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TRANSITION PLANNING GROUP

P.O. Box 2600
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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.

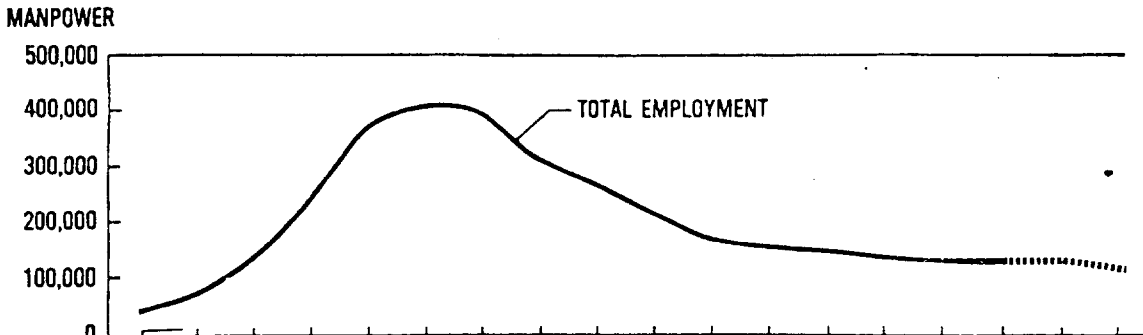
~~NASA At A Glance~~

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.

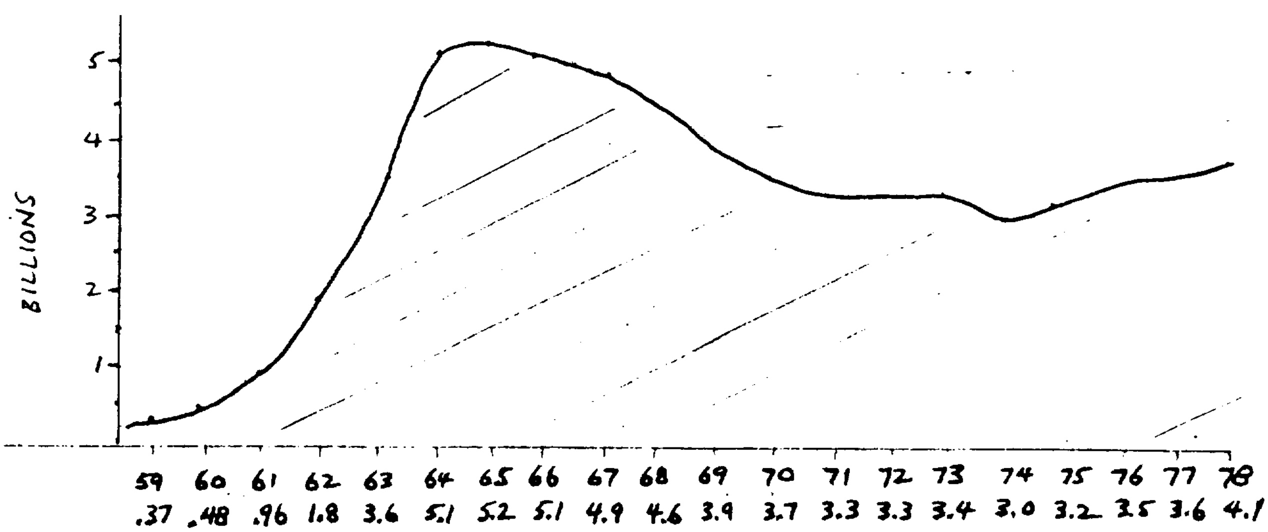


	JUNE 1960	JUNE 1961	JUNE 1962	JUNE 1963	JUNE 1964	JUNE 1965	JUNE 1966	JUNE 1967	JUNE 1968	JUNE 1969	JUNE 1970	JUNE 1971	JUNE 1972	JUNE 1973	JUNE 1974	JUNE 1975	JUNE 1976	SEPT 1977
TOTAL EMPLOYMENT	48.786	74.577	137.656	246.304	379.084	409.900	393.924	306.926	267.871	218.345	167.803	149.609	144.968	134.055	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	188.600	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



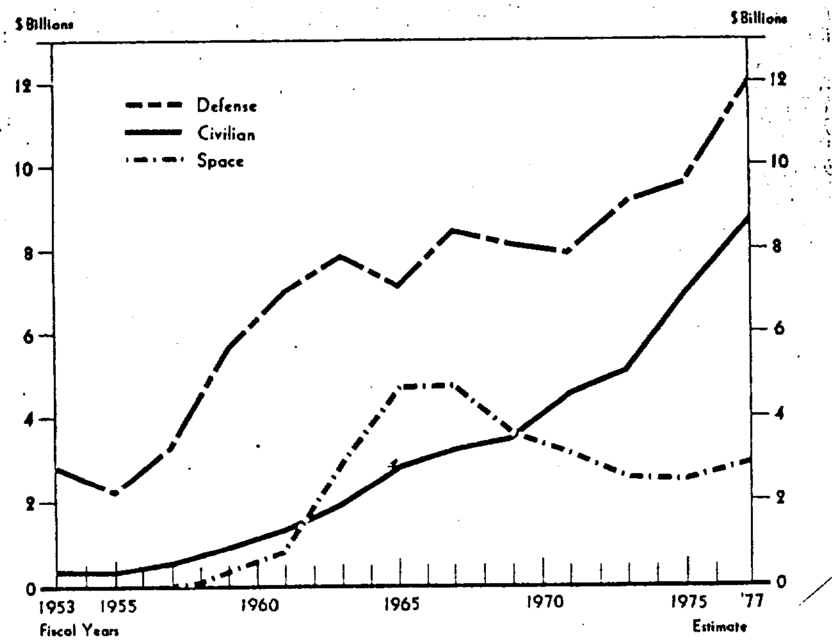
The shaded area above represents about $70 billion.
The U.S. Interstate Highway System has cost about $60 billion.

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.

