Appendixes

Appendix A

Trends in the Space Science Budget

It is instructive to view the total NASA budget in the context of recommendations that were made within the administration in 1969, the year of the first Apollo landings on the Moon. Recognizing that the Nation needed to take a close look at the space program in the post-Apollo era, the President in February 1969 formed a Space Task Group (STG) to study the future course of the U.S. space program. STG was chaired by the Vice President, with membership from the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), and the office of President's Science Advisor.

The report, entitled "The Post-Apollo Space Program: Directions for the Future," was received in September 1969. It presented a comprehensive plan which presented three possible program levels to achieve five program objectives: 1) increased emphasis on activities that have service to man (an expanded space applications program); 2) an enhanced defense posture for the Nation; 3) continuation of a strong program of space research to increase man's knowledge of the universe; 4) development of new systems and technology for space operations, emphasizing certain critical factors as: a) commonality, b) reusability, and c) economy, through the development of a new space transportation capability and space station modules; and 5) promotion of programs that provide broad international participation and cooperation.

The three program levels all contained a space shuttle, a 12-man space station, a 100-man space base, and lunar orbiting and surface stations. Two of the three options also included a manned mission to Mars. The time frames of these options differed, depending on the annual budgets projected for the future, which varied from $6 billion to $10 billion per year (1969 dollars). Figure A-1 shows a comparison of those NASA funding options (I, II and III, with a low-level bound having no manned flight). The upper curve marked "maximum pace bound" presents the funding required for a program limited not by funds, but by technology; the low-level program was constructed with an increased unmanned science and applications effort without a manned flight program. Figure A-1 also shows in 1969 dollars what level of funding for NASA actually was achieved.

In the post-Apollo era there was opposition to the levels of the space program proposed in the STG report which was expressed by critics in Congress, in the media, and in the American public generally and which led to a stretched-out time schedule shown in figure A-1. The actual program included the development of the space shuttle, but the rest of the recommendations of STG were not implemented. At the moment, no effort to develop a space station has been approved by the administration, despite the fact that the Soviet Union has been very active in developing a strong capability in this field for a number of years and will soon be able to sustain a permanent presence of man in orbit, either around the Earth or around the Moon.

Figures A-2 and A-3 show the space science budget of the NASA Office of Space Science and Applications (OSSA) from fiscal year 1964 to fiscal year 1983, expressed in millions of (1983) dollars, corrected for inflation.[1]

