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Fact Sheet for the Chairman and the Ranking Minority Member, Subcommittee on Science, Technology, and Space, Committee on Commerce, Science, and Transportation, U.S. Senate

March 1989

SPACE FUNDING

NASA and DOD Activities for Fiscal Years 1981 Through 1989

GAO/NSIAD-89-102FS

GAO

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National Security and
International Affairs Division

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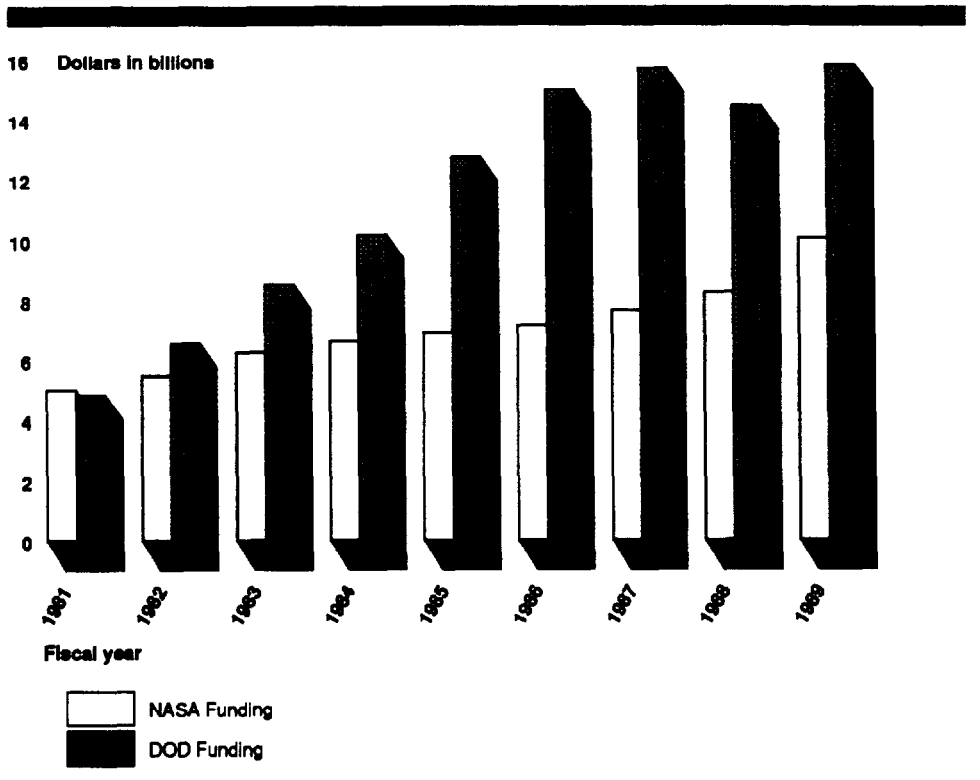
The Honorable Albert Gore, Jr., Chairman
The Honorable Larry Pressler, Ranking
Minority Member
Subcommittee on Science, Technology, and Space
Committee on Commerce, Science, and Transportation
United States Senate

In October 1988 you requested us to update the National Aeronautics and Space Administration's (NASA) and the Department of Defense's (DOD) space funding estimates, which we reported to your Subcommittee in our report, Space Funding: NASA's Appropriations and DOD's Funding Estimates for Space Programs (GAO/NSIAD-87-81FS, February 26, 1987). We briefed your representatives on the results of our work on February 10, 1989. This report summarizes the information we provided at that time.

