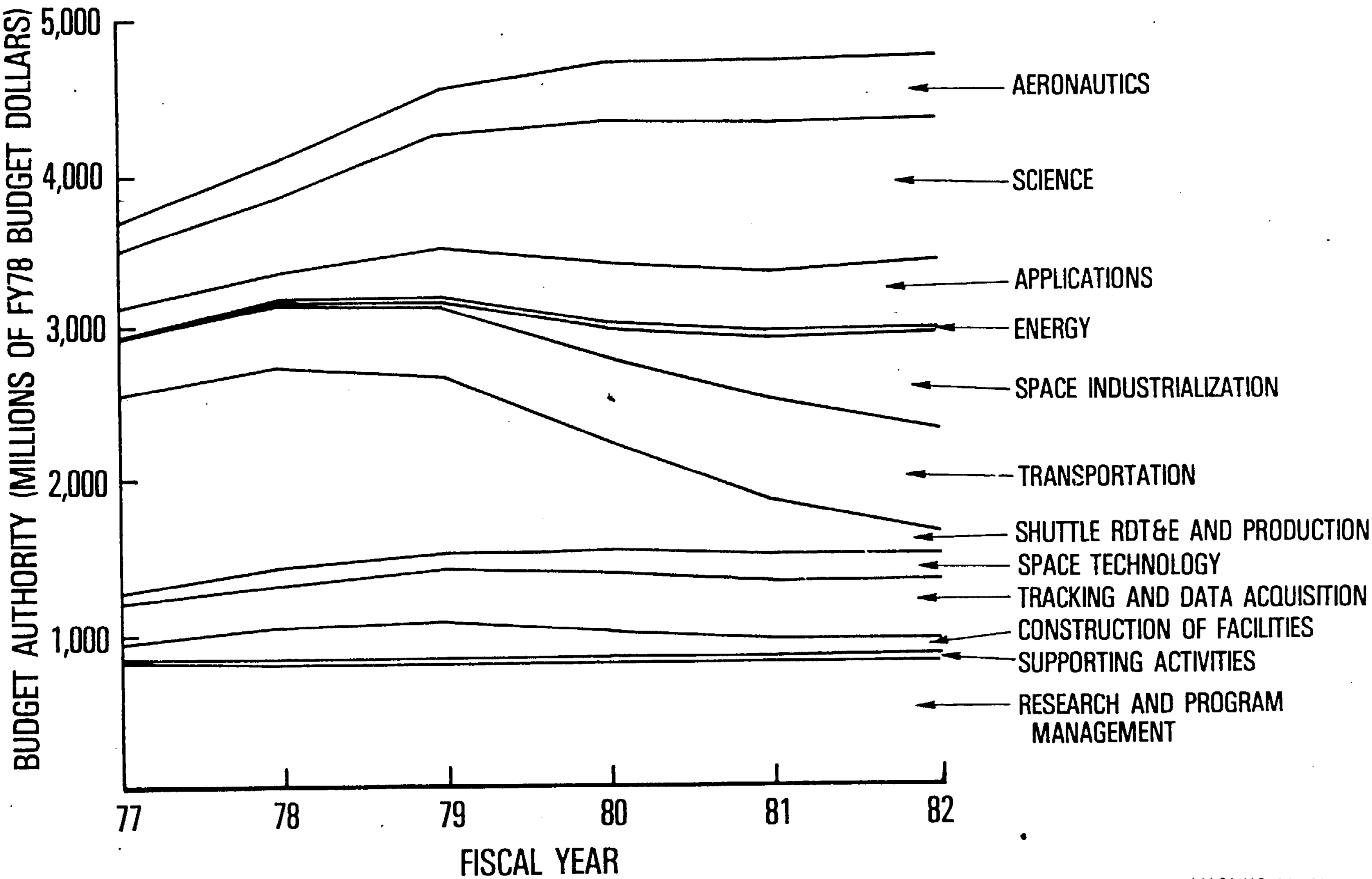


FIGURE 10. ESTIMATED BUDGET AUTHORITY REQUIRED

NASA 5-YEAR PROJECTION



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3. Funding Justifications Unconvincing

a. NASA Mission Unclear

Much apprehension and uneasiness about the NASA budget would disappear if the civilian space program, like its military counterpart, had clear objectives related to national goals.

DOD, with 38% of the space budget, would deny that its space efforts constitute a program; Defense programs are not ends but rather the means of accomplishing certain military missions, the purpose of which is to defend the nation and its allies from attack. Space programs have to compete with other means of accomplishing the same mission.

The entire NASA budget, on the other hand, is considered R & D. According to the National Science Foundation,

> R & D is not an end in itself but is a means whereby national goals can be achieved more effectively and efficiently....

What are these goals? NASA has more difficulty than most agencies in describing national goals in such a way that its programs relate to them. The law establishing NASA is no help in this regard. The National Aeronautics and Space Act of 1958 declares that the general welfare and security of the United States require "adequate provision" for aeronautical and space activities. But then it states that NASA must contribute to one or more of eight objectives, several of which go far beyond the usual understanding of welfare and security. Are we called as a nation to something greater than our welfare and security? There is no guide in law as to what "provision" is "adequate" for NASA's programs.

b. The Budgeting Process

Budgeting decisions are made in a framework provided by space scientists and engineers. This term is short-hand for those employed by NASA, by the aerospace industry, and by the universities. They decide what NASA's mission in space is (see Figure 11),they tell us the value of space activities, and they largely determine the share of available funds each program receives (see Figure 2).

The club seems to achieve a consensus in-house, by rallying around those programs with enough political appeal

NASA MISSION IN SPACE

- EXPLORATION
  - — NEW FUNDAMENTAL KNOWLEDGE ABOUT EARTH, SOLAR SYSTEM AND UNIVERSE
  - — SEARCH FOR LIFE
- APPLICATIONS
  - — BENEFITS IN AGRICULTURE, WEATHER FORECASTING, COMMUNICATIONS AND OTHER FIELDS
  - — DIRECT COOPERATION WITH DOD, NOAA, EPA, DOI, DOA
  - — NEW INDUSTRIES
- MAN LIVING AND WORKING IN SPACE
- SPACE TRANSPORTATION
  - — MAKING SPACE MORE ACCESSIBLE TO BOTH DOMESTIC (CIVIL AND MILITARY) AND FOREIGN USERS
- ENERGY
  - — TERRESTRIAL APPLICATIONS FOR ERDA, USE OF SPACE
- RESEARCH AND TECHNOLOGY SUPPORTING THE ABOVE

FIGURE 11

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to have a spill-over or logjam-breaking effect for the most members. Thus seldom will scientists or engineers openly criticize programs that they consider ill-advised. Budget requests are made to OMB and the public with as little open dissent and as much gravity and consensus as possible. This behavior is the result of a shared outlook. It is aggravated by the ease with which most professional groups accept the "responsible" consensus.

It is true that independent budget evaluations are attempted by OMB, the Appropriations and Budget Committees, and the GAO. But as long as there is a general consensus within the club, and as long as evaluations are based on NASA-commissioned studies, these economy-oriented critiques will not be effectual. Indeed, not all these authorities are economy-oriented. As staffers become familiar with space activities they become interested in them. If pressures build to stimulate the economy, what better place than in one's favorite R & D program?

c. Unconvincing Arguments

Most agencies have a wide range of arguments to back up budget requests but they usually use these arguments informally. At budget hearings an agency will try to keep it simple. Informal arguments might lose some of their appeal to individual interests if they were listed together, and exposed to criticism.

Critics of a particular program would do a service if they took issue not only with the program's formal justification but with all the other claims that are made in support of it. However, the critic runs the risk of strengthening his case logically and weakening it here and there politically. Inaccurate claims can usually be asserted more quickly than they can be refuted.

Unconvincing arguments tend to weaken the aura of scientific invincibility and suggest a bureaucratic tendency to keep trying a multitude of arguments to weaken people's resistance, or to provide that particular argument which one group can accept. This list is by no means complete.

(1) The "Critical Threshold" Argument

NASA will maintain that funding must be kept at a certain level to preserve the necessary scientific and engineering base in people and facilities.

There is no one threshold, but a series of thresholds depending on the level and the purpose of R & D. The concept itself is suspect: if a base could be created when needed, it can be re-created. The costs of starting it up must be balanced against the costs of an entrenchment process that diverts the government's attention and funds from new problems, or new approaches to old problems.

(2) NASA's Stimulative Effect on the Economy

It is claimed that NASA expenditures are highly labor intensive, have a high multiplier effect, are not inflationary, and return the investment many times over due to the advanced technology involved.

Aside from the fact that these are the findings of studies commissioned by NASA (see following section on vested experts), the point is not how stimulative NASA spending is in absolute terms, but how stimulative it is compared to equivalent spending by some other agency in some other sector, or by different fiscal and monetary policies.

(3) The Level Budget "Commitment" of January 1972

NASA often refers to OMB assurances that it would have a funding floor in constant dollars to build the shuttle. Actually the "commitment" was made by NASA, not by OMB. The political process does not permit long-term comitments to controversial programs, yet claims of a "commitment" are still heard.

(4) The "Cutting Edge" of Technology

In simplest form this argument holds that what makes America preeminent is advanced technology, and that we depend on it for our defense and foreign exchange earnings. The "cutting edge" is never far from nuclear energy and the aerospace industry, and in these areas the high quality of research brings the highest return on our R & D dollars.

This argument confuses the value of R & D with subjective judgments on the value of different types of R & D. The issue should not be whether aircraft sales are a major earner of foreign exchange, but whether some other industry would have produced greater social and economic benefits if an equivalent amount had been invested in it. As to quality of research, talent follows money.

Our military and space efforts might well benefit from cheaper, more numerous and more expendable units. See Annex D.

(5) Individual Science Programs Vital.

This tactic is to evaluate individual science programs in isolation from basic research policy. The stress is on the worthy objective and not on whether the program is cost effective, or whether data are related to results from recent or concurrent programs, or whether technology offers the possibility of leap-frogging to a more advanced stage.

The Space Telescope is a case in point. If observations are vastly improved outside the earth's atmosphere, why have observatories been built or upgraded recently in Chile, Mexico, Hawaii, Puerto Rico, and Arizona? Is there duplication from military space programs?

(6) National Security, or A Race with the Russians

The space club is not averse to taking a page out of DOD's book. When pressed, NASA will disclaim competition, but say the Russians are ahead.

> DR. FLETCHER. We don't regard ourselves as being in a race with the Soviet Union. We do feel that we cannot fall too far behind in technology.

Some proponents will say that NASA programs have profound security implications. These claims suggest that DOD does not recognize certain defense needs, or that NASA should pay for a certain part of national defense.

(7) International Prestige

Akin to national defense is the notion that to keep our political and cultural values in high esteem, here and abroad, we must periodically give a display of technological virtuosity. Perhaps a winning team in sports or technology helps Americans feel less threatened by foreign developments beyond our control. We transfer vigor and Number 1 status in a particular field, to the nation as a whole. Selling international prestige on this basis panders to people's insecurities.

(8) The Call of Adventure

Adventure covers a variety of appeals to our emotions and imaginations.

--Vicarious space travel:
e.g. the Shuttle will have hygienic facilities for both men and women

and that "average" people -- non-astronauts -- will be placed in orbit, to obtain the "liberating perspectives" of space.

--Creativity:
e.g. the space program fills the same human need as cathedral-building in the Middle Ages.

--An Alternative to War:
e.g. World War I might have been avoided if European nations could have vented their aggressiveness on space operations rather than armaments.

--A New Start for Mankind:
e.g. artists' conceptions of space colonies, space factories.

--America's Destiny:
e.g. The United States is the only country on this planet that can answer the riddle of man.

--Spectator Sport:
e.g. Astronauts -- technological sports figures -- may do more to heighten this sense of adventure than to justify the added expense of manned over un-manned space missions. Perhaps they can be likened to a strong football team, that provides the gate receipts to support other athletic programs.

As with the international prestige appeal, there is a touch of "Madison Avenue" to this -- space is more than R & D -- it is patriotism, "gee-whiz" technology, entertainment, creativity, our national destiny. But the very success of these appeals to our emotions and imaginations shows that welfare and security are not the total of human aspiration. We enter a decision-making area full of risk for public policy which imposes certain responsibilities on government officials. Programs funded emotionally often lead to waste, empty psychological gratifications, and inflation. Ancient and recent history offer examples of peoples who have asserted their values and spirit in unprecedented, uneconomic programs that drained them, sometimes fatally, of their vitality and resources. The display of power was as important as the end it was put to. See Annex, Shuttle Justifications, 2g.

But non-economic or "irrational" motivations do exist, and they carry the potential for great creativity as well as great waste. Adventurous social programs and R & D programs have given us new knowledge, new powers and perhaps a new identity. Thus it is essential to argue over what kind of adventure we are getting into, and the costs. This is almost impossible when budget requests are made entirely on economic grounds, and the appeal to non-economic motivations is under the table. (See Recommendations.)

(9) Fait Accompli Statement

"The debate over manned vs. unmanned space flight was settled by the decision to build the Shuttle." This ploy can be used for most programs. It was a favorite for continuing the Vietnam war.

d. <u>Expert vs. Popular Opinion</u>

Related to the consensus of scientists and engineers with regard to budget requests is the absence of an outside vantage point that the layman could turn to for a professional but fresh perspective. The problem goes beyond the natural similarity of viewpoint of persons in the same field. As then Senator Mondale asked on May 9, 1972:

> How can Congress and the public approve massive spending on new technology programs without the benefit of independent evaluations of such programs?

NASA's contractors are not likely to offer opinions which have not been checked with NASA. At times estimates suggest a form of blackmail:

> NASA said that if the expendable alternate were selected, a further analysis might increase the development cost of the new expendable (launch vehicles) by about 1 billion dollars. [1]

On the one hand there must be a taxpayer counterweight to vested expert opinion. On the other hand there must be disinterested expert opinion to dampen public enthusiasm for space programs based on psychic gratifications rather than economic or scientific returns. Those who find entertainment or the solution to war in space may ultimately push space expenditures higher than space scientists and engineers. The object of both counterweights is to use national resources wisely.