Conduct of Research and Development — Obligations

P-1



2. Current Programs

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

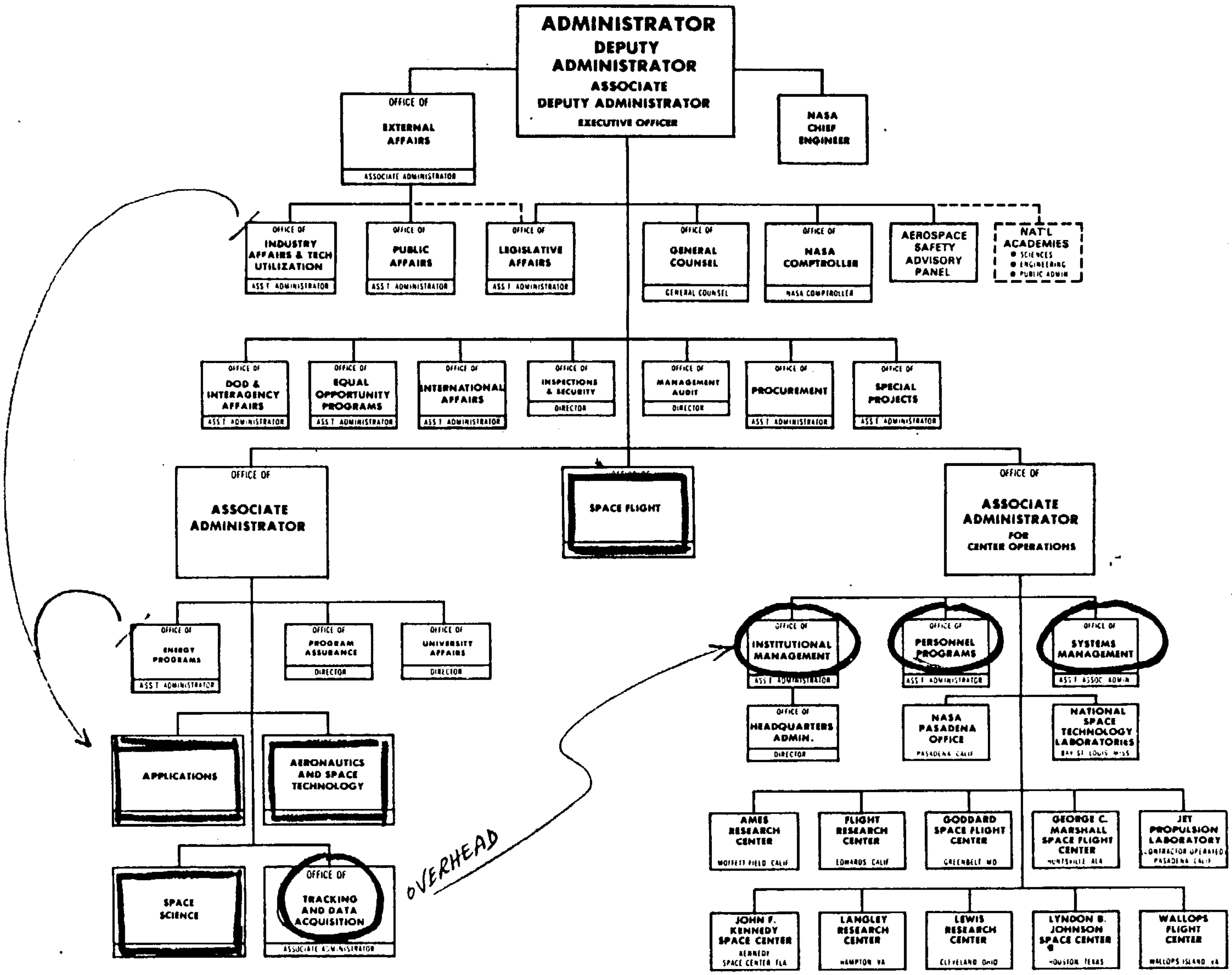
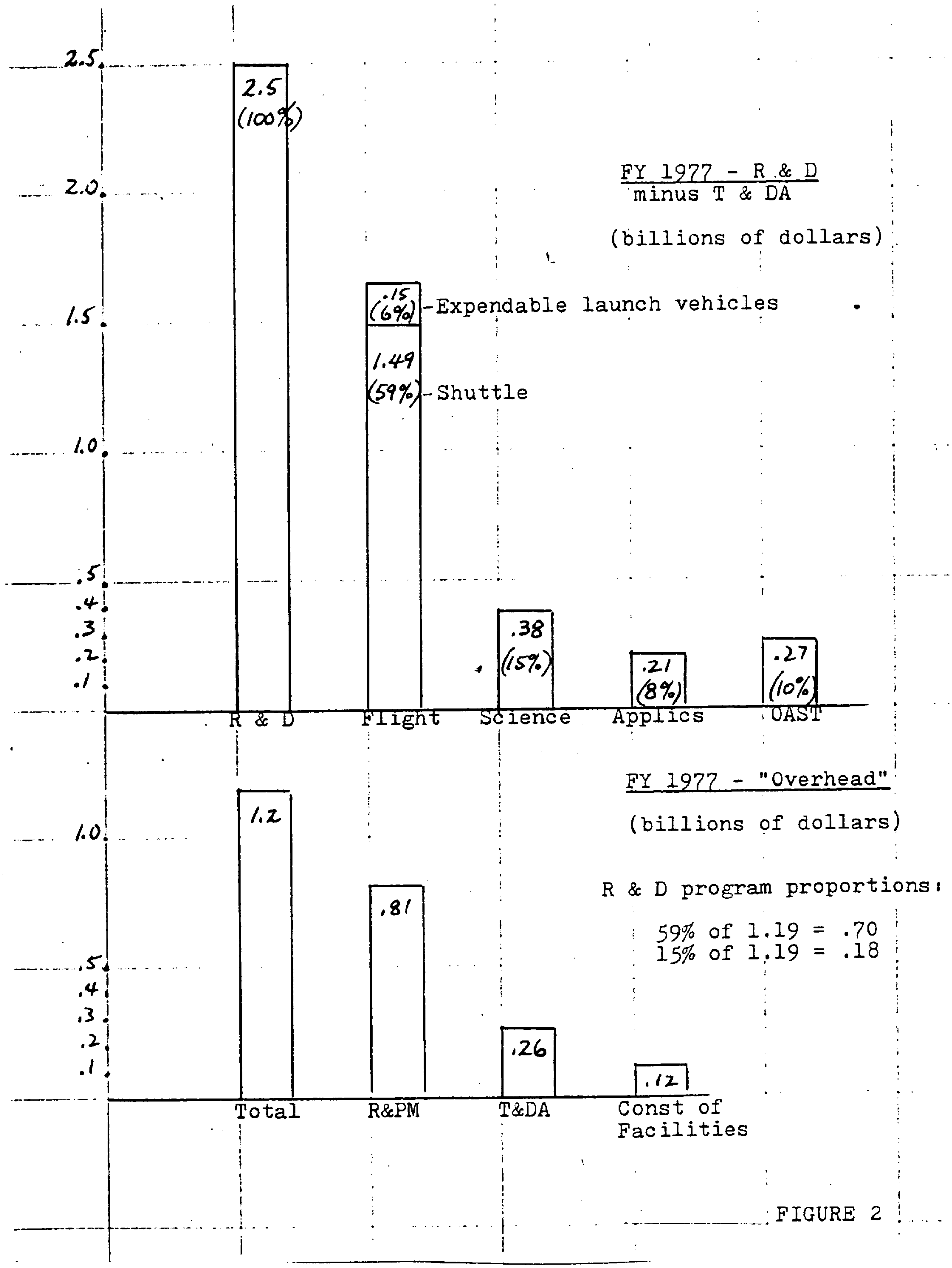