COMPARISON OF NASA'S AND DOD'S SPACE FUNDING

In fiscal year 1981 NASA's and DOD's funding of their space programs were at about the same level. However, from fiscal years 1981 through 1989, NASA's space funding increased approximately 100 percent, from about $5 billion to about $10 billion, and DOD's increased approximately 228 percent, from about $5 billion to about $16 billion. (See fig. 1.) NASA's funding rose relatively slowly and constantly from fiscal years 1981 through 1989, whereas DOD's funding increased much more rapidly from fiscal years 1981 through 1986 but essentially leveled off after that. DOD's space funding has exceeded NASA's every fiscal year since 1982, mainly because of DOD's increasing reliance on space and its assumption of responsibility for developing and procuring its own launch systems. A more detailed comparison of NASA's and DOD's space funding is discussed in appendix I.

Figure 1: Comparison of NASA's and DOD's Space Funding



In addition to the increases in its level of space funding, NASA's reimbursements for goods and services it provided to both commercial and government clients, including DOD, increased from $723 million during fiscal year 1981 to $953 million during fiscal year 1989. During these years reimbursements reached a high in 1986 when they totaled about $1.8 billion. Since fiscal year 1984, most of NASA's reimbursements have come from DOD. However, the amounts of DOD's reimbursements have been declining since fiscal year 1987, and they are not expected to increase significantly anytime in the foreseeable future, since DOD is not planning to rely substantially on the space shuttle.

NASA's space funding and reimbursements and DOD's space funding are discussed in more detail in appendixes II and III, respectively. Related GAO products on NASA and DOD space activities are listed in appendix IV.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to update our previous report with data from fiscal years 1986 through 1989 for both NASA and DOD space and space-related funding. The information in this report was obtained from our prior report and from estimates provided by, and discussions with, NASA and DOD officials. We did not verify the accuracy of the estimates, which were derived from the same data NASA and DOD use to support their budget requests.

We conducted our work from October 1988 through January 1989 in accordance with generally accepted government auditing standards. As requested, we did not obtain official agency comments on this report. However, we discussed a draft of this report with NASA and DOD officials and incorporated their comments where appropriate.

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As arranged with your representatives, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time we will send copies to the Chairmen, House and Senate Committees on Appropriations and on Armed Services; House Committee on Science, Space, and Technology; the Secretary of Defense; the Administrator, NASA; and the Director, Office of Management and Budget. Copies will also be made available to other interested parties upon request.

GAO staff members who made major contribution to this report are listed in appendix V.

Harry R. Finley
Director, Air Force Issues

CONTENTS

ABBREVIATIONS

DOD	Department of Defense
NASA	National Aeronautics and Space Administration
R&D	Research and Development

COMPARISON OF NASA'S AND DOD'S SPACE FUNDING

Between fiscal years 1981 and 1989, the National Aeronautics and Space Administration's (NASA) space funding increased approximately 100 percent, from about $5 billion to about $10 billion. At the same time, the Department of Defense's (DOD) space funding increased approximately 228 percent, from about $5 billion to about $15.8 billion.

Table I.1 compares NASA's and DOD's space funding in current dollars and in fiscal year 1985 constant dollars.[1]

Table I.1: NASA's and DOD's Space Funding Comparison

Fiscal year	Current dollars		Constant 1985 dollars	
	NASA	DOD	NASA	DOD
	(millions)			
1981	$4,996	$4,828	$5,894	$5,729
1982	5,504	6,575	6,144	7,343
1983	6,289	8,551	6,759	9,174
1984	6,651	10,195	6,905	10,558
1985	6,925	12,768	6,925	12,768
1986	7,165	15,000	6,976	14,614
1987	7,698[a]	15,717	7,241[a]	14,815
1988	8,297	14,504	7,317	13,138
1989	10,082	15,839	8,743	13,867

[a]These amounts do not include about $2.4 billion, or its equivalent constant dollars, appropriated to NASA--about $2.1 billion to fund replacement for the space shuttle Challenger and about $0.3 billion to cover the anticipated loss of reimbursements due to the Challenger accident.

NASA's and DOD's space funding relates to the agencies' different space missions. NASA's and DOD's missions and associated funding levels are discussed in appendixes II and III, respectively.