1. Note that there is no comparison of <u>total</u> development costs of expendable and reusable launch systems.

4. Recommendations

a. Outline National goals -- for example --

(1) The President's Economic Goals:

-- $4\frac{1}{2}$% unemployment by 1981

-- inflation under x%

-- a balanced budget, amounting to 21% of GNP

-- a relatively favorable balance of trade

(2) Defense Against Military Threat

(3) Pollution at Acceptable Levels

(4) International Collaboration, Project Humanitarian Values

(5) Scientific Discovery

(6) A Program to Express National Values and Energy (?)

b. Outline Corresponding Space Programs -- for example --

(1) Defense Satellites

(2) Scientific Probes, Experiments

(3) Economic Application Satellites (crop and weather forecasting, resource management)

(4) Pollution Detection Devices

(5) Public Service Satellites (education, search and rescue)

(6) Solar Energy Platform

(7) Reimbursable Projects (communications satellites, space manufacturing)

(8) International Cooperative Ventures
(To train foreign scientists, share information, share the expense, use and seek superior talent.)

To make these ventures effective the U.S. should avoid paternalism, or the notion that our resources give us a Manifest Destiny in space.

(9) Experimental Civilian R & D
Develop technology that applies to the way people live now, in this country and abroad. See Annex D, NASA's R & D Direction.

c. <u>Accurate Labelling</u>

Avoid the scientific mystique. Justify programs in terms of all other activity being carried out to achieve the same broad objective. Set forth all the arguments used to support the program, strong or weak, point by point. If the program is based partly on non-economic considerations, such as curiosity or adventure, make that part of the appeal explicit, so that the rest of us can recognize the trade-offs and judge for ourselves whether the adventure will strengthen or weaken us in the long run.

d. <u>Downgrade Economic Objectives</u>

Economic stimulation should take a back seat when R & D programs are funded, because these programs invest in personnel and facilities that are far more specialized and influential, and multiply more rapidly, than the constituencies of non-R & D programs. Multiplying the supply of program administrators multiplies the demand for more of the same. This skews the economy more than it stimulates it. See Annex D, NASA's R & D Direction, Constituencies.

e. <u>Curb Budget Expansion</u>

Through Executive Order establish an obstacle course of hearings, studies and consultations for budget increases over, say, 5%. Once a benchmark budget has been set, vary the size of the slices, not the pie (see Figure 2). When priorities change, resources must be shifted, not added on. Scientists and engineers should be encouraged to blunt their spears on each other rather than the Administration.

f. <u>Use a Science/R&D Jury to Recommend R & D Priorities to the President</u>

Appoint a Science/R&D Council, headed by the Vice President, made up of distinguished laymen, to recommend allocation of R & D funding as to function and agency. (See Figure 12.)

This Council would not resemble the President's new Committee on Science and Technology. It would present the President with a proposed R & D budget. Its members would represent labor, business, education, consumers, the press and other sectors without being weighted 2 to 1 in favor of engineers, scientists and bureaucrats. The members would serve full-time, for a year, without staff.

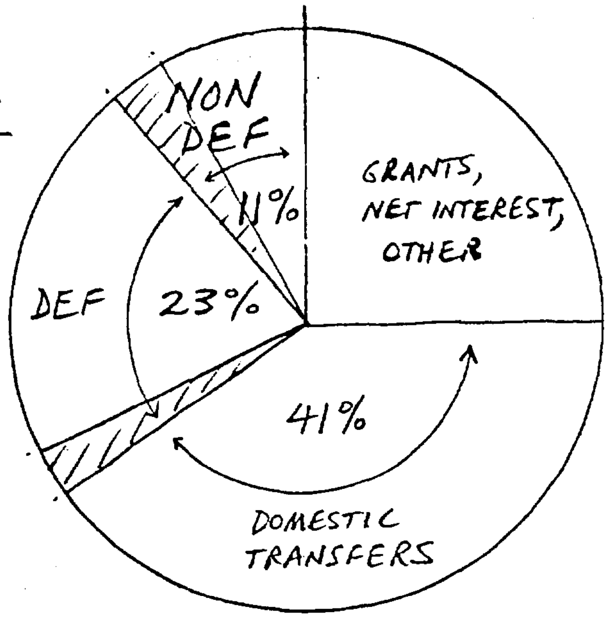
The Council would hear expert testimony from scientists, engineers, and those most knowledgeable about R & D. Its recommended budget would include military as well as civilian R & D. In the space field, for example, the members would have security clearances adequate to allow them to try to fund military and space programs from the same "pie," minimizing duplication and maximizing multiple missions.

Discussion:

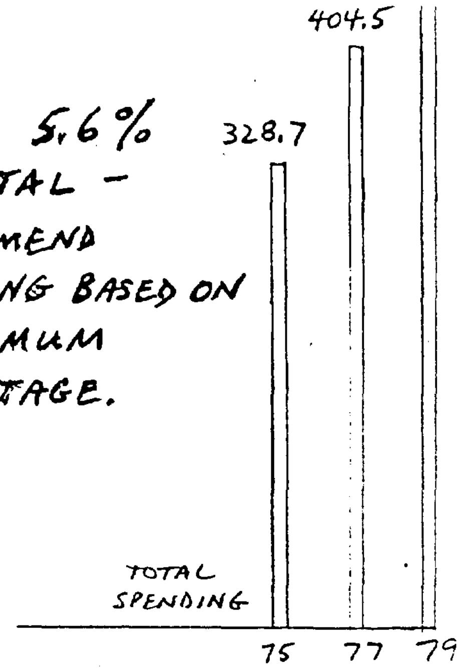
In seeking impartiality for decision-makers it would seem logical to assign laymen to determine <u>the overall size</u> of the Science/R&D budget, and scientists and engineers to decide <u>how the R & D pie will be divided</u>. But more impartiality can be achieved by reversing the roles.

At the level of deciding between the nation's R & D and other non-defense goods and services (assuming this model is accepted), laymen are not disinterested, and may be too shortsighted to see the value of R & D, whereas the parochialism of scientific and engineering opinion would be less at the overall R & D level than at the level of funding individual R & D programs. At the program level, experts seek national commitments to their own programs, thus tending to jack up overall R & D on political considerations. Expert opinion at the <u>overall</u> R & D level, however, might dampen this effect. A compromise would be to set R & D within a narrow percentage range of Federal spending (not GNP).

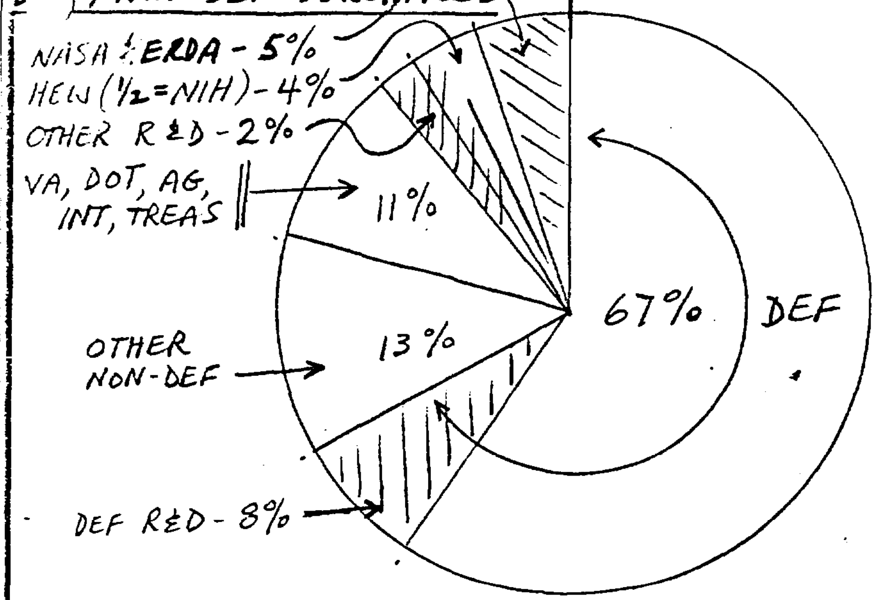
FY 1977
FEDERAL
EXPENDITURES



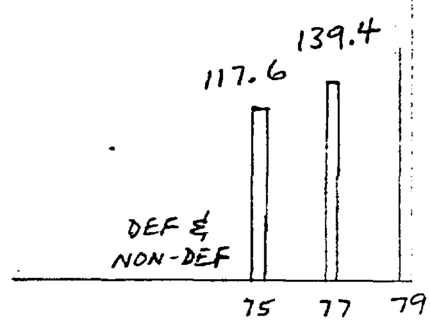
R & D 5.6% OF TOTAL - RECOMMEND PLANNING BASED ON AN OPTIMUM PERCENTAGE.

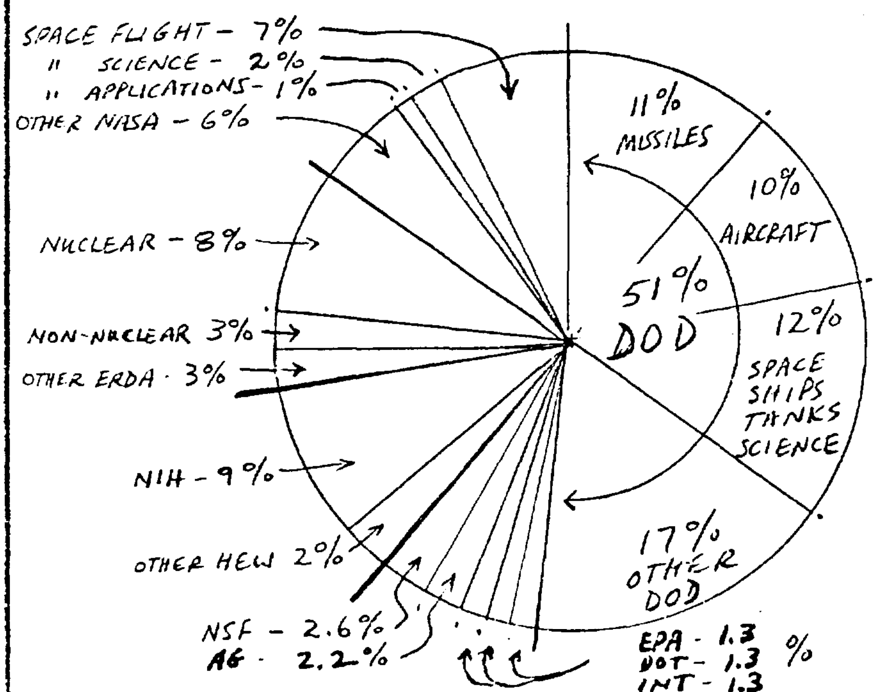


D & NON-DEF PURCHASES

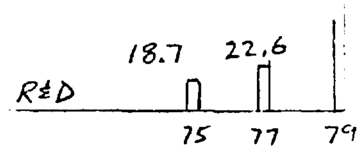


R & D 23% OF NON DEFENSE, 16% OF DEFENSE & NON DEFENSE COMBINED. RECOMMEND R & D PROPONENTS BE STRENGTHENED IN BUDGET DECISION-MAKING.





AGENCY & MISSION SHARES OF R & D - RECOMMEND JURY CONCE TO WEAKEN PROPONENTS OF INDIVIDUAL R & D PROGRAMS, PRESIDENTIAL BACKING TO PROVIDE LEAD-TIME FOR CONTRACTION AND EXPANSION.



R & D priorities are as political as they are scientific. A full debate is necessary. Without it we will be less likely to achieve mid-range budgetary stability and more importantly the lead-time necessary for contractors and scientists to prepare themselves for new problems and priorities.

g. Enforce OMB Circular A-109; Decentralize

Depending on how one defines a need, circular A-10 could have prevented the Shuttle controversy. The circula states:

> "When analysis of an agency's mission shows that a need for a new major system exists, such a need should not be defined in equipment terms, but should be defined in terms of the mission, purpose, capability, agency components involved, schedule and cost objectives, and operating constraints."

The present arrangement allows Space Flight to turn to Space Science and Space Applications and say "Here is your equipment, the Shuttle. Make use of it." Ma Space Flight will then find a new project. When it can no longer carry the expense of the Spacelab, or Space Industri alization, it will turn these half-started programs over t Science or Applications, the offices which should have controlled R & D from the beginning.

To take mission-orientation further, overhead could be funded out of the end-result offices (Science, Application and OAST). The NASA Comptroller would be split in three, and those three offices would draw up budget requests for C of F and R & PM. Facilities would bill those 3 offices for services rendered. (OMB and the GAO would have to ensure that billings represent the full cost of government facilitie and personnel.) In effect all work would be contracted out, to either private or government contractors, whichever progra management preferred.

Some of the advantages of decentralized budgeting are the following:

-- it would weaken the agency's hierarchy, its institutional values, its growth as a bureaucrac

-- it would force economies on laboratories and facilities of marginal usefulness.

-- it would increase the practical applications of independent (unstructured) R & D.

-- it would make programs available to facilities, and facilities available to programs, across the board. Facilities and laboratories affected would be subject to a wider range of ideas and work opportunities.

-- it would require ways of making the Civil Service more responsive to public needs.

h. Reorient NASA Leadership

Section 203 (b) (2) of the 1958 Aeronautics and Space Act allows the NASA Administrator to hire up to 425 executives, and set their salaries to the top Civil Service grades. This high number of excepted positions tends to unify top management. Unity is more beneficial to the implementation of policy than to the formation of it.

This system naturally lends itself to the notion of a network, and a perception that when RIFs come the Civil Service takes a disproportionate share. The system may also be related to NASA's poor Equal Employment Opportunity (EEO) record, discussed in Annex E.

Disturbing also is the number of former military personnel and former NASA contractors within the excepted positions. They cannot help but affect relations between NASA, Defense, and industry, and the kinds of work that NASA undertakes. Likewise a survey should be made of where NASA scientists have done their work. There may be a certain parochialism among the prestige institutions. This too may affect the kinds of work NASA does, who does it, and where.