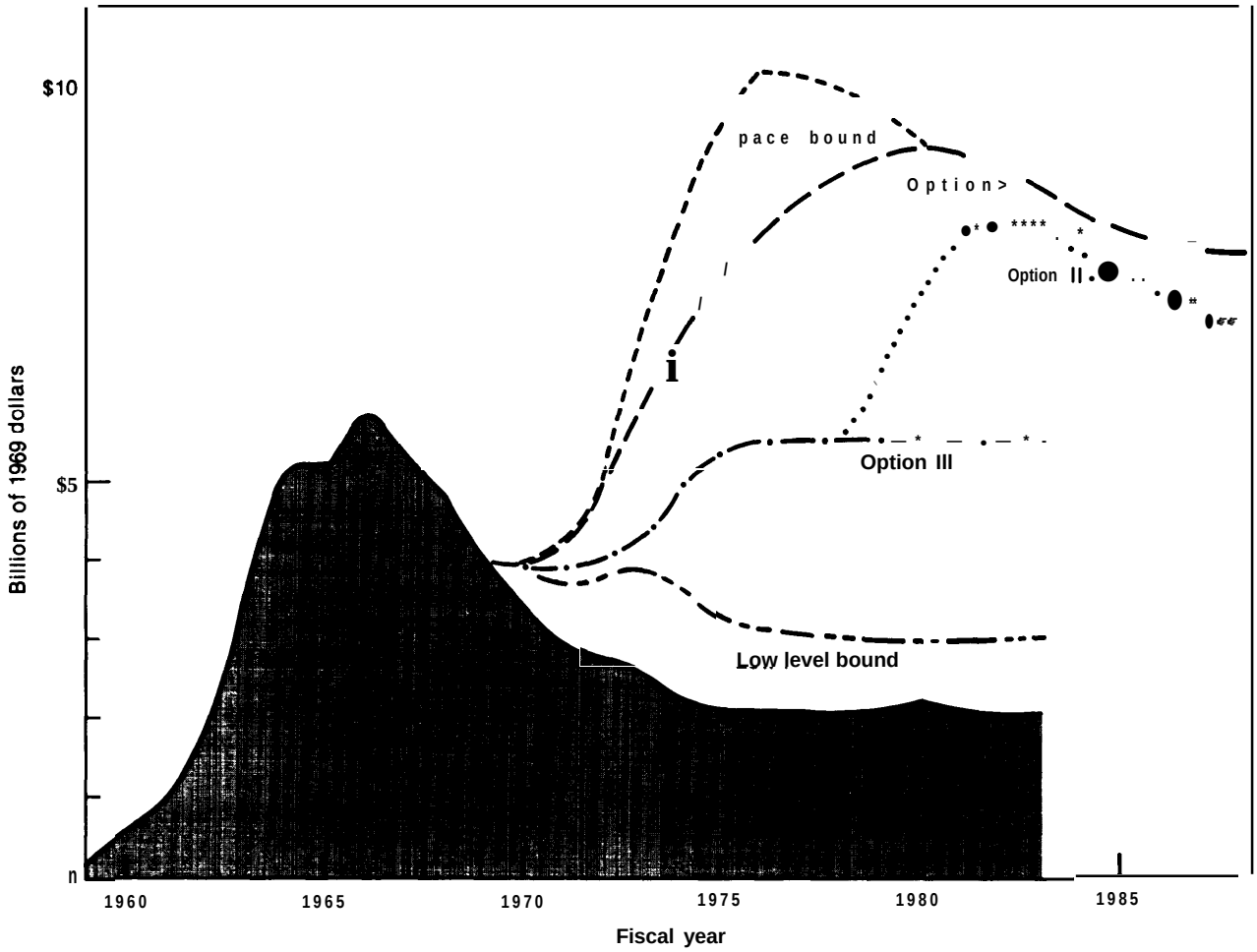
They are expressed in numerical form in tables A-1 and A-2. Three major components of the space science budget are shown: 1) the planetary sciences program, 2) the physics and astronomy program, and 3) the life sciences program. The factors by which actual budget figures have been converted to constant dollar figures are given in the middle (escalation) columns in table A-1. Table A-2 shows the budgets for individual flight programs during the same time interval, expressed in current-year dollars.

Several features of figures A-2 and A-3 deserve mention. First, in terms of purchasing power, the *total* budget for space science from the mid-1960's to the present time has fallen from about $1,450 million to about $650 million, or to approximately 45 percent of its former size. Most of this decline took place precipitously between 1966 and 1969. The budget increased again, but by only 50 percent of its decline, from 1972 to 1975, but fell again to its current value of about $650 million by 1977.

Reference to the other components of figure A-2 shows the trends of those components during the same time interval. The physics and astronomy program decreased by approximately 5o percent in the decade from 1964 to 1974, but has regained about two-thirds of its former value since 1974, principally because of increased funding for Space Telescope. The planetary science program was cut to one-third of its 1965 level by 1969, but grew to slightly more than its 1965 level by 1972-74, principally because of funding support for the Mars Viking program and the beginning of the

*The budget figures for the NASA Office of Space Science and Applications were supplied to OTA by 1. Duke Stanford (NASA/OSSA).