FIGURE 1



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

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
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
(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
(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
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

store the moon rocks

39.5 millio
Shuttle

4.3 millio
Shuttle

35.5 millio
Miscellaneous

Figure 3

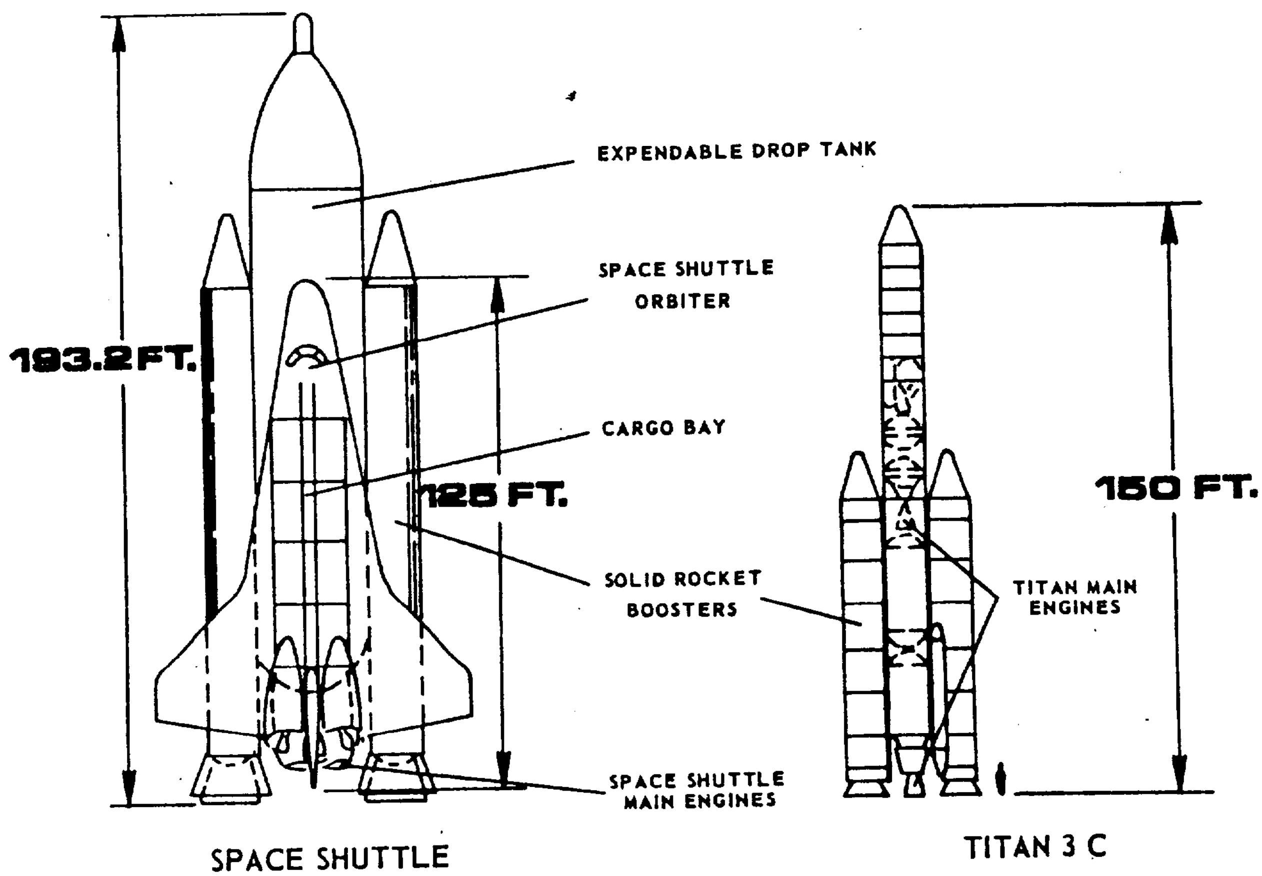
c. The Shuttle, or "Space Transportation System"

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

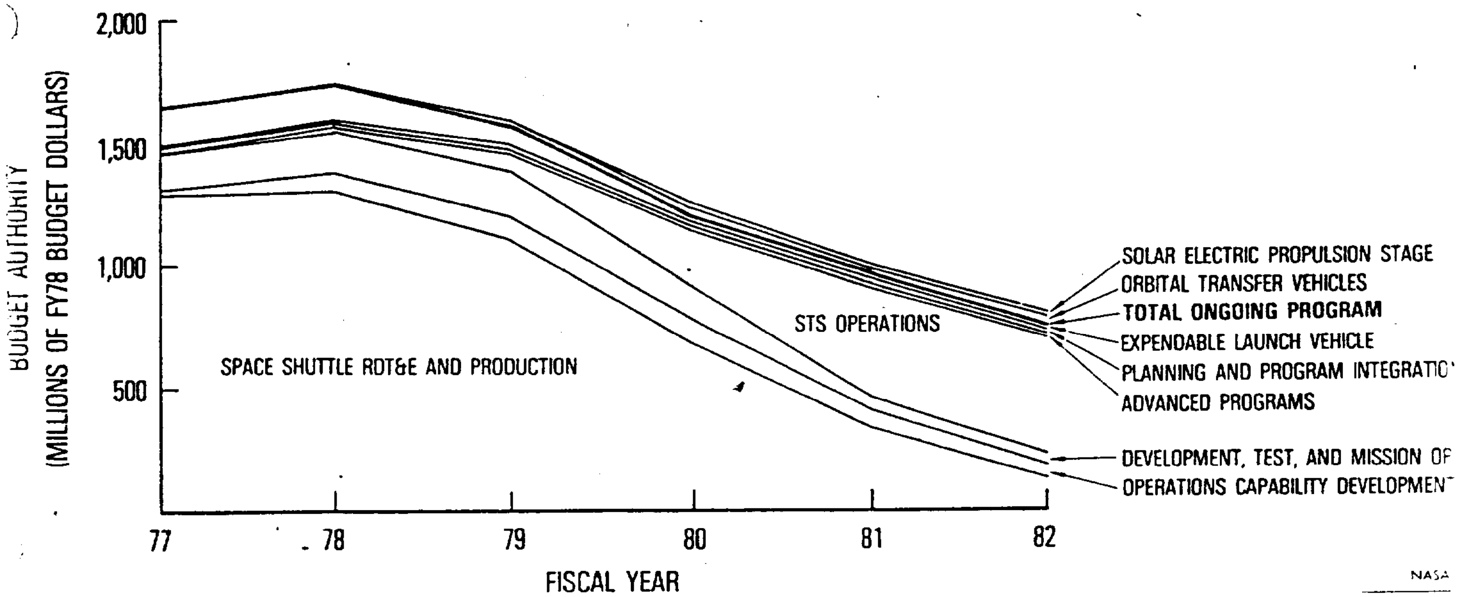
National Aeronautics and Space Administration