If the thrust of this memorandum is followed, a new Administrator will have to come from outside the space club. He or she will have to be willing and able to use his authority to remove NASA veterans from excepted positions, and replace them with younger professionals. The purpose of these changes would be:

-- to make NASA's personnel system <u>more</u> responsive to need, not less.
-- implement the spirit of EEO.
-- offset the steady increase in the average age of NASA employees.
-- encourage disciplined dissent.

i. Postpone the Appointment of a Science Adviser (OSTP) and a NASA Administrator Until These Issues Have Been Discussed

Do not approve new starts at NASA until the budget decision-making has been studied. Do not be rushed. If an attempt is made to challenge the experts who choose our options, appoint science and R & D officials who will support the new approach and make it work.

5. Options

The three options listed probably bear little relation to OMB options, which reflect expert opinion. My options suggest that we explore new directions for R & D, that we not commit ourselves to Shuttle operations, regardless of "cost-effectiveness," and that we give laymen a share in setting R & D priorities. To sum up, the options are based on keeping control of the agency.[1]

The options also reflect a bias toward Space Applications. Admittedly there are no options as to how Applications could use additional resources, but current NASA emphasis suggests that money (and talent) thrown at this area could bring significant results.

1. OMB may not see this as a problem. In discussing NASA's FY 1978 budget request, an OMB report states: "Substantial flexibility exists for reducing future year funding based on long-range policy and budget decisions in future budgets" --as if a program's constituency did not grow and gain a wider hearing, as if our investment does not bind us tighter to a program, with each passing year.

Option 1 - Appoint "jury" to recommend all R & D program priorities.

Budget effect - Unlikely to change level of space funding, but might favor Applications over Flight and Science.

Discussion

OMB states that R & D funding

> is not a separately programed or budgeted activity of the Federal Government. Its funding must therefore be considered primarily in light of the potential contributions of science and technology to meeting agency or national goals and not as an end in itself.

Realizing that "therefore" belongs to the first sentence, not the second, the crucial point is that agency or national goals are slurred together. There is often a time-lag between agency goals and new perceptions of how national goals can be achieved. Since R & D needs more lead-time it is important that agency R & D decisions be subject to modification by a group with a totally national perspective.

Advantages

1. Less overlap between military and civilian space programs.
2. Build broader consensus for longer-range planning, more lead-time for contractors.
3. A form of Executive oversight over Defense R & D.
4. More attention to national goals than agency goals.

Disadvantages

1. "Jury" unqualified to grasp issues involved.
2. "Jury" will become the captive of a particular R & D faction.

Option 2 - Build only three Shuttles. Use Shuttle for R & D and as required by individual missions.

Budget effect - Gradual reduction instead of sharp increase in Shuttle expenditure. FY 1978 is build-up year.

Discussion

Using the Shuttle as an R & D program for launch and payload reusability, while improving expendable systems, will provide greater flexibility. Some resources can be shifted to Space Applications. Publicize DOD distrust, and Mondale, Proxmire and GAO objections. OMB notes "widely divergent views."

Advantages

1. Change the big-program legacy of NASA; re-direct R & D from "producers" to "consumers."

2. Take advantage of new broom; use press and public concern over inflation and bureaucracy.

3. Decision to put "Carter imprint" on Applications, give shuttle contractors an advantage in seeking Applications contracts.

4. Catch up in expendable vehicle technology, building Fords instead of Cadillacs.

5. More Science and Applications value per dollar spent, less drama.

Disadvantages

1. Political repercussions from areas surrounding affected facilities (see Figure

2. Wide currency of "cost-effectiveness" argument.

Option 3 - Expand the NASA charter to provide limited funding for specified technological breakthroughs.

Budget Effect - None.

Discussion

NASA coordinates with other agencies, industry and academia. It has capabilities in energy research, materials development, and across the spectrum of advanced technology. It put a man on the moon. It thinks more about the future than other agencies.

Why not challenge NASA to find technological breakthroughs to problems here on earth? NASA would serve as a gadfly, to weaken monopolization of R & D fields by other agencies. Congress and NASA would draw up a list of problems most susceptible to new technology, and NASA would in effect bid for a contract. New automobiles, insulation, and housing modules come to mind. See Annex D, NASA's R & D Direction, section 3.

Advantages	Disadvantages
1. Encourage new interdisciplinary approaches to old problems.	1. Maintain unneeded personnel and facilities on hare-brained schemes.

ANNEX A

Shuttle Justifications

Lack of clear objectives for the agency is reflected in the confusing justifications for the Shuttle.

1. Formal Justification Is Irrelevant

a. Cost Effective -- the Shuttle is cheaper than expendable launch vehicles.

NASA states that the Shuttle is cheaper than the alternative -- expendable launch vehicles -- based on a certain frequency of missions (58% higher than preceding 10-year average), a certain overall payload weight (an annual payload six times what it was in 1969), a certain savings from lower-cost payload design and reusability, and a steadily increasing budget for NASA in current dollars. In 1972 President Nixon said that the Shuttle would "routinize" transportation into near space and "take the astronomical costs out of astronautics."

This argument does not justify a growing national effort in space; it assumes and even requires it. Readers who wish to be side-tracked by this flypaper device will find it discussed in the last paragraph.

b. A new capability to use space.

When pressed on cost-effectiveness assumptions by Senator Proxmire, in February 1976, the NASA Administrator replied: "We went ahead with the Space Shuttle...because it offers...a new, more effective and efficient way of expanding the uses of space."

Yet no one can clearly identify what these uses are or whether the Shuttle investment is the most efficient way of expanding them.

c. World technological leadership.

In what? Emphasis on Shuttle allows foreign advantage in expendable launch vehicle technology. Why must the "cutting edge" of technology be in military-related programs with high development costs? See Annex D on NASA R & D Direction.

SHUTTLE FUNDING BY CHARACTER OF WORK

(millions of dollars)

	77		78		79	
	$	%	$	%	$	%
Basic & Applied Research	145	7	156	7	156	8
Proof of Concept	18	1	60	3	47	2
Full Scale Development	1809	92	1928	90	1835	90
Total	1972		2144		2038	

Source: OMB

2. <u>Informal Justifications Are Questionable</u>

a. Military Security.

DOD's responsibility.

b. Employment.

On a national level, comparable employment could be generated by other programs, in NASA (Science and Applications) or out of NASA (ERDA, private industry). With regard to specific facilities and contractors, the point is valid.

c. Delays raise cost.

May also slow waste.

d. European Space Agency is investing $500 million in Spacelab.

NASA is investing $300 million in Spacelab.

e. Shuttle essential to Space Applications and Space Science.

Although these are presented as the "uses of space" which the Shuttle will expand, they have actually been neglected by NASA's diversion of funds to the Shuttle program.

f. The need to put non-astronauts in space.

At what cost? For practical results or public relations?

g. Adventure and economic growth (See 3.c.(8))

Let us recognize that the Shuttle offers a form of adventure and a vision of the future, and debate it as such. There are different kinds of intellectual, emotional, and physical adventure, and there are alternative visions of the future. Large scale sophisticated technology should have no monopoly on our imaginations.

Let us keep separate the sales pitches that involve international prestige, displays of power, Buck Rogers entertainment. These play up to our insecurities and offer satisfactions and diversions that are artificial.

Where there are Madison Avenue techniques there is the possibility that the Shuttle vision of the future is the favorite of big business. Businessmen may see space manufacturing as a way of maintaining our present types of growth, technology and consumption. Space scientists may see it as a peaceful offshoot of weapons technology, creating different kinds of growth and different social attitudes.

In this vision of the future, in which we are investing billions, space will provide new sources of energy, new materials, new growth, new cures for disease. People will be distracted from population pressures, economic inequalities, and nuclear contamination. (Problems that don't lend themselves to technological solutions are "cultural factors" which are ignored, or thought to be transformed by the future.)

It is possible that technology will change our lives, but is it this Shuttle type of technology?

3. Factual Justifications

a. Shuttle operations could possibly lead to unforeseen genuinely economical space activities that would not be apparent from using only an R & D shuttle.

b. Space operations in the 90's may require a commitment to manned space flight and the physical retrieval of a high percentage of satellite payloads.

4. Reconstructing the Shuttle Decision

By hindsight it would seem that NASA should have studied the missions for space launches before and not after the development of the $30 to $50 billion Shuttle. At the time the decision was made, however, the following conditions prevailed:

-- the Apollo program was ending, forcing traumatic reductions.

-- NASA could probably get more funds from Congress for the Shuttle than it could for Science or Applications.

-- Shuttle research spills over to aeronautics.

-- NASA is oriented toward expensive "hardware."

-- Space Flight was called Manned Space Flight. The thrust of that office is to enable human beings to work in space, which causes NASA to de-emphasize missions that can be accomplished at less cost without human beings.

5. The "Cost-Effectiveness" Argument

a. Cost estimates were obtained from NASA-contracted studies (See Section 3d.)

b. NASA studies underestimate Shuttle costs and over-estimate those of its alternatives. According to the GAO,

(1) NASA has yet to provide an estimate of all Shuttle costs.

(2) NASA's management-to-cost techniques are a way of holding down more realistic field center estimates.

(3) Major Shuttle costs have gone up 50% from 1972 to 1976, and further real and inflationary increases can be expected from budget-caused delays, environmental impact studies, and unforeseen design problems.

(4) Crucial to "cost-effectiveness" are the "savings" made possible by the Shuttle's ability to <u>retrieve</u> space payloads, <u>repair</u> them in space, and utilize <u>lower-cost payload design</u> -- yet these cost benefits are dubious. A separate Shuttle flight is required for each orbit retrieval. Technology advances so rapidly it may be cheaper to build new units than repair old. Designing for heavier and larger payloads means reversing the industry trend toward greater sophistication.

(5) The 58% higher launch rate may be unrealistic; none of the Shuttle's potential users (e.g. Commerce, DOD) has committed itself to a minimum number of missions.

(6) Budget constraints add to program risk because NASA's "cost-effectiveness" model puts pressure on engineers to compress testing schedules rather than on NASA to postpone revenue-generating operations.

c. DOD is to be a major user of the Shuttle, but several Air Force studies have suggested the Shuttle may cost more than expendable vehicles. The Air Force has not released its studies on the feasibility of recovery and re-use of Defense satellites, most of which are in geosynchronous or higher-than-Shuttle orbits.

d. "Cost-effectiveness" is clever:

(1) It diverts attention from "what's it for?"

(2) It conveys frugality by asserting that substantial savings will result if the nation embarks on a $40 billion program.

(3) It justifies follow-on programs, like a permanent space station, to allow us to get our full money's worth. In FY 78 NASA requested $15 million for "Space Industrialization," the wedge for a new dominant mission.

Annex B

Work Impact at Installations

No other program accounts for the same percentage of R & D work as the Shuttle does at Johnson, Kennedy and Marshall. But Shuttle cut-backs would affect Johnson, Kennedy and Marshall as the percentages indicate, over time, only to the extent that there were no programs to replace the Shuttle. NASA tells us that Shuttle R & D resources will be shifted to Science and Applications after the Shuttle becomes operational. If the Shuttle were cut back, that process could start now.

RESEARCH AND PROGRAM MANAGEMENT,
CONSTRUCTION OF FACILITIES AND SELECTED
R & D PROGRAMS, BY INSTALLATION

FY 1977 Estimates
(Millions of dollars)

Facility	Johnson Houston	Kennedy Cape Canaveral	Marshall Huntsville	Goddard Greenbelt Md.	JPL Pasadena	Ames San Francisco	Langley Hampton Va.
R & PM	134.2	103.6	133.1	109.1	--	50.5	91.7
Tracking & Data	--	--	--	181.9	54.8	--	--
C of F (partial)	3.6	41.7	--	.8	--	4.5	31.1
Shuttle	915.5	148.1	404.7	.4	.5	.4	.2
% of R & D	94%	88%	87%	.1%	.3%	.3%	.1%
Science	20.4	1.0	46.2	83.9	73.9	63.1	28.3
% of R & D	2%	.6%	10%	21%	41%	54%	19%
Applications	33.4	.8	11.5	90.2	30.5	9.2	9.7
% of R & D	3%	.4%	2%	22%	17%	8%	6%

Annex C

Military Space Programs

1. Size and Objectives

Only part of DOD's space-related programs are included in military R & D, but the two are shown together, with NASA's incurred obligations, for comparison. The military space "overhead" may be understated.

Spending 38% of U.S. space money, DOD programs should be scrutinized as closely as NASA's. The scrutiny is more difficult, however, due to overclassification, institutional reticence (see paragraph on Shuttle), and scatteration.

The third factor, more reassuring, is the impression that space activities are split up among distinct military missions. It makes empire-building harder to detect because SAMSO turns the programs over to the commands that use them. The Defense Support Program is run by NORAD, the Defense Meteorological Satellite Program by SAC, and the three communications programs, DSCSII, AFSATCOM, and FLTSATCOM, are run by DCA, the Air Force and the Navy. SAMSO is the Air Force unit that develops and launches Defense satellites.

In theory, space programs are approved by hard-nosed commanders who only want the job done most effectively. In practice a relaxed budget may permit redundancy, or placing satellites in operation before they are perfected for peacetime or reliable in wartime.

2. Overclassification

There should be a presumption that any information that can be correctly assumed by the Soviet government should be available to the American people. A few highly sensitive activities should not make all others classified as well. Cost should be broken down in greater detail.

The need for various systems must also be explained. Defense communications, for example, already seem adequate: only disinterested officers, forced to make choices, can give us an accurate judgment.

($ in millions)

DOD SPACE AND SPACE RELATED PROGRAMS

PROGRAM	FY 1975	FY 1976	FY 197T	FY 1977
Mission Oriented				
Navigation NAVSTAR (GPS)	47.6	104.5	22.7	102.7
Communications DSCS II, AFSATCOM FLTSATCOM	361.5	362.5	57.5	658.6
Geodesy	7.7	9.4	0.1	6.6
Warning DSP	136.5	92.7	15.3	86.4
Weather DMSP	29.1	42.3	7.2	57.9
Veh. Development	36.8	57.2	18.9	109.1
Space Ground Support*	91.9	115.3	21.3	123.0
Supporting R&D**	137.1	139.9	42.6	183.6
General Support III	1044.2	1061.3	262.7	1008.4
TOTAL	1892.4	1985.1	448.3	2336.3
(NASA OBLIGATIONS)	(3246)	(3965)	(931)	(3693)

Notes: * Includes range support, instrumentation, ground based satellite detection, tracking and control.