Figure A-I .—Annual NASA Expenditure and Options

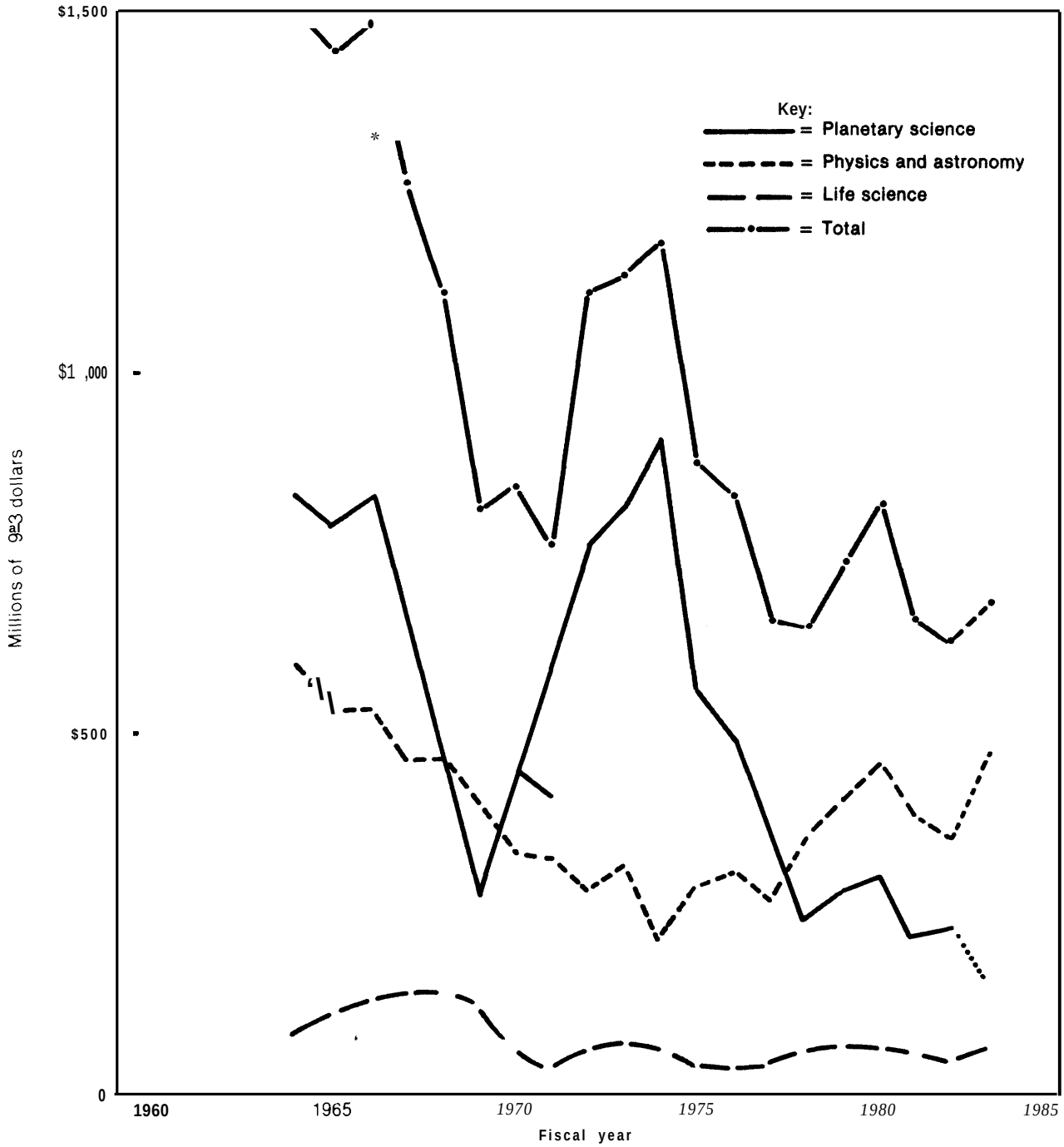


SOURCE: Space Task Group Report to the President, "The Post-Apollo Space Program: Directions for the Future," September 1969.

Voyager programs. However, as these programs tapered off, starting in 1974 and 1976, respectively, the budget for planetary sciences underwent a sharp decrease from its peak of $900 million (1983 dollars) to its current level of about $200 million, a drop to 22 percent of its value **in 1974. The life sciences component of the NASA space science budget has remained relatively constant for the past decade.**