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[1]Current dollars represent the amounts provided or estimated to be needed in the year shown. Constant dollars estimate the amount needed in other years to provide the equivalent spending power of a base year. 1985 was selected as the base year to maintain data compatibility with our previous report for fiscal years 1981 through 1985.

NASA'S SPACE FUNDING

NASA's overall mission is to conduct space and aeronautical activities for peaceful purposes and enhance U.S. leadership in aeronautics and space research, exploration, and utilization. To accomplish this mission, NASA's budget includes both space and aeronautical programs. The funds for NASA's aeronautical program,[2] which are used to enhance the safety of aviation and U.S. leadership in aviation, have been excluded from NASA's space funding estimates, which increased from almost $5 billion to almost $10 billion from fiscal years 1981 through 1989.

DESCRIPTION OF NASA'S APPROPRIATIONS

From fiscal years 1981 through 1983, NASA's funds were appropriated in three categories: Research and Development (R&D), Construction of Facilities, and Research and Program Management. In fiscal year 1984 a new category--Space Flight, Control, and Data Communications--was created to separate shuttle production, operations, and tracking and data operations from the R&D category.

Research and Development

NASA's R&D appropriation is used to extend human knowledge of the earth and the universe, expand the practical applications of space technology, and develop and improve space vehicles with and without crews. This appropriation supports such current efforts as the development of a space station, an earth-orbiting, multipurpose facility that would permanently support a crew and attract a variety of users (see fig. II.1). This appropriation also supports the design, development, and execution of scientific investigations of the earth, the other planets, the sun, and interplanetary and interstellar space. These investigations include (1) the Hubble Space Telescope, one of four planned observatories that will be placed in low earth orbit by NASA, which is expected to facilitate a better understanding of the stars and galaxies, the nature and behavior of the gas and dust between them, and the origin and scale of the universe, and (2) a series of upcoming deep space missions--the Magellan mission to Venus, the Galileo mission to Jupiter, the Ulysses mission to the Sun, and the Mars Observer mission--which are expected to improve knowledge of the solar system and its planets.

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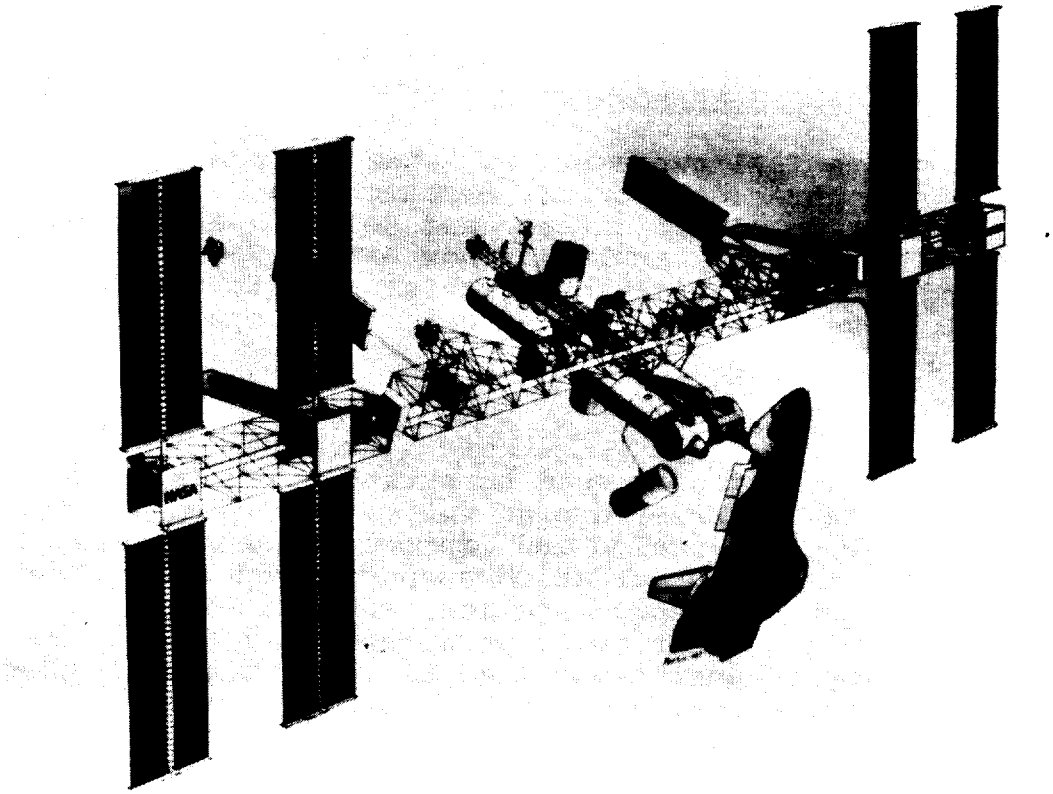
[2]Funding for aeronautics has averaged $620 million per year for fiscal years 1981 through 1989.