** Includes research, exploratory and advanced developments.

*** Includes support organizations as well as general operational support.

Table P-5. DEPARTMENT OF DEFENSE—MILITARY RESEARCH AND DEVELOPMENT (obligations in millions of dollars)

	1975 actual	1976 estimate	TQ estimate	1977 estimate
Conduct of R. & D.:				
Research, development, test, and evaluation:				
Military sciences	405	442	115	513
Aircraft and related equipment	1,648	1,941	443	2,260
Missiles and related equipment	2,160	2,277	562	2,504
Military astronautics and related equipment	527	582	139	593
Ships, small craft and related equipment	634	608	165	736
Ordnance, combat vehicles and related equipment	471	556	171	751
Other equipment	1,844	2,096	538	2,361
Programwide management and support	869	935	263	1,037
Other appropriations	429	442	114	443
Total conduct of R. & D., obligations	8,987	9,879	2,510	11,198
Total conduct of research, included above	1,661	1,756	519	2,035
Total conduct of development, included above	7,326	8,123	1,991	9,163
R. & D. facilities, obligations	164	176	36	356
Total obligations	9,151	10,055	2,546	11,554

3. The Shuttle

As to how necessary the Shuttle is to improve DOD space capabilities, DOD has made no final judgment. Air Force briefers tick off the Shuttle's selling points: twice the payload weight, three times the volume, in-orbit servicing and testing, retrieval, the ending of DOD-NASA duplication.

But they do not refute the counter-arguments:

--Retrieval, for refurbishment of payloads or failure analysis, is only practical from low orbit. Most DOD satellites go to geosynchronous orbit, which the Shuttle cannot reach.

--High equipment reliability and rapid technological advances reduce the importance of in-orbit servicing, and man-in-space. Long lead-time investments run greater risk of obsolescence.

--What would be the advantages and disadvantages of having men in space in time of war?

--If cost estimates for adapting DOD payloads to the Shuttle are now $700 million, and if DOD must build the IUS, how cost effective is the Shuttle from DOD's point of view?

Several hypotheses suggest themselves to explain why this subject is so difficult to discuss:

--tight security (see paragraph 2).
--decision-makers have not grasped all the technical aspects, and the technical people are too specialized to decide.
--political pressure to accept the Shuttle.
--unwillingness to discuss the issue with non-DOD personnel.
--ties with NASA.

Insights into DOD's "commitment" to the Shuttle will not be available through official channels to any questioner who does not have some power of the purse at Defense.

4. Ban on Space Weaponry

STATEMENT OF HERBERT REIS, LEGAL ADVISER, U.S. MISSION TO THE UNITED NATIONS July 28, 1976

The four outer space treaties are the Outer Space Treaty, negotiated in 1966; the Astronaut Assistance and Return Agreement, negotiated in 1967; the Liability Convention, the negotiation of which was completed in 1971; and the Registration Convention, completed in 1974.

The first of these conventions, the Outer Space Treaty, mandates that outer space and celestial bodies are freely available for exploration and use by every state and cannot be subjected to any claim of national sovereignty or exclusive use. It provides that the obligations of a state under international law to avoid using armed force and to resolve its international differences peacefully apply equally to conduct in space.

The treaty lays down the rule that no state may orbit nuclear weapons or install them on a celestial body. It calls for the encouragement of scientific investigation and establishes international cooperation in space and space-related programs as a fundamental objective of the community of nations, however disparate may be their Earth-based policies. It declares that space activities should be conducted with a view to benefiting all mankind.

The Outer Space Treaty specifically bans nuclear weapons and "other weapons of mass destruction." What initiatives have been taken by the U.S. to negotiate a treaty that would ban all weapons from space?

USAF briefers refer to space as the fourth medium of war, after land, sea, and air. Military space activities account for 38% of the U.S. space budget. Does all this money go to surveillance and communications devices?

Lasers and "killer satellites" are mentioned in trade publications and Congressional hearings. Once these weapons are used, how would the conflict escalate? What would be the effects on the global environment? If opposing satellites today can be likened to the early encounters between aviators in World War I, where are we going? Surely nations that forego chemical and biological warfare can forego weapons in space. Even "knock-out" uses of these weapons could not prevent nuclear retaliation.

The thrust of the Outer Space Treaty, which the U.S. proposed, is that space activities should be conducted for the benefit of all mankind. A complete report must be made on exactly the type and extent of U.S. and Soviet efforts to put destructive devices in orbit.

Annex D

NASA's R & D Direction

1. Development vs. Basic Research

Different fields require different proportions of basic and applied research and development. Since development is costlier than basic research, one R & D program with high development costs may starve many basic research programs. How are the trade-offs made? Obviously a program should not be ruled out because it entails high development costs; yet the economic, employment and political benefits are such that the R & D rationale for the program should be given rigorous objective scrutiny.

2. Constituencies

By natural inclination and by training, specialists tend to believe their specialty can be a major if not a determining factor in the progress of mankind. It would not occur to them that money for their specialty brings them status and power. They believe in their specialty (most of them) for the benefits it brings to others.

When cries in the wilderness are eventually heard and supported by government R & D, what emerges is a political constituency. If a small group shakes the tree successfully a larger group gathers, organizes, and shakes harder. New cries in the wilderness are drowned out.

Once a new elite gains tenure it can shape the thinking and outlook of a younger people for a generation. Rapid social and technological change may leave the experts' formative experiences far behind, but they not only control access to leadership positions, they reproduce themselves in those positions. A scientist in a field that affects our future can reproduce himself, in PhD's, every year, for decades after he has done his "best" work. Section 102 (a)(4) of the new National Science Act reflects the expert belief that R & D depends on greater numbers of scientists and engineers. But it is not the number, it is the kind and their orientation.

3. Other Directions

Alternatives to big technology and economic centralization need not lead to stagnation, an orgy of consumption, or a return to the Middle Ages. It is alleged that today the United States operates with the oldest stock of metal-working machinery of any industrial country, and that 80%

FEDERAL OBLIGATIONS FOR R & D

BY AGENCY AND CHARACTER OF WORK - FY 1977

millions of dollars

Research				Development	
Basic		Applied			
HEW	670	DOD	1719	DOD	9214
NSF	630	HEW	1392	NASA	2687
DOD	291	NASA	603	ERDA	2530
ERDA	289	ERDA	459	HEW	474
NASA	255	Commerce	145	DOT	295
Ag	185				

Source: NSF

FEDERAL OBLIGATIONS FOR RESEARCH

BY AGENCY AND FIELD OF SCIENCE - FY 1977

millions of dollars

Basic				Applied			
Physical Sciences		Engineering		Physical Sciences		Engineering	
ERDA	235	DOD	87	ERDA	192	DOD	1155
NSF	175	NSF	73	DOD	161	NASA	412
NASA	160	ERDA	43	Ag	36	NRC	114
DOD	65	NASA	41	EPA	28	ERDA	79
				Commerce	19		
				NASA	18		

Source: NSF

NASA PROGRAM CATEGORIES BY TYPE OF R & D

(millions of dollars)

	Basic & Applied	Proof of Concept	Full Scale Development	Total
Science (e.g.Viking)	4.3	1.2	16.3	21.8
Applications (e.g.Landsat)	8.4	6.6	6.2	21.2
Capability (e.g.Shuttle) Development	3.7	1.6	46.9	52.2
Total	16.4	9.4	69.4	95.2

Source: OMB

of our Federal R & D is related to weaponry. Why is R & D not targeted at new forms of transportation, insulation, clothing, or at products designed specifically for foreign markets, to improve our balance of payments? Why can't we lead the world in low cost products, like Jeeps that cost $1,000, or expendable rocket launchers that cost 20% of current rockets? On the other hand we could increase technical sophistication on a smaller scale. Mindful perhaps of the New York blackout of 1965, the new director of JPL advocates a decentralization of the American economy, based on small scale sophisticated technology, local energy sources, and nation-wide communications.

Defense R & D is not readily transferable to civilian use. Typically it produces units that are few in quantity, high in price. Defense and space R & D are concentrated in developmental R & D, focussed on the end product, rather than basic research, which has more general purpose applications. Defense and space R & D draws away scientists and funds from civilian R & D.

Yet new technological directions require not just a neutral government role in R & D, but active government support. Companies have practical difficulties in obtaining market rewards for "blue sky" R & D. Besides, scientific knowledge is a public good. If effective weapons systems require flexibility, obtained by developing a large "menu" of technology, and buying information on alternative systems, why shouldn't the same principle apply to civilian technology?

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December 18, 1976

ANNEX E

M E M O R A N D U M

TO: Nicholas MacNeil
Carter Mondale Transition Planning Group
P.O. Box 2600
Washington, D.C. 20013

FROM: W.A. Rutherford

SUBJECT: Aide Memoir: NASA Transition Overview Paper

1. As I indicated earlier the following information, observations and views are based on material gathered in the course of interviews with various persons inside and outside of NASA before and during the transition period as well as direct personal experience and exposure while working as a consultant to the Agency over the past two years.

1.1 This material is submitted for your information (and may or may not be included in or appended to your final transition report on NASA) and for the lest possible utilization as you see fit.

2. ORGANIZATIONAL STRUCTURE + BACKGROUND

There are three major considerations in this area:

2.1 First, as an organ of government NASA is singularly free of centralized Federal government control. The Senate and House Committees with legislative oversight responsibilities, along with OMB are the only real "controling" forces or influences on the Agency, and its proven effectiveness in "lobbying" members of Congress have measurably lessened the impact of the former.

2.4 In fact many Centers and Center Directors (including a number of outstanding Scientists - Wernor Von Braun is an Alumnus of the Marshall Space Flight Center- and several former Astronauts) have their own contacts, supporters, friends and lobbyists in the Congress, in various Government Agents as well as professional and public followers making them pote[illegible] forces to deal with and reinforcing their independenc[illegible] from central and external controls.

3. SOME PROBLEM AREAS

3.1 General

This situation has a great deal to do with the array of problems confronting the Agency. The in-group, esoteric atmosphere mentioned earlier has seen the creation of an "old boy-network" among the staff; a number of questionable procurement procedures including early construction and acquisitions outside normal Federal channels and constraints; favoritism in grants and awards to universities, companies and individuals; notoriously unequal personnel practices; costly programs and operations and a serious absence of direction and planning in the overall management of the Agency.

4.3 In fact NASA has a notoriously bad EEO standing. With some 16,000 personnel they presently have only a 7.4 percent minority participation in the work force - up from only 5.4 percent four years ago. Of the first 20 Federal Agencies NASA is 20th or last. The Agency is beset by a growing number of discrimination complaints and is being taken to court in a medley of class action suits.

4.5 The fact is that the Agency's planned rate of increased minority involvement is only 8/10ths of 1 percent annually. At this rate they do not even expect to reach EEO parity with other Federal Agencies until 1985. Many question wheather with management's current lethargic programs parity will be achieved even then.

4.6 The Agency uses the classic excuse that the scienti and technical nature of their work make it difficul to recruit qualified minorities. However the fact of the matter is that only 48% of NASA's work force is scientific or technical. Yet the minority figure is still far below parity in the other 52% of the work force.

4.8 Similarly, minorities and women are totally absent from many key areas of Agency management or are only represented in token numbers.

4.9 NASA procurement, university grants, education office publications and public affairs offices all have only limited and token programs involving minority communities - if at all.

5. REORGANIZATION/CONSOLIDATION

5.1 A clear case can be made for the reorganization and consolidation of those Government Agencies involved in Space and Space related activities. The Agencies that have major programs in these areas in addition to NASA are notably the Department of Defense, ERDA, NSF.

5.2 NASA Officials express interest in and approval of the concept of a National Science and Technolog Agency but make a clear cut distinction between Space Research and applications of research in specific areas. The hiatus is between the developers and the users, as they see it, and would influence their role as the "umbrella" Agency.

6. <u>SOME RECOMMENDATIONS</u>

6.1 That a major management study of the Agency be conducted especially regarding the planning, program development and decision making processes.

6.2 That the decentralized semi-autonomous Center's system be eliminated, and a centralized line of operational and program authority be established.

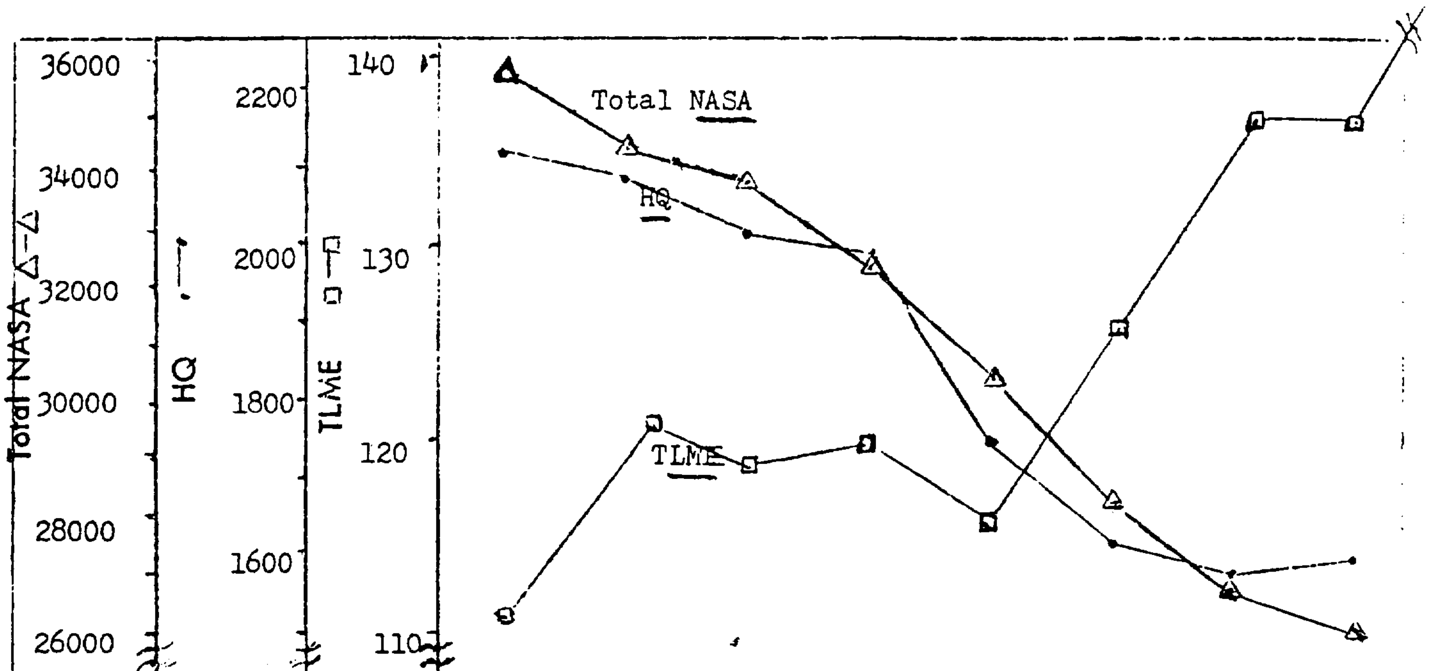
6.3 Develop new Equal Employment policies, programs and staff.