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

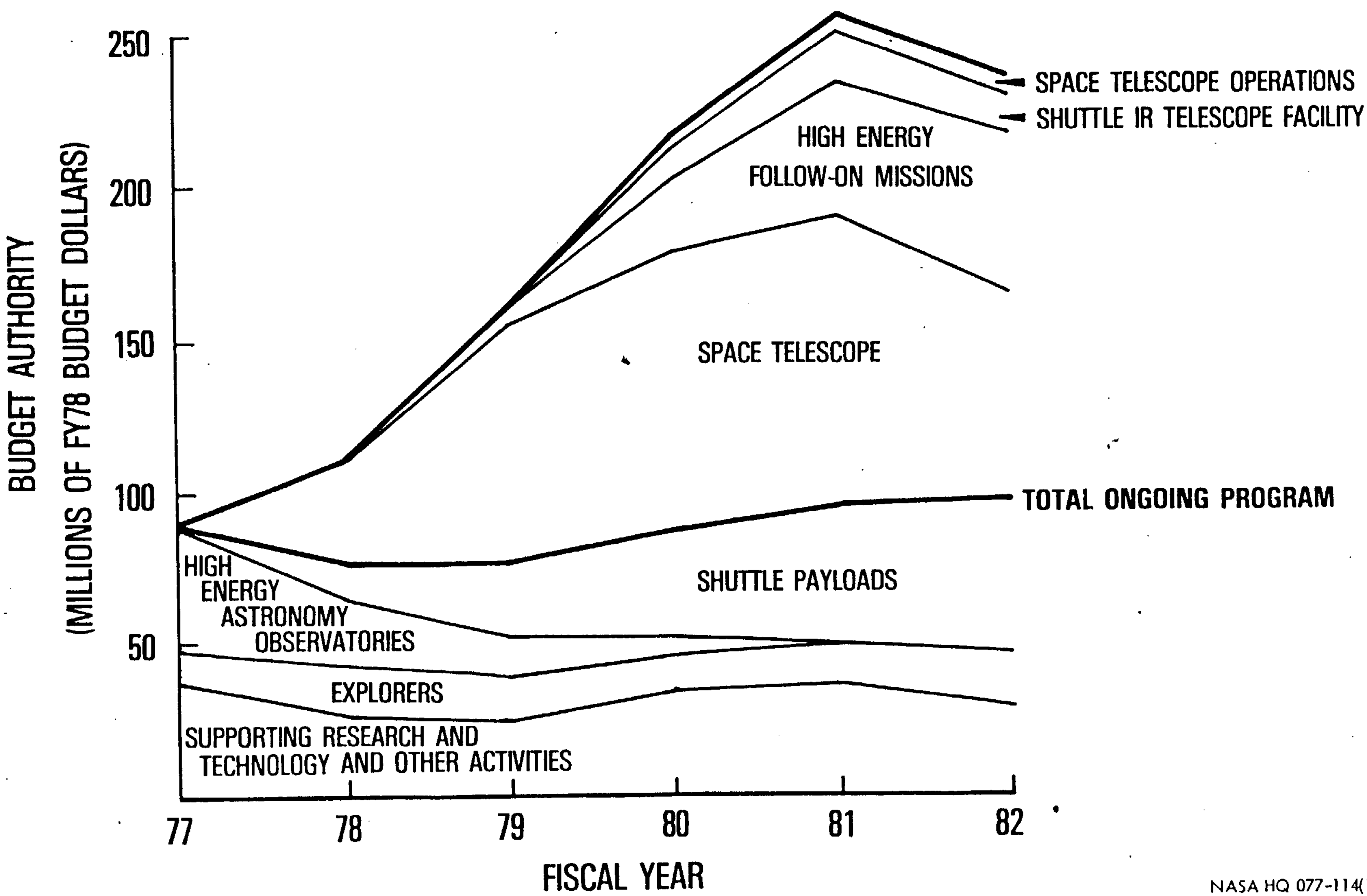


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FIGURE 7. SOLAR TERRESTRIAL PROGRAM FUNDING

(ASTROPHYSICS)

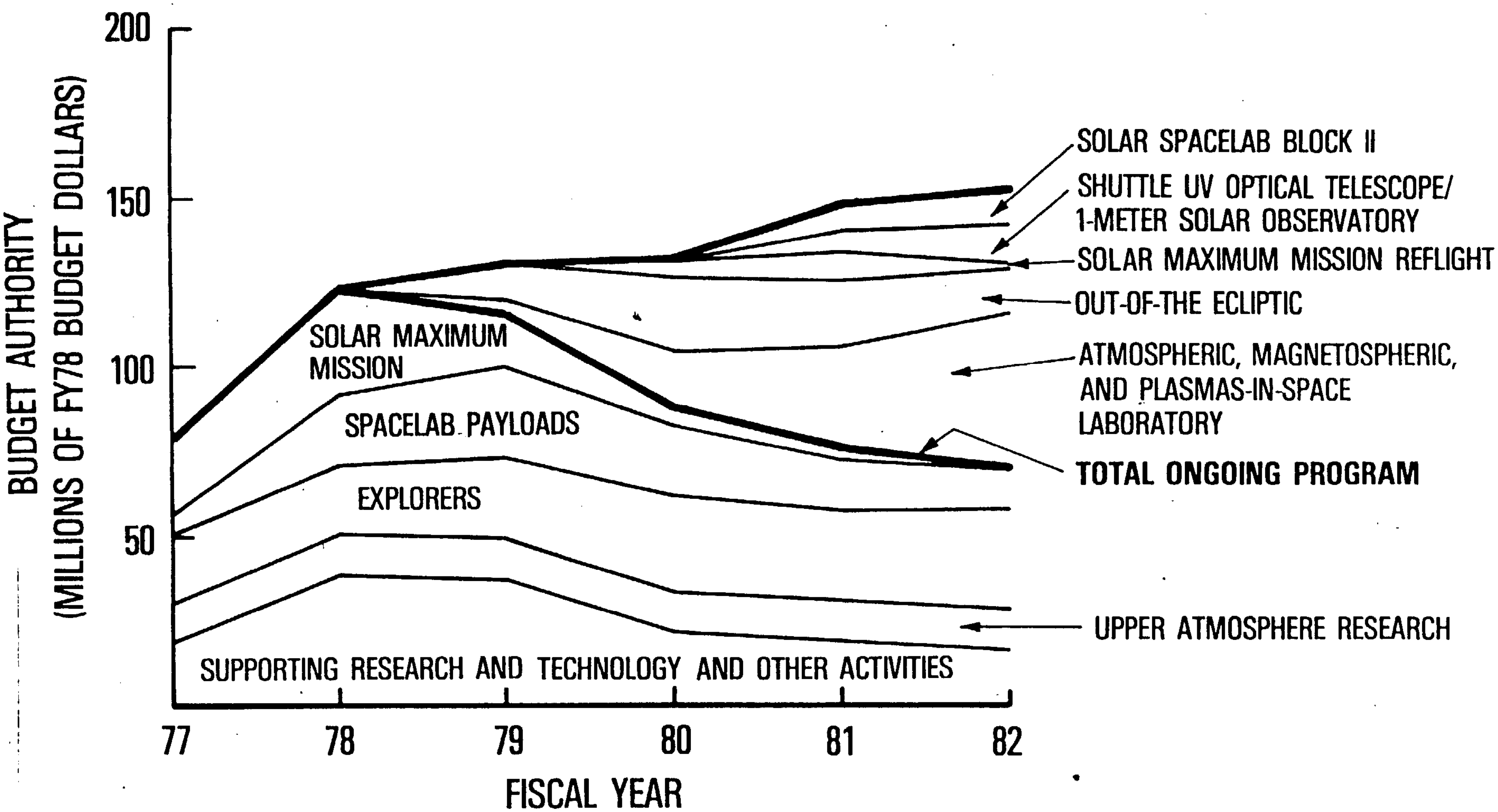
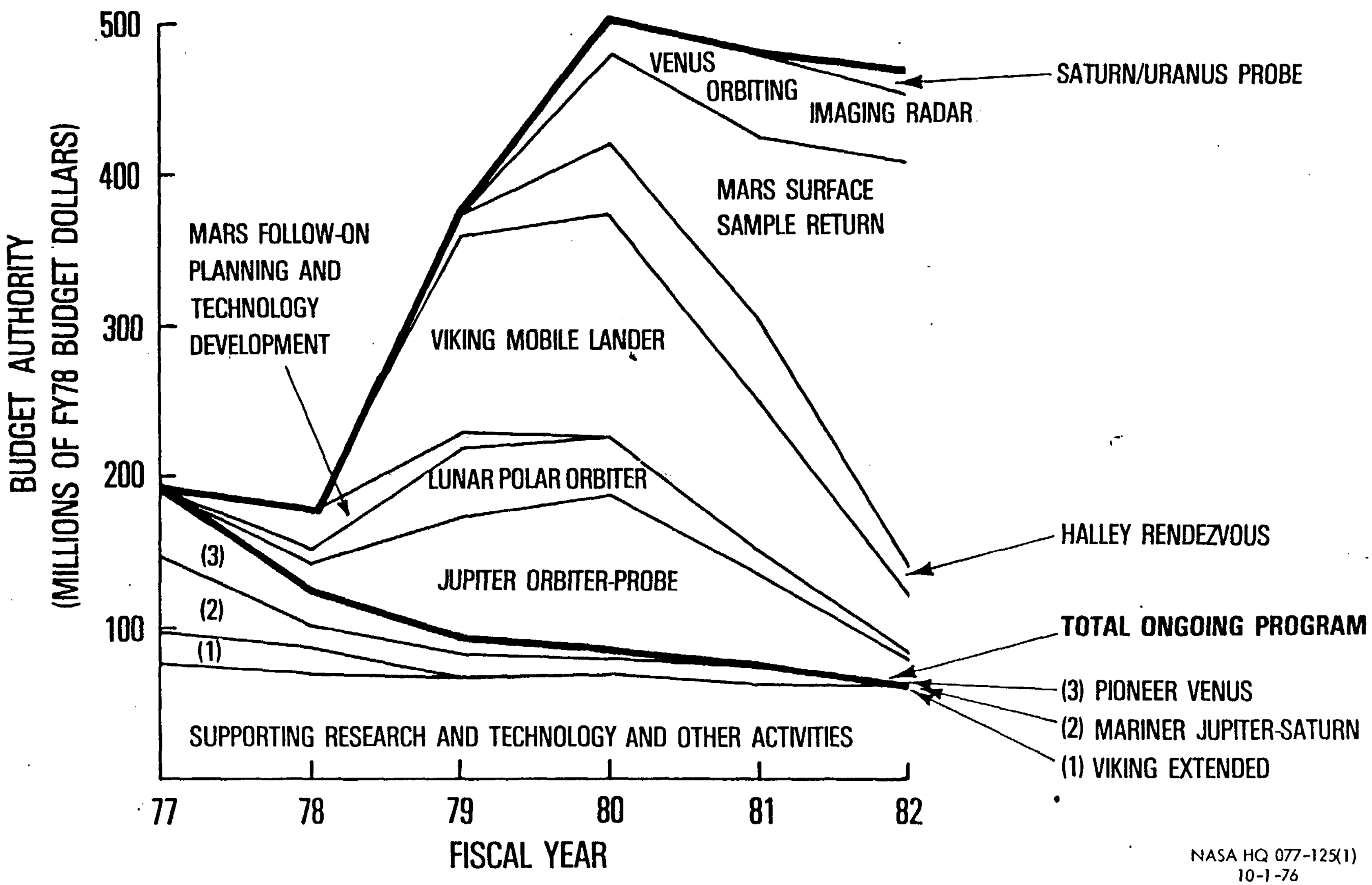