APPENDIX II

Figure II.1: The Proposed Space Station

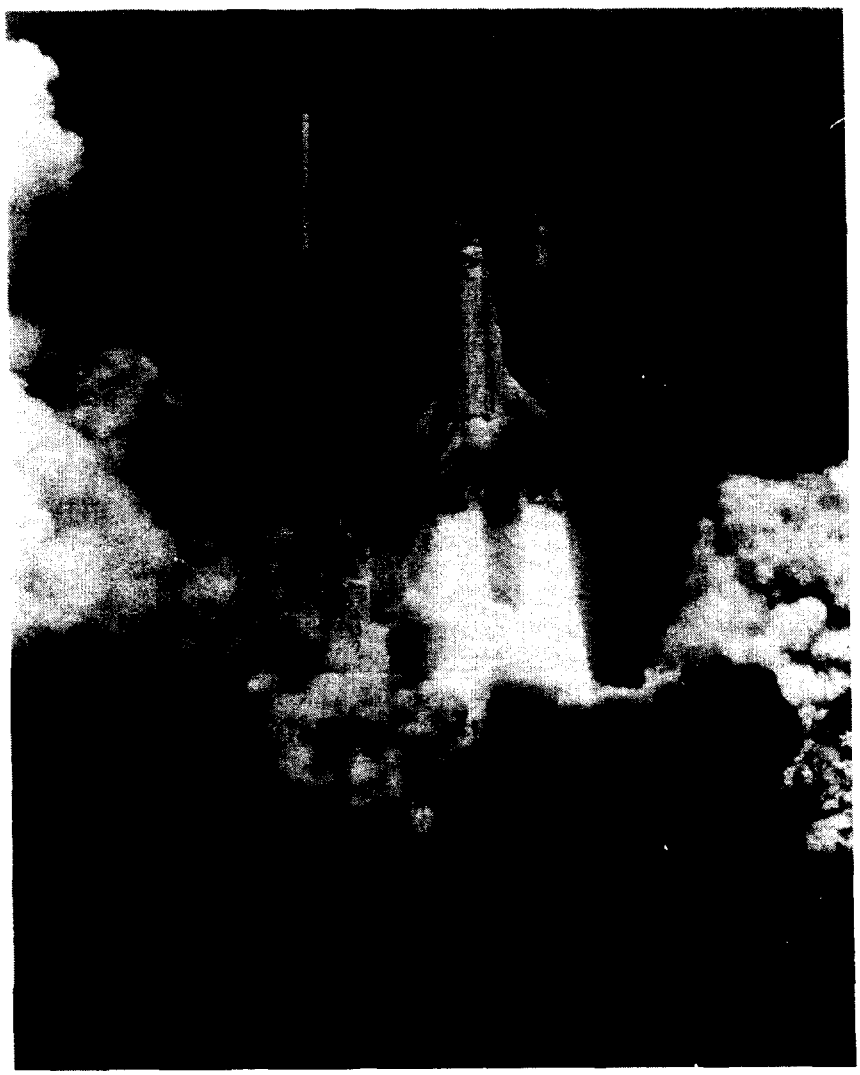


Source: NASA

Space Flight, Control, and Data Communication

NASA's Space Flight appropriation supports space shuttle flight operations, such as the recent 4-day mission by the space shuttle Discovery, which began on September 29, 1988. Figure II.2 shows the launch of the Discovery, which allowed the U.S. space program to resume after the delay resulting from the Challenger accident on January 28, 1986.