6.4 Install a management by objective system for progra development.

6.5 Better coordinate research and share facilities, information and equipment with other Federal Agencies doing related work such as the Air Force, DOD, ERDA, NOOA, etc.

6.6 Improve community relations and public affairs programs to involve and better inform the public

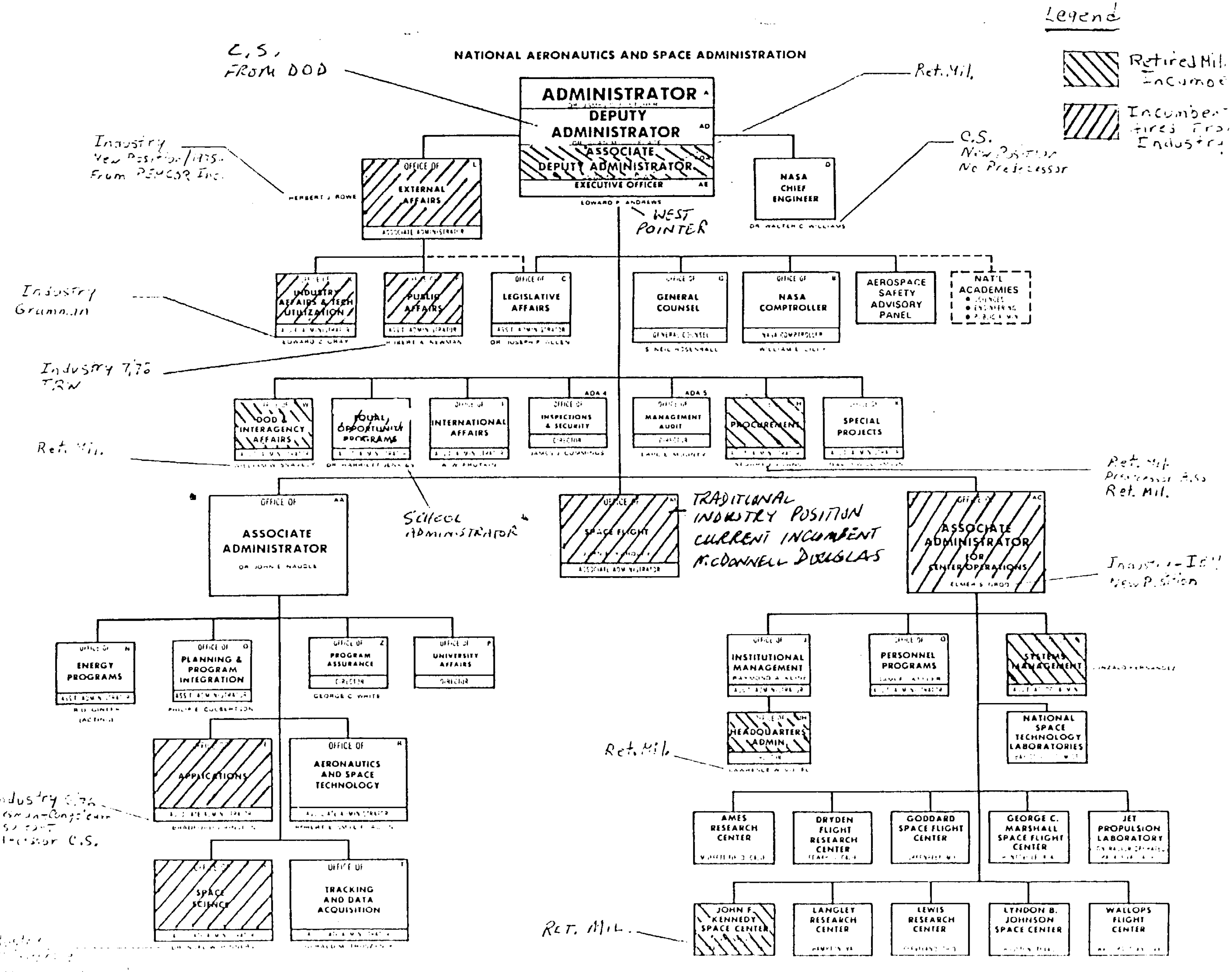
In order to shed some additional light on the subject of top level management talent (TLMT), which the Agency has a "problem" in acquiring (See Fact Sheet #6), the following curves are provided for your perusal:



Calendar Year	67	68	69	70	71	72	73	74
Top Level Mgmt Employees	111	121	119	120	116	126	137	137
HQ Permanent Employees	2116	2080	2022	1994	1750	1630	1584	1591
Total NASA	35860	34641	33929	32548	30506	28362	26777	2600[illegible]

TLME = Top Level Mgmt Employees: Anyone with "Administrator" in Title; 1st level dir.
Sources: TLME-NASA HQ Telephone Directories; GMR Reports: 1970-74 Personnel Records 1967-69;
Total NASA- Jan 75 Historical Pocket Statistics

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



ing solar power in orbit and beaming it down to earth, the President indicated that these kinds of things tend to happen much more quickly than we now expect and that we should not hesitate to talk about them now. He was also interested in the nuclear waste disposal possibilities. The President liked the fact that ordinary people would be able to fly in the shuttle, and that the only requirement for a flight would be that there is a mission to be performed. He also reiterated his concern for preserving the skills of the people in the aerospace industry.

In summary, the President said that even though we now know of many things that the shuttle will be able to do, we should realize that it will open up entirely new fields when we actually have the capability that the shuttle will provide. The President wanted to know if we [2] thought the shuttle was a good investment and, upon receiving our affirmative reply, requested that we stress the fact that the shuttle is not a "$7 billion toy," that it is indeed useful, and that it is a good investment in that it will cut operations costs by a factor of 10. But he indicated that even if it were not a good investment, we would have to do it anyway, because space flight is here to stay. Men are flying in space now and will continue to fly in space, and we'd best be part of it.

2. **International Cooperation.** The President said that he is most interested in making the space program a truly international program and that he had previously expressed that interest. He wanted us to stress international cooperation and participation for *all* nations. He said that he was disappointed that we had been unable to fly foreign astronauts on Apollo, but understood the reasons for our inability to do so. He understood that foreign astronauts of all nations could fly in the shuttle and appeared to be particularly interested in Eastern European participation in the flight program. However, in connection with international cooperation, he is not only interested in flying foreign astronauts, but also in other types of meaningful participation, both in experiments and even in space hardware development.

3. **USSR Cooperation.** The president was interested in our joint activities with the USSR in connection with the probes now in orbit around Mars. We also described to him the real possibility of conducting a joint docking experiment in the 1975 time period. The prospect of having Americans and Russians meet in space in this time period appeared to have great appeal to the President. He indicated that this should be considered as a possible item for early policy level discussions with the USSR.

The president asked John Ehrlichman to mention both the international aspects of the shuttle and the USSR docking possibilities to Henry Kissinger.

George H. Low
cc: A/Dr. Fletcher

Document III-33

Document title: Nick MacNeil, Carter-Mondale Transition Planning Group, to Stuart Eizenstat, Al Stern, David Rubenstein, Barry Blechman, and Dick Steadman, "NASA Recommendations," January 31, 1977.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

Unlike Presidents-elect Kennedy and Nixon, Jimmy Carter did not appoint a blue ribbon group on space during his post-election transition. Instead, the NASA transition paper was prepared by one individual who took a generally skeptical view of NASA and most of its programs. Unlike earlier space transition reports, this document was completed after President Carter entered the White House.

[no pagination] **Summary**

1. NASA's priorities are on the development end of R & D, not the basic research end. NASA directs our R & D resources toward centralized big technology, maintaining the defense R & D orientation of the aerospace industry.

2. The Shuttle has become the end, rather than the means, because NASA space policy has been shaped by the Office of (Manned) Space Flight. The Offices of Space Science, Applications, and Aeronautics Technology get the funds that are left over.

3. Alternative directions for space technology may be neglected because

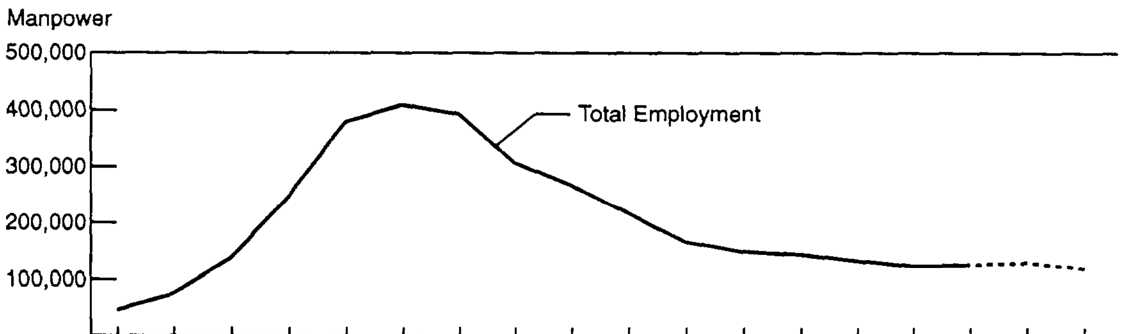
(a) the Administrator's power to hire and fire top management inhibits effective dissent

(b) important NASA managers are from Defense and the aerospace industry

(c) NASA's budget is supported and approved by a space constituency....

1. Budget History

Perhaps the agency's growth, retraction, and resiliency can best be seen in its level of employment since 1962.



	June 1960	June 1961	June 1962	June 1963	June 1964	June 1965	June 1966	June 1967	June 1968	June 1969	June 1970	June 1971	June 1972	June 1973	June 1974	June 1975	June 1976	Sept 1977
Total Employment	46,786	74,577	137,656	246,304	379,084	409,900	393,924	306,926	267,871	218,345	167,803	149,609	144,968	134,055	125,054	127,733	131,016	121,016
Contractor Employment	36,500	57,500	115,500	218,400	347,100	376,700	360,000	273,200	235,400	186,600	136,580	120,130	117,540	108,100	100,200	103,400	106,700	97,200
NASA Employees	10,286	17,077	22,156	27,904	31,984	33,200	33,924	33,726	32,471	31,745	31,223	29,479	27,428	25,955	24,854	24,333	24,316	23,816

In real year dollars NASA funding is 70% [of what] it was in its peak year, and increasing....

3. Funding Justifications Unconvincing

a. **NASA Mission Unclear**

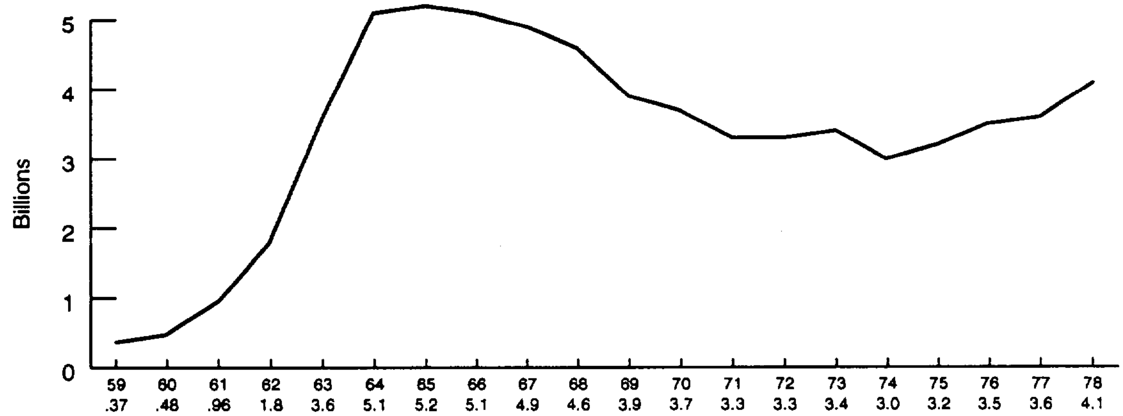
Much apprehension and uneasiness about the NASA budget would disappear if the civilian apace program, like its military counterpart, had clear objectives related to national goals.

DOD, with 38% of the space budget, would deny that its space efforts constitute a program; Defense programs are not ends but rather the means of accomplishing certain military missions, the purpose of which is to defend the nation and its allies from attack. Space programs have to compete with other means of accomplishing the same mission.