FIGURE 8. LUNAR AND PLANETARY PROGRAM FUNDING



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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.

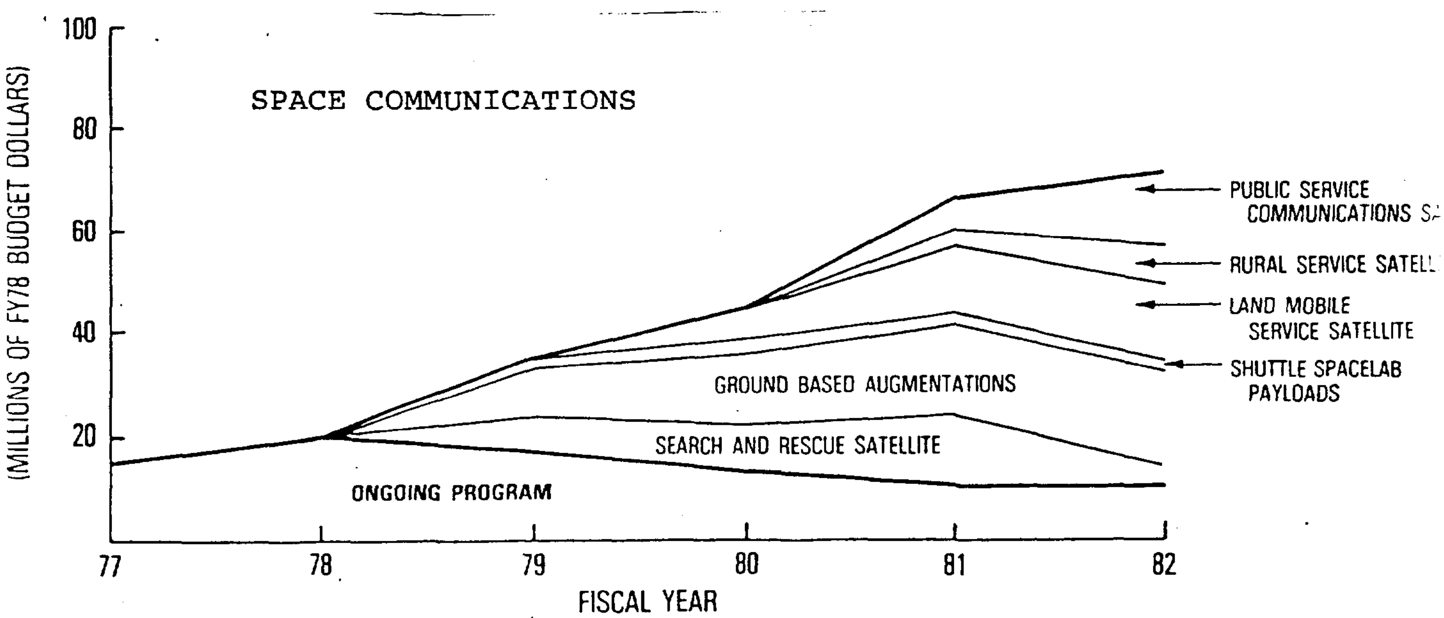
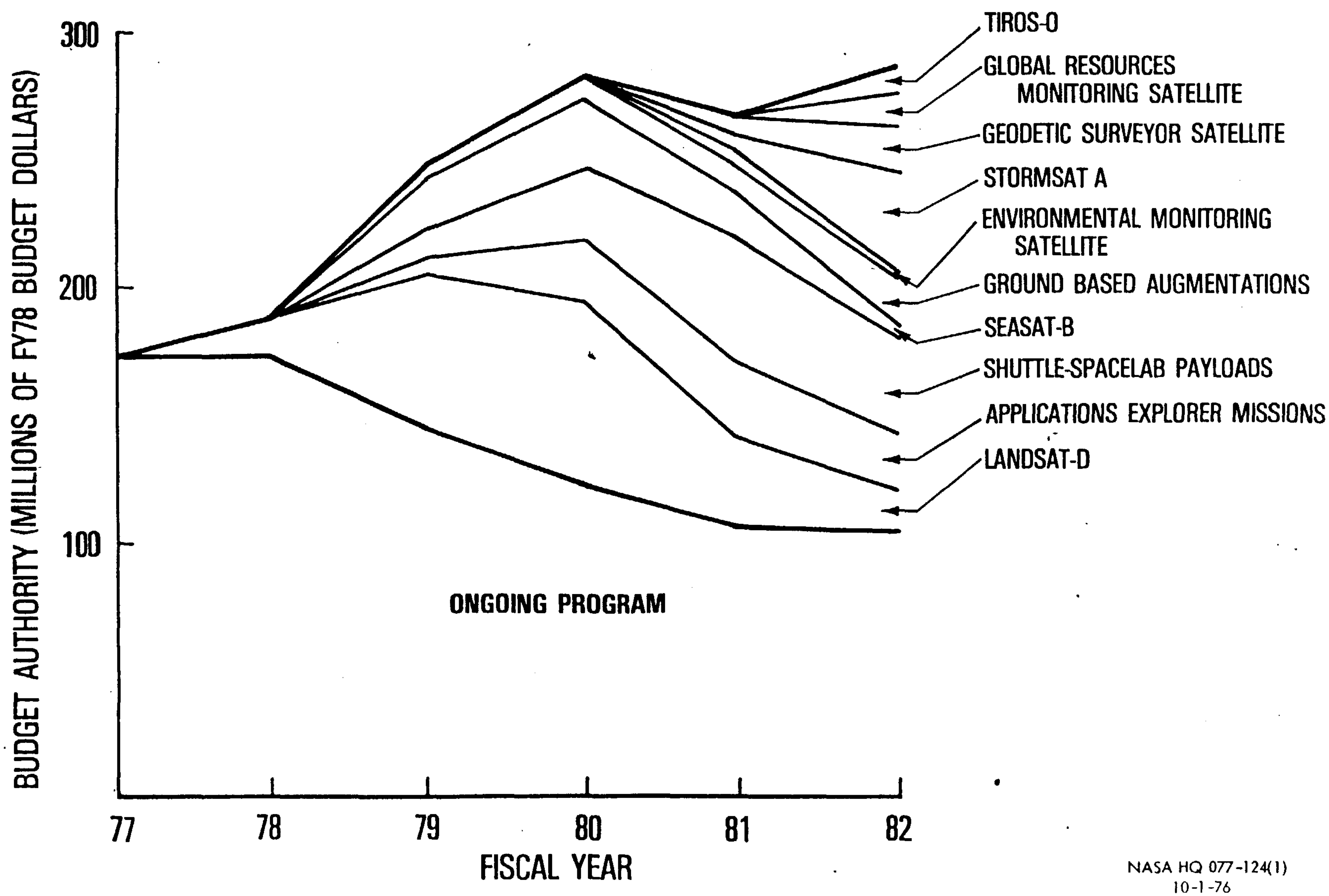