Figure II.2: The Launch of Space Shuttle Discovery on September 29, 1988



Source: NASA

Construction of Facilities and Research and Program Management

The Construction of Facilities appropriation funds the repair and modification of existing facilities and the construction of new ones. The Research and Program Management appropriation funds NASA's personnel costs and general operations support.

NASA'S SPACE APPROPRIATIONS FOR FISCAL YEARS 1981 THROUGH 1989

NASA's space appropriation increased from about $5 billion in fiscal year 1981 to about $10 billion in fiscal year 1989, as shown in table II.1.

Table II.1: NASA's Space Appropriations

Fiscal year	Appropriations (millions)	Increase	Annual percent increase
1981	$4,996	N/A	N/A
1982	5,504	$508	10
1983	6,289	785	14
1984	6,651	362	6
1985	6,925	274	4
1986	7,165	240	3
1987	7,698[a]	533	7
1988	8,297	599	8
1989	10,082	1,785[b]	22

[a]This amount does not include about $2.4 billion appropriated to NASA--about $2.1 billion to fund replacement for the space shuttle Challenger and about $0.3 billion to cover the anticipated loss of reimbursements due to the Challenger accident.

[b]This increase is mostly due to increases in the Space Station and the Science Application areas of the R&D appropriation category.

Table II.2 shows the change in each of NASA's space appropriation categories for fiscal years 1981 through 1989. The fastest-growing category was Space Flight, which increased 185 percent, primarily due to space shuttle operations.

Table II.2: NASA's Space Funding by Appropriation Category

Fiscal year	R&D	Space Flight	Construction of Facilities	Research and Program Management	Total[a]
			(millions)		
1981	$2,499	$1,564[b]	$73	$860	$4,996
1982	2,368	2,139[b]	91	905	5,504
1983	1,623	3,633[b]	84	950	6,289
1984	1,749	3,772	132	998	6,651
1985	2,126	3,594	133	1,072	6,925
1986	2,282	3,666	126	1,091	7,165
1987	2,757	3,600	150	1,191	7,698
1988	2,896	3,806	135	1,460	8,297
1989	3,828	4,464	222	1,568	10,082

[a]Some rows do not add to the total due to rounding.

[b]Since the space flight appropriation was separated from the R&D appropriation in 1984, we asked NASA personnel to allocate these amounts from the R&D appropriation for 1981 through 1983 so the data would be consistent with other data in the table.

REIMBURSEMENTS TO NASA

NASA is reimbursed for goods and services that it provides to both commercial and government clients. In fiscal year 1981 a total of $723 million was reimbursed to NASA[3] (see table II.3), including $182 million from DOD (25 percent of the total). By fiscal year 1989, reimbursements to NASA totaled $953 million, of which $524 million (55 percent) was from DOD. Reimbursements reached a high of about $1.8 billion in fiscal year 1986, of which about $1.3 billion (73 percent) was from DOD.

[3]All reimbursement figures are NASA estimates and exclude aeronautical estimates.

Table II.3: Reimbursements to NASA

Fiscal year	Reimbursements			DOD percent of total reimbursements
	DOD[a]	Other[b]	Total	
	(millions)			
1981	$182	$541	$723	25
1982	304	603	907	34
1983	569	584	1,153	49
1984	703	601	1,304	54
1985	1,210	553	1,763	69
1986	1,326	499	1,825	73
1987	776	331	1,107	70
1988	641	266	907	71
1989	524	429	953	55

[a]The amounts shown are included in DOD's space funding estimates, discussed in appendix III.