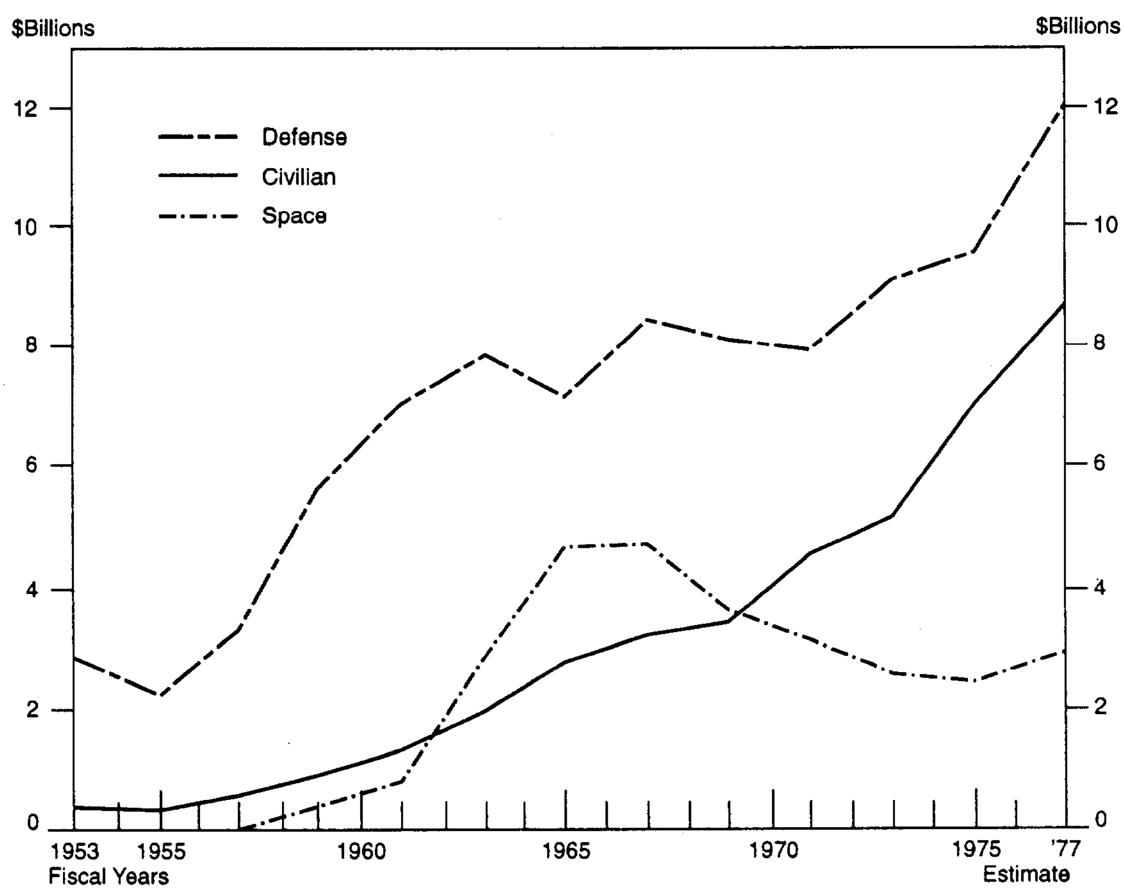
The entire NASA budget, on the other hand, is considered R & D. According to the National Science Foundation, "R & D is not an end in itself but is a means whereby national goals can be achieved more effectively and efficiently...."

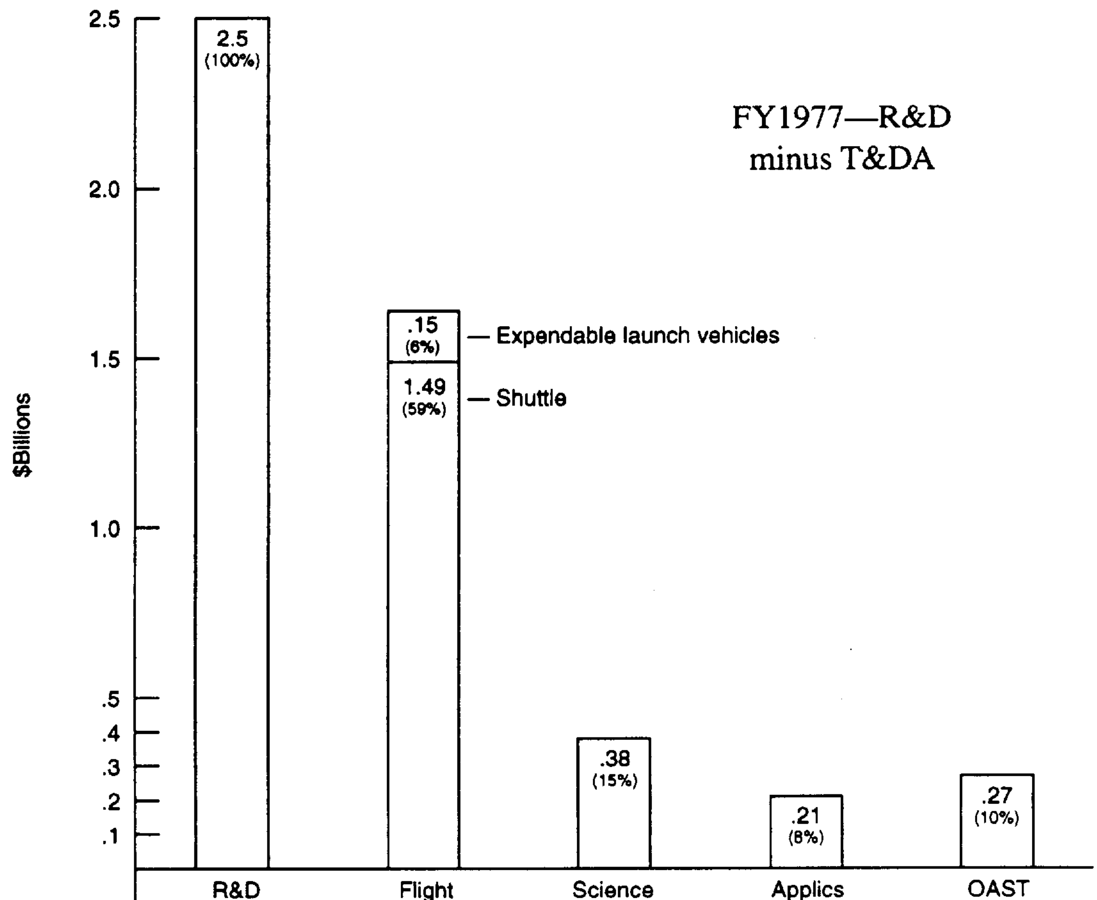
What are these goals? NASA has more difficulty than most agencies in describing

NASA Appropriations
In Year-by-Year Dollars

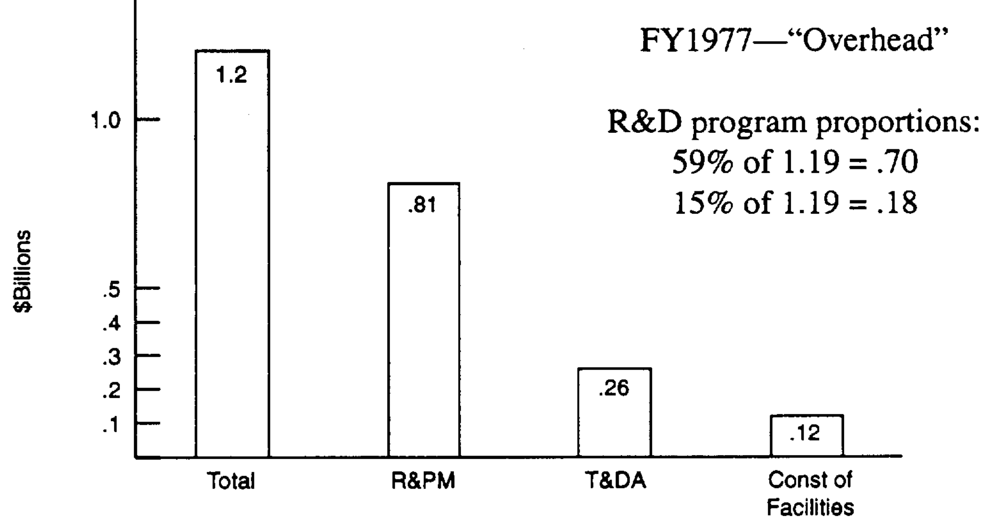


Conduct of Research and Development—Obligations P-1





FY1977—R&D
minus T&DA
$Billions
2.5
2.0
1.5
1.0
.5
.4
.3
.2
.1
2.5
(100%)
.15
(6%)
— Expendable launch vehicles
1.49
(59%)
— Shuttle
.38
(15%)
.21
(8%)
.27
(10%)
R&D
Flight
Science
Applics
OAST



FY1977—"Overhead"
R&D program proportions:
59% of 1.19 = .70
15% of 1.19 = .18
$Billions
1.0
.5
.4
.3
.2
.1
1.2
.81
.26
.12
Total
R&PM
T&DA
Const of
Facilities

Construction of Facilities
and Research and Program Management

FY 77 Estimate
(Millions of Dollars)

Program Activities	C of F	R & PM	Function	R & PM
Space Flight	39.8	348.1	Personnel	612.4
Science	8.7	114.2	Travel & Transp.	19.7
Applications	—	87.1	Rent	61.7
Space Research	.7	75.3	Supplies	13.9
Aero Research	28.9	146.2	Equipment	2.5
Support 45.8	43.1		Other	103.9
	124.0	814.0		814.0

national goals in such a way that its programs relate to them. The law establishing NASA is no help in this regard. The National Aeronautics and Space Act of 1958 declares that the general welfare and security of the United States require "adequate provision" for aeronautical and space activities. But then it states that NASA must contribute to one or more of eight objectives, several of which go far beyond the usual understanding of welfare and security. Are we called as a nation to something greater than our welfare and security? There is no guide in law as to what provision is "adequate" for NASA's programs.

b. **The Budgeting Process**

Budgeting decisions are made in a framework provided by space scientists and engineers. This term is short-hand for those employed by NASA, by the aerospace industry, and by the universities. They decide what NASA's mission in space is . . . , they tell us the value of space activities, and they largely determine the share of available funds each program receives . . .

The club seems to achieve a Consensus in-house, by rallying around those programs with enough political appeal to have a spill-over or logjam-breaking effect for the most members. Thus seldom will scientists or engineers openly criticize programs that they consider ill-advised. Budget requests are made to OMB and the public with as little open dissent and as much gravity and consensus as possible. This behavior is the result of a shared outlook. It is aggravated by the ease with which most professional groups accept the "responsible" consensus.

It is true that independent budget evaluations are attempted by OMB, the Appropriations and Budget Committees, and the GAO. But as long as there is a general consensus within the club, and as long as evaluations are based on NASA-commissioned studies, these economy-oriented critiques will not be effectual. Indeed, not all these authorities are economy-oriented. As staffers become familiar with space activities they become interested in them. If pressures build to stimulate the economy, what better place than in one's favorite R & D program?

c. **Unconvincing Arguments**

Most agencies have a wide range of arguments to back up budget requests but they usually use these arguments informally. At budget hearings an agency will try to keep it simple. Informal arguments might lose some of their appeal to individual interests if they were listed together, and exposed to criticism.

Critics of a particular program would do a service if they took issue not only with the program's formal justification but with all the other claims that are made in support of it. However, the critic runs the risk of strengthening his case logically and weakening it here

National Aeronautics and Space Administration

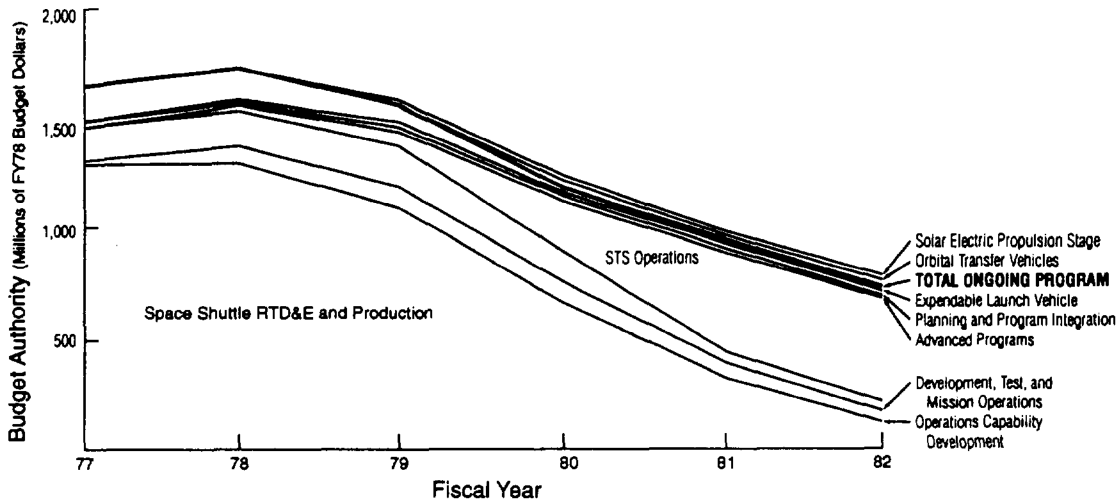
FY 1978 Budget Estimates
($Millions)

				FY 1978 Program Runout				
Budget Authority	FY 1976	T. P.	FY 1977	FY 1978	FY 1979	FY1980	FY 1981	FY 1982
Research & Development								
Space Shuttle	1,206.0	321.0	1,288.1	1,302.7	1,115.4	680.8	343.9	135.9
Space Flight Operations	188.7	48.4	202.2	297.6	360.4	508.7	594.0	592.1
Expendable Launch Vehicles	165.9	37.1	151.4	138.5	95.4	45.2	25.6	20.8
Suborbital Flight	1,560.6	406.5	1,641.7	1,738.8	1,571.2	1,234.7	963.5	748.8
Physics and Astronomy	159.3	43.5	166.3	234.1	270.2	266.9	264.0	235.7
Lunar & Planetary Expl	254.2	67.5	191.9	170.3	216.2	225.9	152.1	84.4
Life Sciences	20.6	5.4	22.1	36.4	51.1	58.5	63.8	67.9
Subtotal Science	434.1	116.4	380.3	440.8	537.5	551.3	479.9	388.0
Space Applications	178.2	47.7	198.2	224.8	242.8	266.4	163.0	135.5
Multi-Mission Modular S/C	-0-	-0-	-0-	25.0	40.0	21.0	2.5	-0-
Space Research & Tech.	74.9	19.3	82.0	115.0	114.7	112.9	~110.4	110.2
Aeronautical Res. & Tech.	175.4	43.8	190.1	245.6	302.1	311.6	264.4	'198.5
Subtotal OAST	250.3	63.1	272.1	360.6	416.8	424.5	374.8	308.7
Tracking & Data Acquisition	240.8	63.4	255.0	284.3	312.8	384.7	376.0	374.8
Technology Utilization	7.5	2.0	8.1	10.0	10.0	10.0	10.0	10.0
Energy Technology Applic.	5.9	1.5	6.0	8.5	10.5	5.O	5.0	5.0
Subtotal R&D	2,677.4	700.6	2,761.4	3,092.8	3,141.6	2,857.6	2,374.7	1,970.8
Construction of Facilities	82.1	10.7	118.1	19 5.6	200.O	161.0	125.O	110.0
Research & Program Management	792.3	220.8	813.0	818.5	818.5	818.5	818.5	818.5
Total NASA	3551.8	932.1	3,692.5	4,106.9	4,160.1	3,837.1	3,318.2	2,899.3
Additional Requirement								
Procurement of Fourth and Fifth Shuttle Orbiter				46.5	141.4	213.3	278.4	291.2
Grand Total	3,551.8	932.1	3,692.5	4,153.4	4301.5	4,050.4	3,596.6	3,190.5