FIGURE 9. GLOBAL RESOURCES AND ENVIRONMENTAL INFORMATION PROGRAM FUNDING



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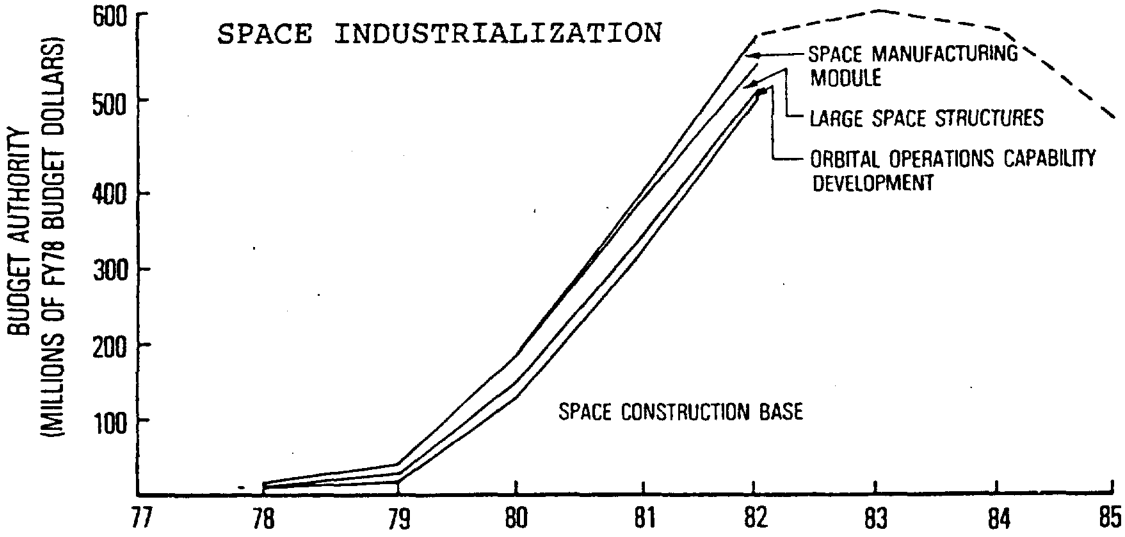
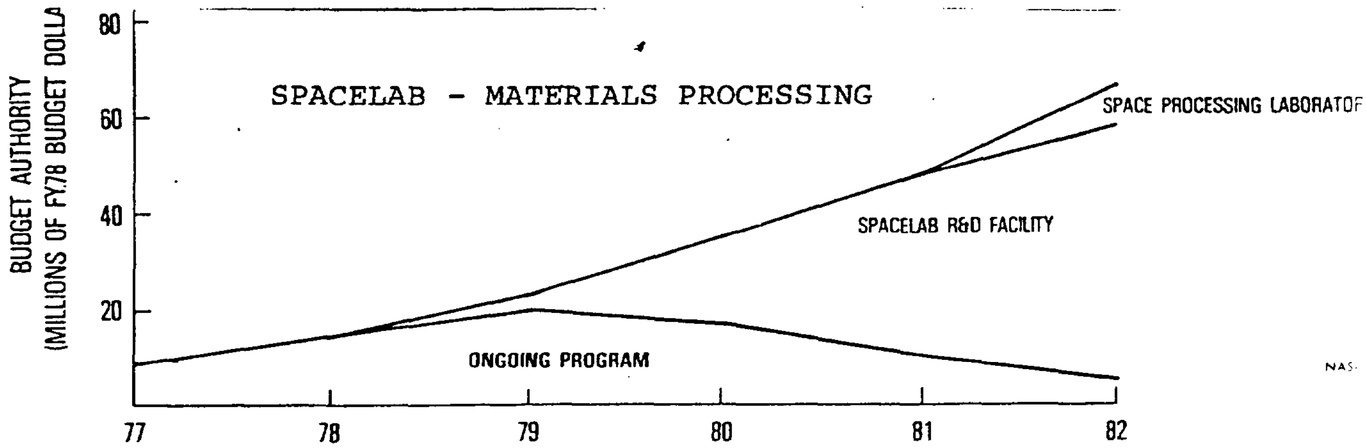
(4) Shuttle-dependent Applications

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.