[b]This category includes other federal agencies and commercial customers, both domestic and foreign.

The majority of DOD's reimbursements to NASA have been for goods and services in the R&D and Space Flight appropriations categories. Table II.4 shows DOD's reimbursements by NASA appropriation category for fiscal years 1981 through 1989. After peaking in the mid-1980s, DOD's reimbursements to NASA have been steadily decreasing in recent years. They are not expected to increase significantly anytime in the foreseeable future, since DOD is not planning to rely substantially on the space shuttle.

Table II.4: DOD's Reimbursements to NASA by Appropriation Category

Fiscal year	R&D	Space Flight	Construction of Facilities	Research and Program Management	Total[a]
			(millions)		
1981	$169	[b]	$4	$8	$182
1982	293	[b]	2	9	304
1983	549	[b]	9	11	569
1984	244	$443	2	13	703
1985	424	756	14	16	1,210
1986	524	780	2	20	1,326
1987	482	272	2	20	776
1988	372	253	1	15	641
1989	377	131	1	15	524

[a]Some totals do not add due to rounding.

[b]These amounts were included in the R&D category.

DOD'S SPACE FUNDING

DOD does not have a separate space program appropriation. However, it estimates its space funding annually in the following categories: (1) navigation, (2) communication, (3) mapping, charting, and geodesy, (4) tactical warning and attack assessment, (5) meteorology and oceanography, (6) launch vehicle acquisition, (7) ground support, (8) supporting research and development, and (9) general support. The total of these estimates increased from under $5 billion to almost $16 billion from fiscal years 1981 through 1989.

DOD'S PROCESS FOR ESTIMATING SPACE FUNDING

From fiscal years 1981 through 1989, DOD's Office of the Under Secretary of Defense for Acquisition (formerly Research and Engineering) requested that the services and defense agencies provide space funding estimates for those programs that

-- contain space-based system elements,

-- have elements with a space-related mission,

-- have a support infrastructure (i.e., management, administrative, and logistic support) involved with space missions, or

-- contribute to space technology or capability.

Each service and defense agency decides which programs and what percent of each program should be included in the space funding estimates. This information is submitted to the Office of the Under Secretary, where it is reviewed and compiled.[4] The information is used to help describe the scope, size, commitment, and content of DOD's space efforts and to support the annual Aeronautics and Space Report of the President, which provides information on NASA's, DOD's, and other agencies' space programs.

DOD'S SPACE FUNDING COMPARED TO DOD'S TOTAL FUNDING

From fiscal years 1981 through 1989, DOD's space funding increased from about $5 billion to about $15.8 billion, an increase of approximately 228 percent. Table III.1 shows the increase by fiscal year.

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[4]A DOD official told us that the information is not validated.