National Aeronautics and Space Administration
New Starts in FY 1978 Budget
($Millions)

Research and Development	FY 1978	FY 1979	FY 1980	FY 1981	FY1982	Balance	Total
Space Flight Operations	15.0						15.0
Space Industrialization	15.0						15.0
Physics and Astronomy	36.0	79.4	92.0	95.7	66.8		435.0
Space Telescope	36.0	79.4	92.0	95.7	66.8	65.1	435.0
Lunar and Planetary Exp.	47.8	122.6	139.4	75.3	21.6		406.7
Jupiter Orbiter Probe	20.7	78.7	102.0	61.4	18.9		281.7
Lunar Polar Orbiter	7.1	43.9	37.4	13.9	2.7		105.0
Mars Follow-on	20.0						20.0
Applications	14.0	60.0	72.0	34.0	15.0	18.0	213.0
Landsat D	14.0	60.0	72.0	34.0	15.0	18.0	213.0
Multi-Mission Modular Spacecraft	25.0	40.0	21.0	2.5			88.5
Aeronautics	4.2	10.5	19.6	17.2	5.5		57.0
Lift Cruise Fan Research Aircraft	4.2	10.5	19.6	17.2	5.5		57.0
Expendable Launch Vehicles	.4	17.3	6.5				
Landsat D		11.0	4.9				
Lunar Polar Orbiter	.4	6.3	1.6				
Tracking & Data AcquisitionSupport	2.6	4.9	9.9	7.1	10.2		
Total New Starts	145.0	334.7	360.4	231.8	119.1		

	1975 Actual ($Thousands)	1977 Budget Estimate ($Thousands)
Space Shuttle	797,500	1,288,100
Space Flight Operations	298,800	205,200
Expendable Launch Vehicles	139,500	151,400
Total	1,235,800	1,644,700



and there politically. Inaccurate claims can usually be asserted more quickly than they can be refuted.

Unconvincing arguments tend to weaken the aura of scientific invincibility and suggest a bureaucratic tendency to keep trying a multitude of arguments to weaken people's resistance, or to provide that particular argument which one group can accept. This list is by no means complete.

(1) The "Critical Threshold" Argument

NASA will maintain that funding must be kept at a certain level to preserve the necessary scientific and engineering base in people and facilities.

There is no one threshold, but a series of thresholds depending on the level and the purpose of R & D. The concept itself is suspect: if a base could be created when needed, it can be recreated. The costs of starting it up must be balanced against the costs of an entrenchment process that diverts the government's attention and funds from new problems, or new approaches to old problems.

(2) NASA's Stimulative Effect on the Economy

It is claimed that NASA expenditures are highly labor intensive, have a high multiplier effect, are not inflationary, and return the investment many times over due to the advanced technology involved.

Aside from the fact that these are the findings of studies commissioned by NASA (see following section on vested experts), the point is not how stimulative NASA spending is in absolute terms, but how stimulative it is compared to equivalent spending by some other agency in some other sector, or by different fiscal and monetary policies.

(3) The Level Budget "Commitment" of January 1972

NASA often refers to OMB assurances that it would have a funding floor in constant dollars to build the shuttle. Actually the "commitment" was made by NASA, not by OMB. The political process does not permit long-term commitments to controversial programs, yet claims of a "commitment" are still heard.

(4) The "Cutting Edge" of Technology

In simplest form this argument holds that what makes America preeminent is advanced technology, and that we depend on it for our defense and foreign exchange earnings. The "cutting edge" is never far from nuclear energy and the aerospace industry, and in these areas the high quality of research brings the highest return on our R & D dollars.

This argument confuses the value of R & D with subjective judgments on the value of different types of R & D. The issue should not be whether aircraft sales are a major earner of foreign exchange, but whether some other industry would have produced greater social and economic benefits if an equivalent amount had been invested in it. As to quality of research, talent follows money.

Our military and space efforts might well benefit from cheaper, more numerous and more expendable units. See Annex D,

(5) Individual Science Programs Vital

This tactic is to evaluate individual science programs in isolation from basic research policy. The stress is on the worthy objective and not on whether the program is cost effective, or whether data are related to results from recent or concurrent programs, or whether technology offers the possibility of leap-frogging to a more advanced stage.

The Space Telescope is a case in point. If observations are vastly improved outside the earth's atmosphere, why have observatories been built or upgraded recently in Chile, Mexico, Hawaii, Puerto Rico, and Arizona? Is there duplication from military space programs?

(6) National Security, or A Race with the Russians

The space club is not averse to taking a page out of DOD's book. When pressed, NASA will disclaim competition, but say the Russians are ahead.

DR. FLETCHER. We don't regard ourselves as being in a race with the Soviet Union. We do feel that we cannot fall too far behind in technology.

Some proponents will say that NASA programs have profound security implications. These claims suggest that DOD does not recognize certain defense needs, or that NASA should pay for a certain part of national defense.

(7) International Prestige

Akin to national defense is the notion that to keep our political and cultural values in high esteem, here and abroad, we must periodically give a display of technological virtuosity. Perhaps a winning team in sports or technology helps Americans feel less threatened by foreign developments beyond our control. We transfer vigor and Number 1 status in a particular field, to the nation as a whole. Selling international prestige on this basis panders to people's insecurities.

(8) The Call of Adventure

Adventure covers a variety of appeals to our emotions and imaginations.

– Vicarious space travel: e.g. the Shuttle will have hygienic facilities for both men and women and that "average" people—non-astronauts—will be placed in orbit, to obtain the "liberating perspectives" of space

– Creativity: e.g. the space program fills the same human need as cathedral-building in the Middle Ages.

– An Alternative to War: e.g. World War I might have been avoided if European nations could have vented their aggressiveness on space operations rather than armaments.

– A New Start for Mankind: e.g. artists' conceptions of space colonies, space factories.

– America's Destiny: e.g. the United States is the only country on this planet that can answer the riddle of man.

– Spectator Sport: e.g. Astronauts—technological sports figures—may do more to heighten this sense of adventure than to justify the added expense of manned over un-manned space missions. Perhaps they can be likened to a strong football team, that provides the gate receipts to support other athletic programs.

As with the international prestige appeal, there is a touch of "Madison Avenue" to this—space is more than R & D—it is patriotism, "gee-whiz" technology, entertainment, creativity, our national destiny. But the very success of these appeals to our emotions and imaginations shows that welfare and security are not the total of human aspiration. We enter a decision-making area full of risk for public policy which imposes certain responsibilities on government officials. Programs funded emotionally often lead to waste, empty psychological gratifications, and inflation. Ancient and recent history offer examples of peoples who have asserted their values and spirit in unprecedented, uneconomic programs that drained them, sometimes fatally, of their vitality and resources. The display of power was as important as the end it was put to. See Annex, Shuttle Justifications, 2g.

But non-economic or "irrational" motivations do exist, and they carry the potential for great creativity as well as great waste. Adventurous social programs and R & D programs have given us new knowledge, new powers and perhaps a new identity. Thus it is essential to argue over what kind of adventure we are getting into, and the costs. This is almost impossible when budget requests are made entirely on economic grounds, and the appeal to non-economic motivations is under the table. (See Recommendations.)

(9) Fait Accompli Statement

"The debate over manned vs. unmanned space flight was settled by the decision to build the Shuttle." This ploy can be used for most programs. It was a favorite for continuing the Vietnam war.

d. **Expert vs. Popular Opinion**

Related to the consensus of scientists and engineers with regard to budget requests is the absence of an outside vantage point that the layman could turn to for a professional but fresh perspective. The problem goes beyond the natural similarity of viewpoint of persons in the same field. As then Senator Mondale asked on May 9, 1972:

How can Congress and the public approve massive spending on new technology programs without the benefit of independent evaluations of such programs?

NASA's contractors are not likely to offer opinions which have not been checked with NASA. At times estimates suggest a form of blackmail:

NASA said that if the expendable alternate were selected, a further analysis might increase the development cost of the new expendable (launch vehicles) by about 1 billion dollars.[1]

On the one hand there must be a taxpayer counterweight to vested expert opinion. On the other hand there must be disinterested expert opinion to dampen public enthusiasm for space programs based on psychic gratifications rather than economic or scientific returns. Those who find entertainment or the solution to war in space may ultimately push space expenditures higher than space scientists and engineers. The object of both counterweights is to use national resources wisely.

4. Recommendations

a. **Outline National Goals—for example—**

(1) The President's Economic Goals:
- 4 1/2% unemployment by 1981
- inflation under x%
- a balanced budget, amounting to 21% of GNP
- a relatively favorable balance of trade

(2) Defense Against Military Threat
(3) Pollution at Acceptable Levels
(4) International Collaboration, Project Humanitarian Values
(5) Scientific Discovery
(6) A program to Express National Values and Energy (?)

b. **Outline Corresponding Space Programs—for example—**

(1) Defense Satellites
(2) Scientific Probes, Experiments
(3) Economic Application Satellites (crop and weather forecasting, resource management)
(4) Pollution Detection Devices
(5) Public Service Satellites (education, search and rescue)
(6) Solar Energy Platform
(7) Reimbursable Projects (communications satellites, space manufacturing)
(8) International Cooperative Ventures (To train foreign scientists, share information, share the expense, use and seek superior talent.) To make these ventures effective the U.S. should avoid paternalism, or the notion that our resources give us a Manifest Destiny in space.

[1] Note that there is no comparison of *total* development costs of expendable and reusable launch systems.

(9) Experimental Civilian R & D Develop technology that applies to the way people live now, in this country and abroad.
See Annex D, NASA's R & D Direction.

c. **Accurate Labelling**

Avoid the scientific mystique. Justify programs in terms of all other activity being carried out to achieve the same broad objective. Set forth all the arguments used to support the program, strong or weak, point by point, if the program is based partly on non-economic considerations, such as curiosity or adventure, make that part of the appeal explicit, so that the rest of us can recognize the trade-offs and judge for ourselves whether the adventure will strengthen or weaken us in the long run.

d. **Downgrade Economic Objectives**

Economic stimulation should take a back seat when R & D programs are funded, because these programs invest in personnel and facilities that are far more specialized and influential, and multiply more rapidly, than the constituencies of non-R & D programs. Multiplying the supply of program administrators multiplies the demand for more of the same. This skews the economy more than it stimulates it. See Annex D, NASA's R & D Direction, Constituencies.

e. **Curb Budget Expansion**

Through Executive Order establish an obstacle course of hearings, studies and consultations for budget increases over, say, 5%. Once a benchmark budget has been set, vary the size of the slices, not the pie.... When priorities change, resources must be shifted, not added on. Scientists and engineers should be encouraged to blunt their spears on each other rather than the Administration.

f. **Use a Science/R&D Jury to Recommend R & D Priorities to the President**

Appoint a Science/R&D Council, headed by the Vice President, made up of distinguished laymen, to recommend allocation of R & D funding as to function and agency....

This Council would not resemble the President's new Committee on Science and Technology. It would present the president with a proposed R & D budget. Its members would represent labor, business, education, consumers, the press and other sectors without being weighted 2 to 1 in favor of engineers, scientists and bureaucrats. The members would serve full-time, for a year, without staff.

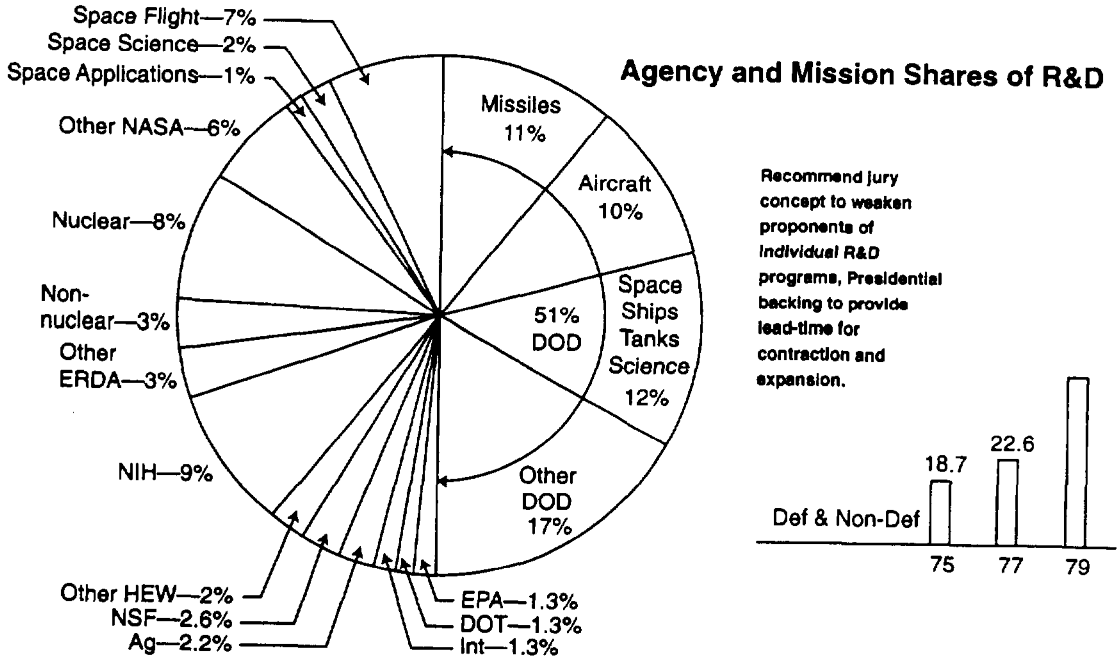
The Council would hear expert testimony from scientists, engineers, and those most knowledgeable about R & D. Its recommended budget would include military as well as civilian R & D in the space field, for example, the members would have security clearances adequate to allow them to try to fund military and space programs from the same "pie," minimizing duplication and maximizing multiple missions.