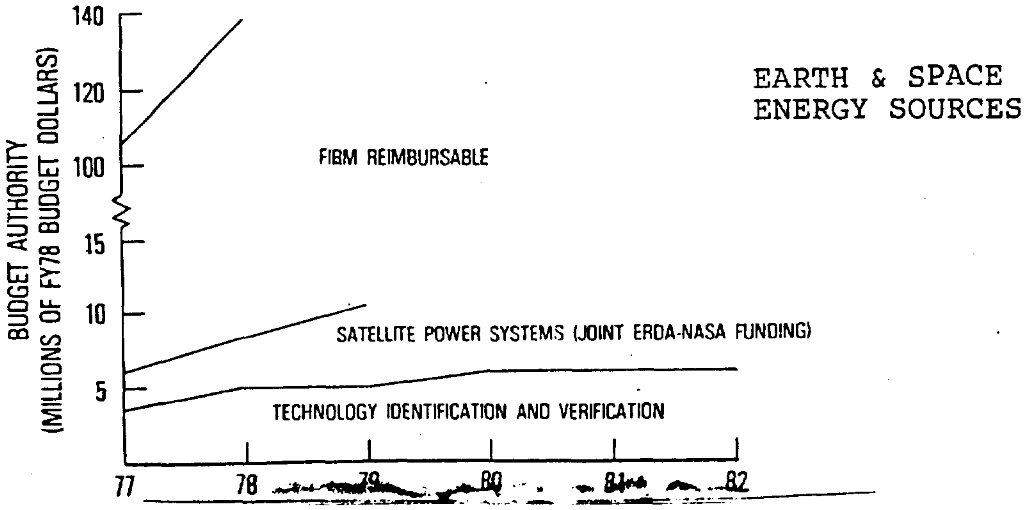
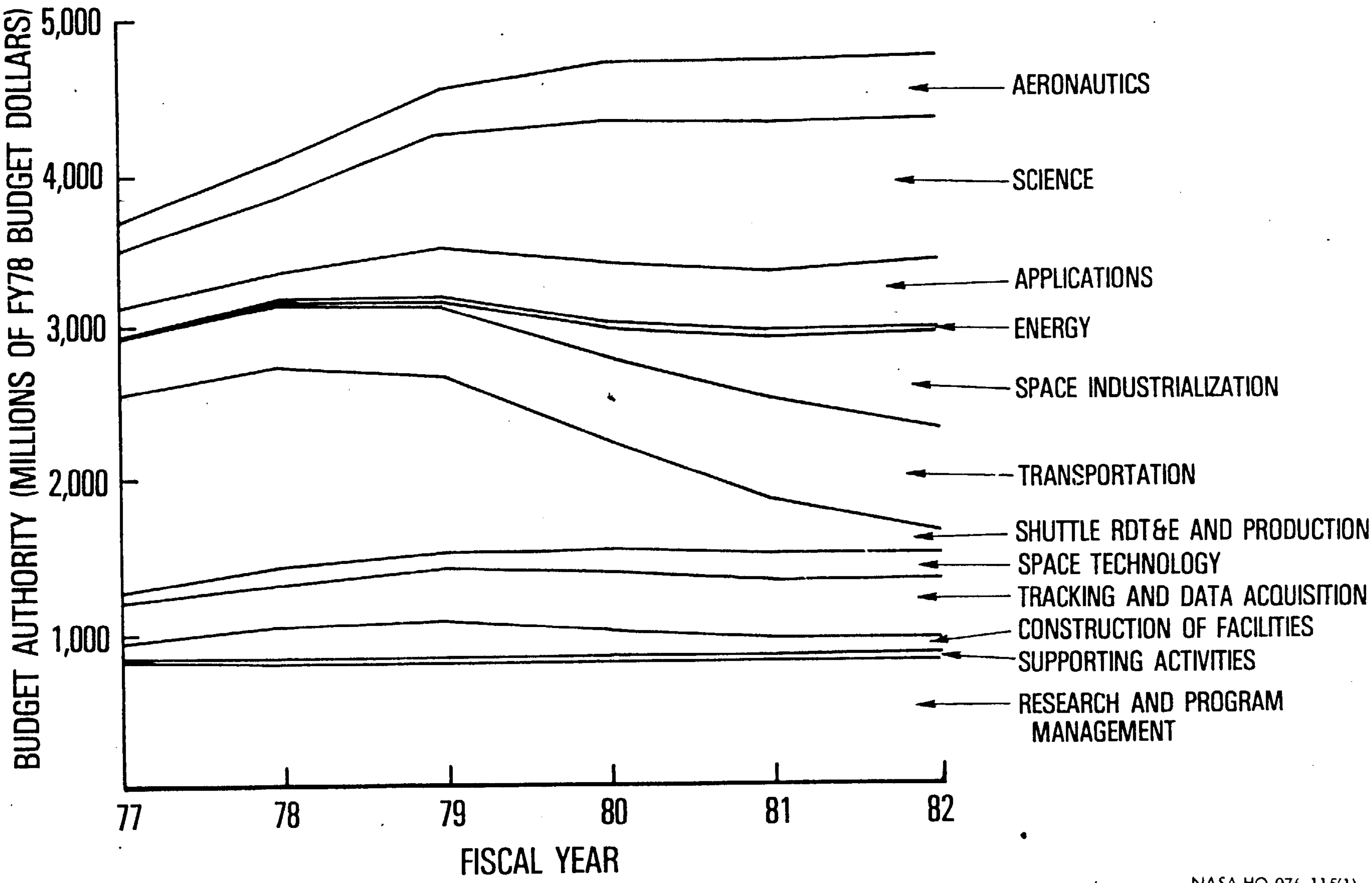


FIGURE 10. ESTIMATED BUDGET AUTHORITY REQUIRED

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

NASA HQ J177-617(1)
11-15-76

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. 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.

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

4. <u>Recommendations</u>

a. <u>Outline National goals -- for example</u> --

(1) The President's Economic Goals:

-- 4½% 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. <u>Outline Corresponding Space Programs -- for example</u> --

(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.