Table III.1: DOD's Space Funding

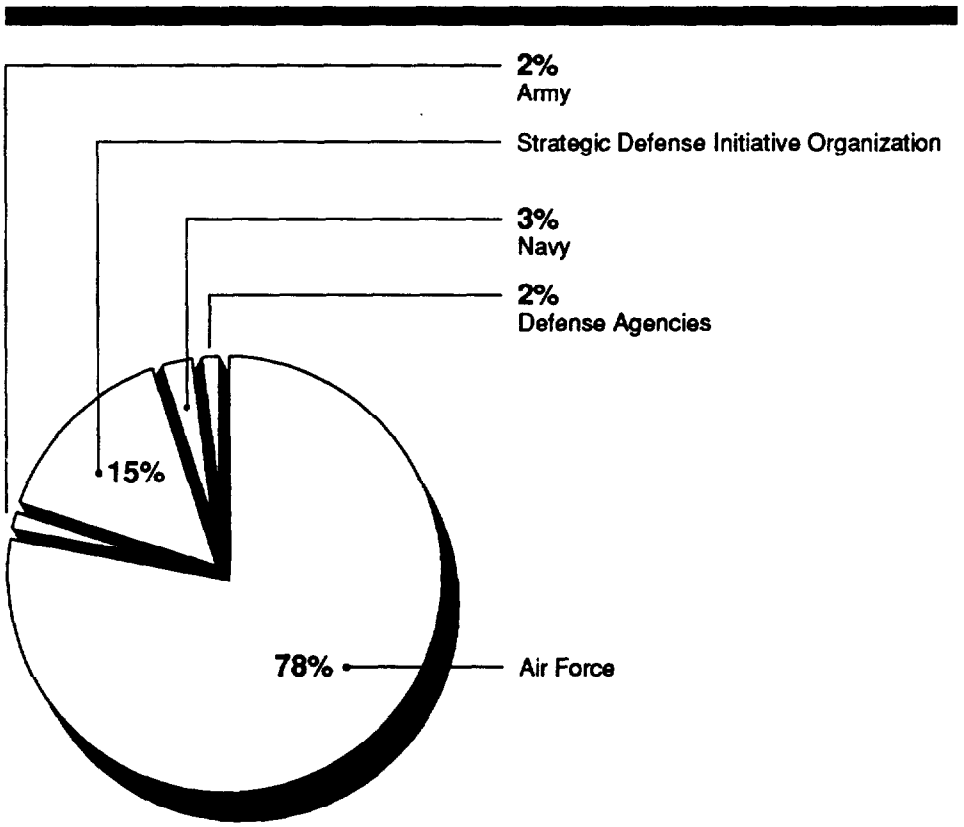
Fiscal year	Funding estimates[a] (millions)	Increase	Annual percent increase
1981	$4,828	N/A	N/A
1982	6,575	$1,747	36
1983	8,551	1,976	30
1984	10,195	1,644	19
1985	12,768	2,573	25
1986	15,000	2,232	17
1987	15,717	717	5
1988	14,504	-1,213[b]	-8[b]
1989	15,839	1,335	9

[a]Reimbursements to NASA are included in the funding estimates.

[b]This decrease was due to DOD reducing its space program funding to help keep the DOD budget within its portion of the total federal budget, as set to meet the Gramm-Rudman-Hollings legislation's budget deficit reduction target.

DOD's space funding includes programs in the Army, the Air Force, the Navy/Marine Corps, and other defense agencies such as the Defense Mapping Agency, the Defense Advanced Research Projects Agency, the Defense Nuclear Agency, and the Defense Communications Agency. It also includes the Strategic Defense Initiative Program and classified programs. As shown in figure III.1, the Air Force's space programs represented 78 percent of DOD's fiscal year 1989 space funding.

Figure III.1: Percentage Distribution of DOD's Space Funding for Fiscal Year 1989



Source: DOD

From fiscal years 1981 through 1989, when DOD's space funding increased approximately 228 percent, total DOD funding increased approximately 67 percent, from about $175.6 billion to about $292.3 billion. Table III.2 shows the increases for each fiscal year.