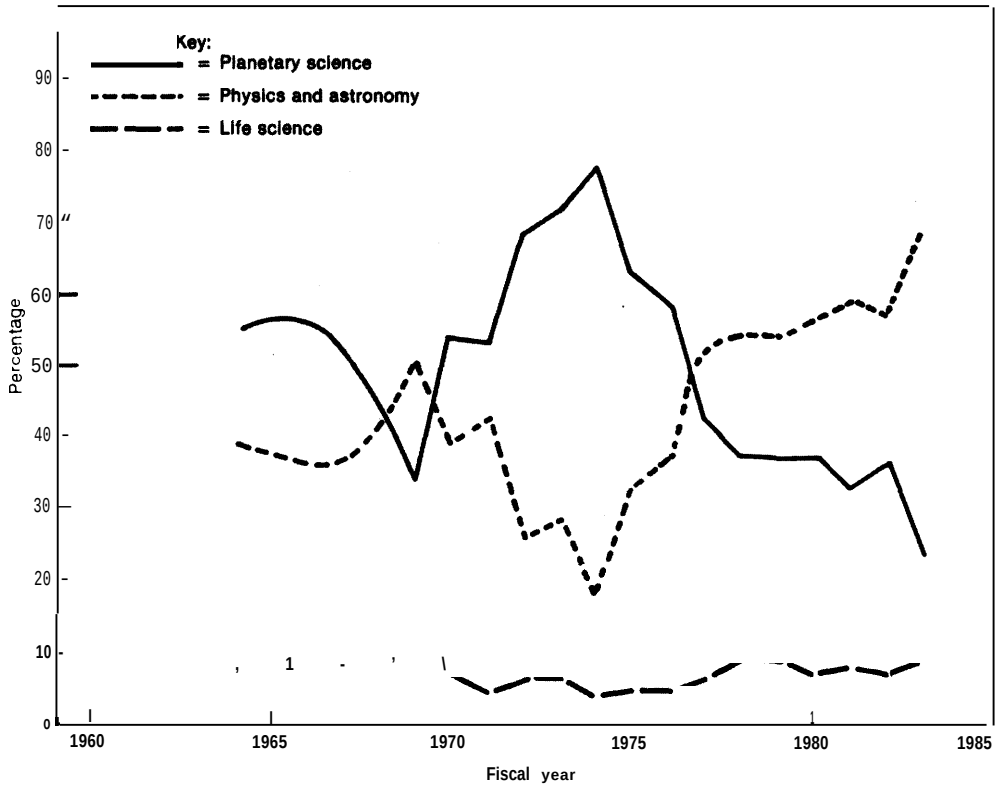
Reference to figure A-3 shows that the life sciences have typically taken about 510 percent of the space sciences budget for the past two decades. The budget for planetary science exceeded the budget for physics and astronomy from 1964 **to 1968 and from 1970 to 1976, whereas the budget for physics and astronomy exceeded the budget for planetary science for 1969 and for the period from 1977 to the present. The budget for planetary science has been significantly lower in 1981-1983. It was noted that the fiscal year 1983 budget is still under discussion at the time of this writing (August 1982).**

Figure A-2.— Budgets for NASA's Space Science Program



SOURCE Off Ice of Technology Assessment from NASA's supplied data

Figure A-3.— Breakdown of NASA's Space Science Budget



SOURCE: National Aeronautics and Space Administration

Table A-1 .—Office of Space Science Funding Summary (dollars in millions)

Actual fiscal year	Actuals: Physics and astronomy	Planetary	Life science	Total	Escalation[a]: Rate	Factor	In constant 1983 dollars: Physics and astronomy	Planetary	Life science	Total
1964	148.6	205.8	21.5	375.9	3.7	3.983	591.8	819.7	85.6	1,497.1
1965	139.1	206.0	28.5	373.6	3.0	3.867	537.8	796.6	110.2	1,444.6
1966	142.8	221.4	34.4	398.6	4.1	3.714	530.3	822.2	127.7	1,480.2
1967	129,8	184.2	42.0	356.0	4.9	3.541	459.6	652.2	148,7	1,260.5
1968	139.5	147.5	41.8	328.8	5.4	3.359	468.5	495.4	140,4	1,104.3
1969	128.9	87.9	37.9	254.7	5.7	3.178	409.6	279.3	120.4	809.3
1970	112.8	150.9	19.7	283.4	6.9	2.973	335.3	448,6	58.5	842.4
1971	116.0	144.9	12.9	273.8	6.3	2.797	324.4	405.2	36.1	765.7
1972	110.1	285.5	22.8	418.4	5.7	2.645	291.3	755.4	60.3	1,107.0
1973	126.2	325.9	26.6	478.7	5.7	2.503	315.8	815.7	66.5	1,135.0
1974	94.0	387.7	22.8	504.5	7.2	2.335	219.4	905.2	53.2	1,177.8
1975	136.3	261.2	19.8	417.3	10.8	2.108	287.3	550.6	41.7	879.6
1976	159.3	254.2	20.6	434.1	9.0	1.934	308.0	491.6	39.8	839.4
1977	154.7	191.9	22.1	368.7	8.5	1.782	275.7	341.9	39.3	656.9
1978	212.6	147.2	33.3	393.1	7.8	1.653	351.4	243.3	55.0	649.7
1979	270.0	182.4	40.1	492.5	9.5	1.510	407,7	275.4	60.5	743.6
1980	336.8	219.9	43.8	600.5	10,7	1.364	459.3	299.9	59.7	818.9
1981	323.7	175.6	42.2	541.5	12.0	1.218	394.2	213.8	51.4	659.4
1982	323.5	205.0	39.5	568.0	10.7	1.100	355.8	225.5	43.4	624.7
1983[b]	(471.7)	(154.6)	(55.7)	(682.0)			(471.7)	(154.6)	(55.7)	(682.0)

[a]Based On NASA R&D Index dated September 1981
[b]Proposed.