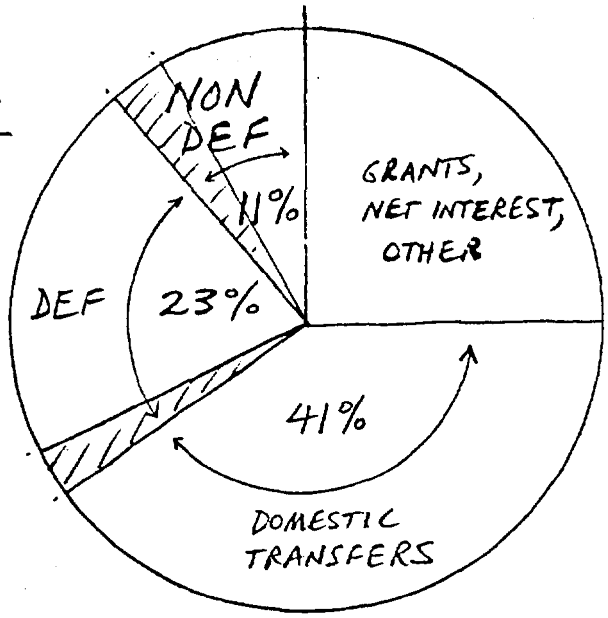
The Council would hear expert testimony from scientists, engineers, and those most knowledgeable about R & D. Its recommended budget would include military as well as civilian R & D. In the space field, for example, the members would have security clearances adequate to allow them to try to fund military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

Discussion:

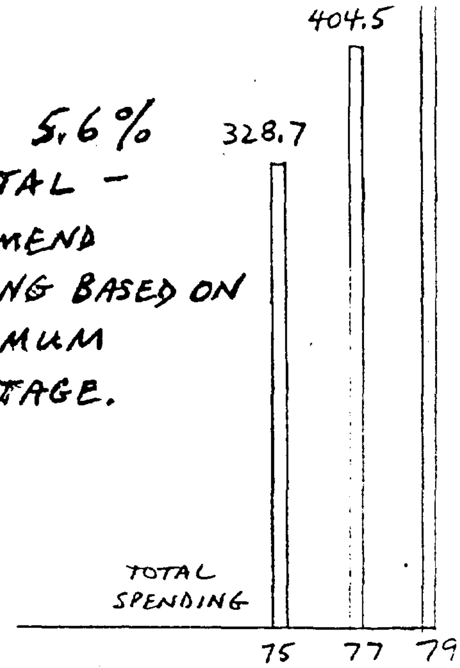
In seeking impartiality for decision-makers it would seem logical to assign laymen to determine <u>the overall size</u> of the Science/R&D budget, and scientists and engineers to decide <u>how the R & D pie will be divided</u>. But more impartiality can be achieved by reversing the roles.

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).

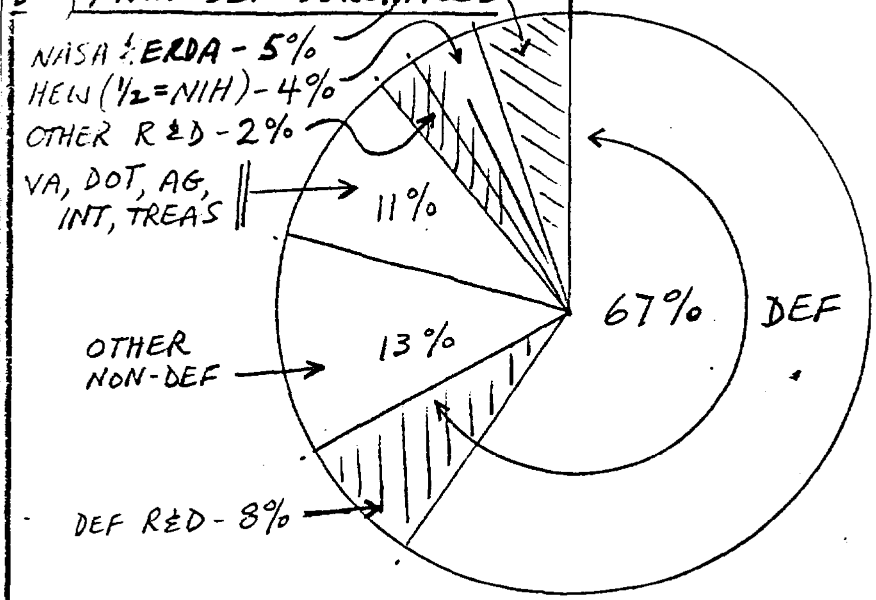
FY 1977 FEDERAL EXPENDITURES



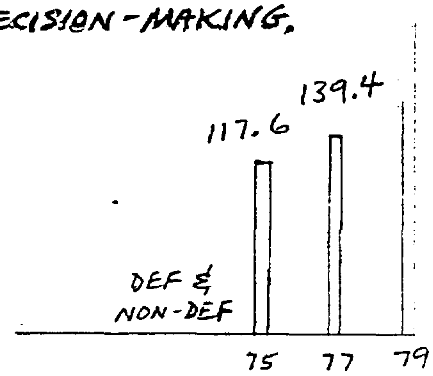
R&D 5.6% OF TOTAL - RECOMMEND PLANNING BASED ON AN OPTIMUM PERCENTAGE.

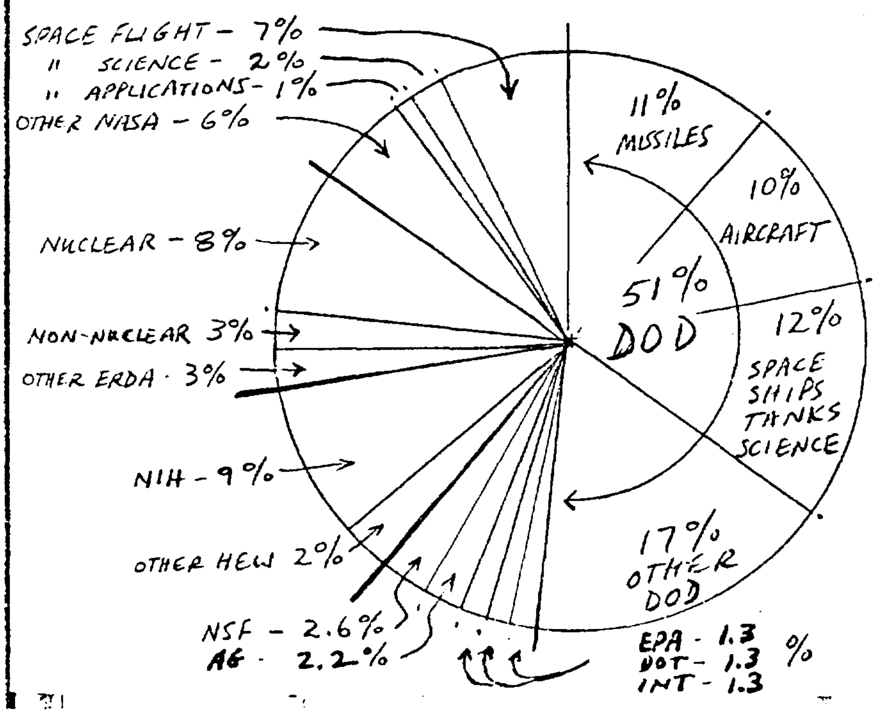


D & NON-DEF PURCHASES

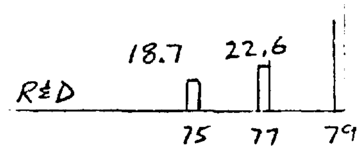


R&D 23% OF NON DEFENSE, 16% OF DEFENSE & NON DEFENSE COMBINED. RECOMMEND R&D PROPONENTS BE STRENGTHENED IN BUDGET DECISION-MAKING.





AGENCY & MISSION SHARES OF R&D - RECOMMEND JURY CONCE TO WEAKEN PROPONENTS OF INDI- VIDUAL R&D PROGRAMS, PRESI DENTIAL 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.