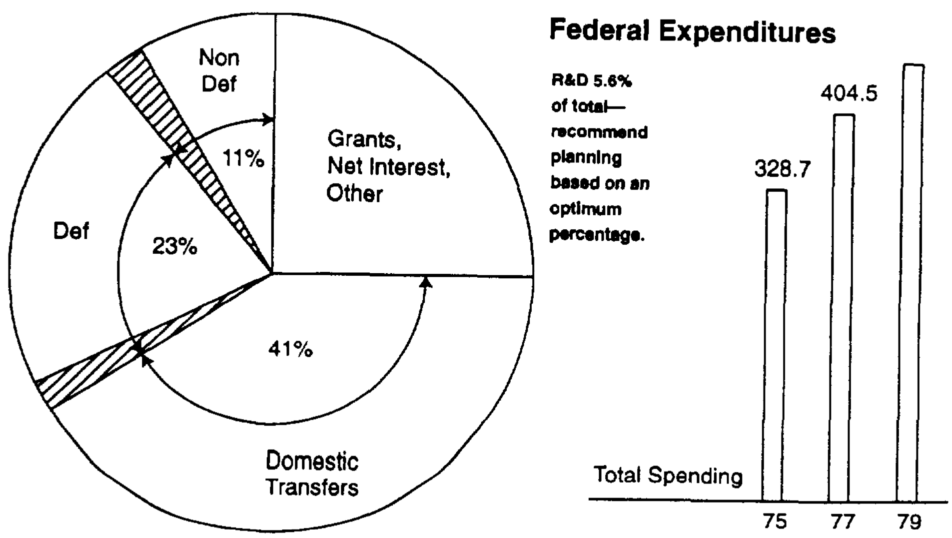
Discussion:

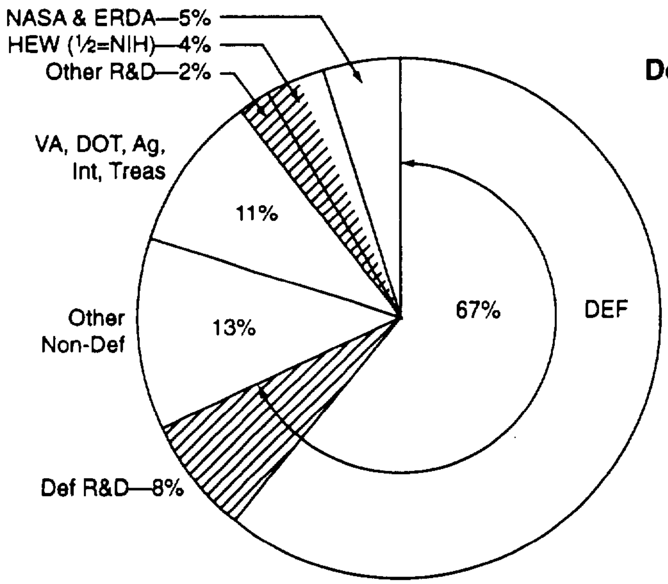
In seeking impartiality for decision-makers it would seem logical to assign laymen to determine *the over-all size* of the Science/R&D budget, and scientists and engineers to decide *how the R & D pie will be divided.* But more impartiality can be achieved by reversing the roles.

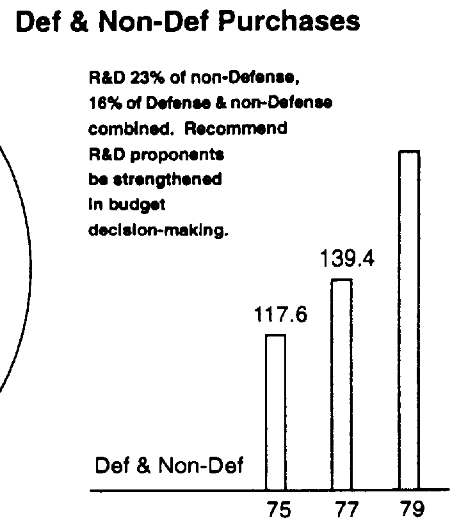
At the level of deciding between the nation's R & D and other non-defense goods and services (assuming this model is accepted, laymen are not disinterested, and may be too shortsighted to see the value of R & D, whereas the parochialism of scientific and engineering opinion would be less at the overall R & D level than at the level of funding individual R & D programs. At the program level, experts seek national commitments to their own programs, thus tending to jack up overall R & D on political considerations. Expert opinion at the *overall* R & D level, however, might dampen this effect. A compromise would be to set R & D within a narrow percentage range of general spending (not GNP).

R & D priorities are as political as they are scientific. A full debate is necessary. Without it we will be less likely to achieve mid-range budgetary stability and more importantly the lead-time necessary for contractors and scientists to prepare themselves for new problems and priorities.


Agency and Mission Shares of R&D
Space Flight—7%
Space Science—2%
Space Applications—1%
Other NASA—6%
Nuclear—8%
Non-nuclear—3%
Other ERDA—3%
NIH—9%
Other HEW—2%
NSF—2.6%
Ag—2.2%
EPA—1.3%
DOT—1.3%
Int—1.3%
Missiles 11%
Aircraft 10%
Space Ships Tanks Science 12%
51% DOD
Other DOD 17%
Recommend jury concept to weaken proponents of individual R&D programs, Presidential backing to provide lead-time for contraction and expansion.
Def & Non-Def
18.7
22.6
75
77
79


Federal Expenditures
Non Def
11%
Grants, Net Interest, Other
Def
23%
41%
Domestic Transfers
R&D 5.6% of total—recommend planning based on an optimum percentage.
Total Spending
328.7
404.5
75
77
79





g. **Enforce ONE Circular A-109; Decentralize**

Depending on how one defines a need, circular A-109 could have prevented the Shuttle controversy. The circular states:

"When analysis of an agency's mission shows that a need for a new major system exists, such a need should not be defined in equipment terms, but should be defined in terms of the mission, purpose, capability, agency components involved, schedule and cost objectives, and operating constraints."

The present arrangement allows Space Flight to turn to Space Science and Space Applications and say "Here is your equipment, the Shuttle. Make use of it." Manned Space Flight will then find a new project. When it can no longer carry the expense of the Spacelab, or Space Industrialization, it will turn these half-started programs over to Science or Applications, the offices which should have controlled R & D from the beginning.

To take mission-orientation further, overhead could be funded out of the end-result offices (Science, Applications, and OAST). The NASA Comptroller would be split in three, and those three offices would draw up budget requests for C of F and R & PM. Facilities would bill those 3 offices for services rendered. (OMB and the GAO would have to ensure that billings represent the full cost of government facilities and personnel.) In effect all work would be contracted out, to either private or government contractors, whichever program management preferred.

Some of the advantages of decentralized budgeting are the following:

- it would weaken the agency's hierarchy, its institutional values, its growth as a bureaucracy.
- it would force economies on laboratories and facilities of marginal usefulness.
- it would increase the practical applications of independent (unstructured) R & D.
- it would make programs available to facilities, and facilities available to programs, across the board. Facilities and laboratories affected would be subject to a wider range of ideas and work opportunities.
- it would require ways of making the Civil Service more responsive to public needs.

h. **Reorient NASA Leadership**

Section 203 (b) (2) of the 1958 Aeronautics and Space Act allows the ASH Administrator to hire up to 425 executives, and set their salaries to the top Civil Service grades. This high number of excepted positions tends to unify top management. Unity is more beneficial to the implementation of policy than to the formation of it.

This system naturally lends itself to the notion of a network, and a perception that when RIFs come the Civil Service takes a disproportionate share. The system may also be related to NASA's poor Equal Employment Opportunity (EEO) record, discussed in Annex E.

Disturbing also is the number of former military personnel and former NASA contractors within the excepted positions. They cannot help but affect relations between NASA, Defense, and industry, and the kinds of work that NASA undertakes. Likewise a survey should be made of where NASA scientists have done their work. There may be a certain parochialism among the prestige institutions. This too may affect the kinds of work NASA does, who does it, and where.

If the thrust of this memorandum is followed, a new Administrator will have to come from outside the space club. He or she will have to be willing and able to use his authority to remove NASA veterans from excepted positions, and replace them with younger professionals. The purpose of these changes would be:

- to make NASA's personnel system more responsive to need, not less.
- implement the spirit of EEO.
- offset the steady increase in the average age of NASA employees.
- encourage disciplined dissent.

i. **Postpone the Appointment of a Science Adviser (OSTP) and a NASA Administrator Until These Issues Nave Been Discussed**

Do not approve new starts at NASA until the budget decision-making has been studied. Do not be rushed. If an attempt is made to challenge the experts who choose our options, appoint science and R & D officials who will support the new approach and make it work.

5. Options

The three options listed probably bear little relation to OMB options, which reflect expert opinion. My options suggest that we explore new directions for R & D, that we not commit ourselves to Shuttle operations, regardless of "cost-effectiveness," and that we give laymen a share in setting R & D priorities. To sum up, the options are based on keeping control of the agency.[2]

The options also reflect a bias toward Space Applications. Admittedly there are no options as to how Applications could use additional resources, but current NASA emphasis suggests that money (and talent) thrown at this area could bring significant results.

Option 1 - Appoint "jury" to recommend all R & D program priorities.

Budget effect - Unlikely to change level of space funding, but might favor Applications over Flight and Science.

Discussion

OMB states that R & D funding "is not a separately program[m]ed or budgeted activity of the Federal Government. Its funding must therefore be considered primarily in light of the potential contributions of science and technology to meeting agency or national goals and not as an end in itself."

Realizing that "therefore" belongs to the first sentence, not the second, the crucial point is that agency or national goals are slurred together. There is often a time-lag between *agency goals* and new perceptions of how *national goals* can be achieved. Since R & D needs more lead-time it is important that agency R & D decisions be subject to modification by a group with a totally national perspective.

[2] OMB may not see this as a problem. In discussing NASA's FY 1979 budget request, an OMB report states: "Substantial flexibility exists for reducing future year funding based on long-range policy and budget decisions in future budgets"—as if a program's constituency did not grow and gain a wider hearing, as if our investment does not bind us tighter to a program, with each passing year

Advantages
1. Less overlap between military and civilian space programs.
2. Build broader consensus for longer-range planning, more lead-time for contractors.
3. A form of Executive oversight over Defense R & D.
4. More attention to national goals than agency goals.

Disadvantages
1. "Jury" unqualified to grasp issues involved.

2. "Jury" will become the captive of a particular R & D faction.

Option 2 - Build only three Shuttles. Use Shuttle for R & D and as required by individual missions.

Budget effect - Gradual reduction instead of sharp increase in Shuttle expenditure. FY 1978 is build-up year.

Discussion

Using the Shuttle as an R & D program for launch and payload reusability, while improving expendable systems, will provide greater flexibility. Some resources can be shifted to Space Applications. Publicize DOD distrust, and Mondale, Proxmire and GAO objections. OMB notes "widely divergent views."

Advantages
1. Change the big-program legacy of NASA; redirect R & D from "producers" to "consumers."
2. Take advantage of new broom; use press and public concern over inflation and bureaucracy.
3. Decision to put "Carter imprint" on Applications, give shuttle contractors an advantage in seeking Applications contracts.
4. Catch up in expendable vehicle technology, building Fords instead of Cadillacs.
5. More Science and Applications value per dollar spent, less drama.

Disadvantages
1. Political repercussions from areas surrounding affected facilities.

2. Wide currency of "cost-effectiveness" argument.

Option 3 - Expand the NASA charter to provide limited funding for specified technological breakthroughs.

Budget Effect - None.

Discussion

NASA coordinates with other agencies, industry and academia. It has capabilities in energy research, materials development, and across the spectrum of advanced technology. It put a man on the moon. It thinks more about the future than other agencies.

Why not challenge NASA to find technological breakthroughs to problems here on earth? NASA would serve as a gadfly, to weaken monopolization of R & D fields by other agencies. Congress and NASA would draw up a list of problems most susceptible to new technology, and NASA would in effect bid for a contract. New automobiles, insulation, and housing modules come to mind. See Annex U, NASA's R & D Direction, section 3.

Advantages	Disadvantages
1. Encourage new interdisciplinary approaches to old problems....	1. Maintain unneeded personnel and facilities on harebrained schemes.

Document III-34

Document title: Presidential Directive/NSC-37, "National Space Policy," May 11, 1978.

Source: NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

This directive resulted from a comprehensive review of U.S. space policy and programs undertaken during the early months of the Carter administration. It dealt primarily with the relationships among the civilian and national security portions of the national space program; its policy guidance with respect to the national security aspects of the effort was highly classified. The review was carried out under the auspices of the National Security Council, and it established a National Security Council Policy Review Committee chaired by the Director of the White House Office of Science and Technology Policy, Frank Press, as the mechanism for space policy formulation.

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[1]

Presidential Directive/NSC-37

May 11, 1978

This directive establishes national policies which shall guide the conduct of United States activities in and related to the space programs and activities discussed below. The objectives of these policies are (1) to advance the interests of the United States through the exploration and use of space and (2) to cooperate with other nations in maintaining the freedom of space for all activities which enhance the security and welfare of mankind.

1. The United States space program shall be conducted in accordance with the following basic principles.

[2] a. [paragraph deleted during declassification review]

b. The exploration and use of outer space in support of the national well-being and policies of the United States.

c. Rejection of any claims to sovereignty over outer space or over celestial bodies, or any portion thereof, and rejection of any limitations on the fundamental right to acquire data from space.

d. The space systems of any nation are national property and have the right of passage through and operations in space without interference. Purposeful interference with operational space systems shall be viewed as an infringement upon sovereign rights.

e. The United States will pursue Activities in space in support of its right of self-defense.

f. [paragraph deleted during declassification review]

g. The United States will pursue space activities to increase scientific knowledge, develop useful civil applications of space technology, and maintain United States leadership in space.

NASA SP-4407

EXPLORING THE UNKNOWN

Selected Documents in the History of the U.S. Civil Space Program Volume I: Organizing for Exploration

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Ray A. Williamson, and Dwayne A. Day

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