SOURCE National Aeronautics and Space Administration.

Table A-2.—Space Science Budget From Congressional Submission

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Flight program	***$297.8***	***$283.0***	***$299.3***	***$249.5***	***$208.8***	***$146.0***	***$192.6***	***$184.5***	***$330.2***	***$368.7***	***$381.6***	***$277.7***	***$275.6***	***$196.0***	***$191.6***	***$279.6***	***$371.4***	***$292.0***	***$341.8***	***$425.3***
OSO's	20.0	16.6	19.1	10.1	11.3	13.8	14.5	16.9	18.6	20.4	12.8	4.3	3.6	1.0	1.3	—	—	—	—	—
OAO's	35.6	32.6	22.3	27.7	44.8	36.4	33.3	23.2	13.4	5.7	2.3	2.2	2.3	2.6	2.0	—	—	—	—	—
OGO's	42.9	30.3	28.2	24.8	20.1	13.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Explorers	15.5	21.6	18.6	18.2	17.5	19.4	18.3	25.9	22.6	33.2	32.8	34.0	29.9	30.2	24.3	31.3	32.3	33.3	33.3	34.3
HEAO	—	—	—	—	—	—	—	—	13.4	21.8	4.8	42.9	59.2	39.4	19.8	10.6	2.1	—	—	—
SL P/L	—	—	—	—	—	—	—	—	—	—	—	3.3	2.1	8.4	37.6	50.6	57.2	40.1	54.0	105.4
SMM	—	—	—	—	—	—	—	—	—	—	—	—	—	21.3	29.6	16.7	3.1	—	—	—
S.T.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36.0	79.2	112.7	119.3	121.5	137.5
S. Polar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12.5	47.9	28.0	5.0	21.0
GRO	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.2	8.0	34.5
Ranger	30.3	11.0	1.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Surveyor	70.0	81.8	104.6	79.9	33.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lunar Orbit	20.0	49.5	58.1	26.0	9.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mariners	49.2	17.4	17.6	43.2	66.2	46.2	63.9	41.8	61.6	37.7	11.1	5.3	—	—	—	—	—	—	—	—
Voyager '73	—	7.2	17.1	12.7	0.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pioneer	13.6	15.0	12.7	6.9	6.0	4.7	22.6	41.7	15.2	11.6	—	—	—	—	—	—	—	—	—	—
Viking	—	—	—	—	—	12.4	40.0	35.0	176.2	232.2	290.4	89.0	39.5	—	—	—	—	—	—	—
Pioneer-Venus	—	—	—	—	—				—	—	—	26.9	56.6	42.8	20.0	—	—	—	—	—
Voyager '77	—	—	—	—	—	—	—	—	9.2	6.1	27.4	69.2	82.4	50.3	—	—	—	—	—	—
Galileo	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21.0	78.7	116.1	63.1	120.0	92.6
Res. Base	***78.1***	***90.6***	***99.3***	***106.5***	***120.0***	***108.7***	***90.8***	***89.3***	***88.2***	***110.0***	***122.9***	***139.6***	***158.5***	***172.7***	***201.5***	***212.9***	***229.1***	***249.5***	***226.2***	***112.1***
MO&DA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	84.8	95.9	100.7	88.3	112.1
R&A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	128.1	133.2	148.8	137.9	144.6
Total OSS	***$375.9***	***$373.6***	***$398.6***	***$356.0***	***$328.8***	***$254.7***	***$283.4***	***$273.8***	***$418.4***	***$478.7***	***$504.5***	***$417.3***	***$434.1***	***$368.7***	***$393.1***	***$492.5***	***$600.5***	***$541.5***	***$568.0***	***682.0***

Flight programs	*Number of missions*
OSO's	8
OAO's	4
OGO's	6
Pioneers	15
HEAO's	3
Rangers	9
Surveyors	7
Mariners	10

SOURCE: National Aeronautics and Space Administration.