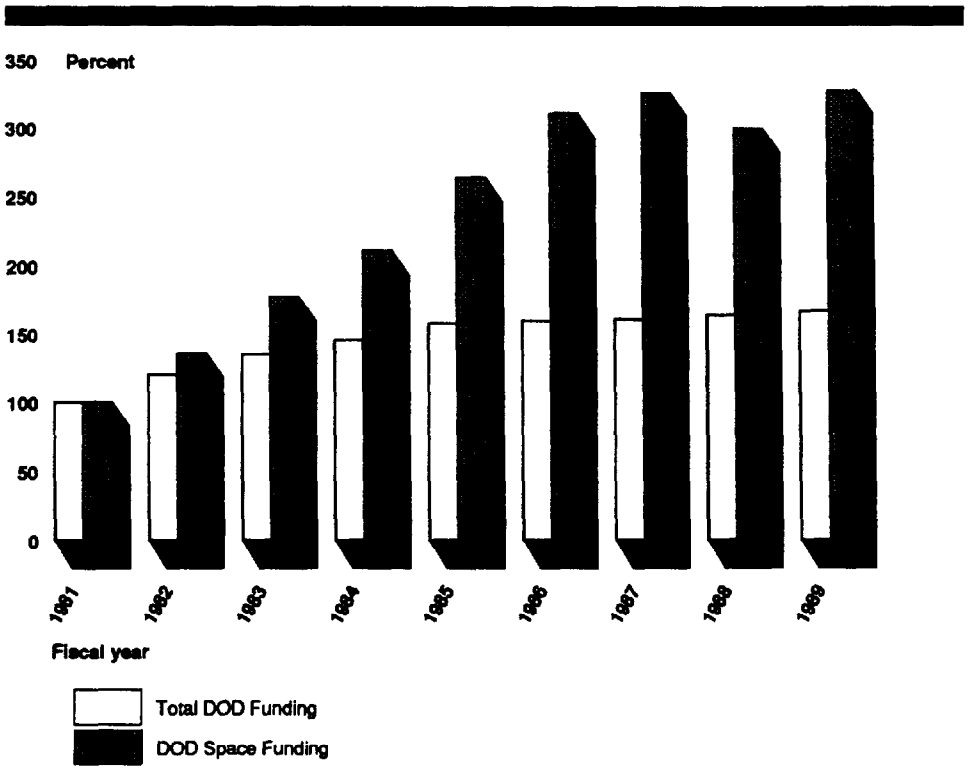
Table III.2: Comparison of DOD's Total Funding to DOD's Space Funding

Fiscal year	DOD total funding			DOD space funding		
	Amount	Increase	Percent increase	Amount	Increase	Percent increase
	---(millions)---			---(millions)---		
1981	$175,548	N/A	N/A	$4,828	N/A	N/A
1982	210,899	$35,351	20	6,575	$1,747	36
1983	236,525	25,626	12	8,551	1,976	30
1984	255,431	18,906	8	10,195	1,644	19
1985	277,544	22,113	9	12,768	2,573	25
1986	280,520	2,976	1	15,000	2,232	17
1987	283,475	2,955	1	15,717	717	5
1988	288,607	5,132	2	14,504	-1,213	-8
1989	292,692	4,085	1	15,839	1,335	9

Another way to display the increases in DOD's total funding and space funding is through the use of growth indexes,[5] as shown in figure III.2.

[5]Growth indexes show the percent of increase of a given year to a base year.

Figure III.2: Comparison of DOD's Total Funding to DOD's Space Funding



Note: Fiscal year 1981 was used as the base year and was set to equal 100 percent.

DOD'S SPACE FUNDING CATEGORIES

DOD's space funding covers the nine categories of effort described below.

-- Navigation consists mainly of the Navstar and Global Positioning System satellite program, a space-based radio positioning and navigation system being jointly developed by the services, the Defense Mapping Agency, the Department of Transportation, and the North Atlantic Treaty Organization. The satellites and control segments are developed and procured by the Air Force. The services are jointly developing the equipment to receive the navigation data provided by the satellite constellation.

-- Communication includes such programs as the Defense Satellite Communication System and Milstar, which provide essential wartime communication capability for command and control of strategic and tactical forces through all levels of conflict.

-- Mapping, charting, and geodesy includes efforts to obtain more accurate data for maps and charts and provide geophysical information to strategic and tactical weapon systems, such as knowledge of the size, shape, and gravity field of the earth for supporting ballistic missile forces.

-- Tactical warning and attack assessment covers various satellite programs and ground programs that together provide attack warning information.

-- Meteorology and oceanography consists mainly of the Defense Meteorological Satellite Program and other environmental programs that supply timely weather information to help DOD effectively employ forces.

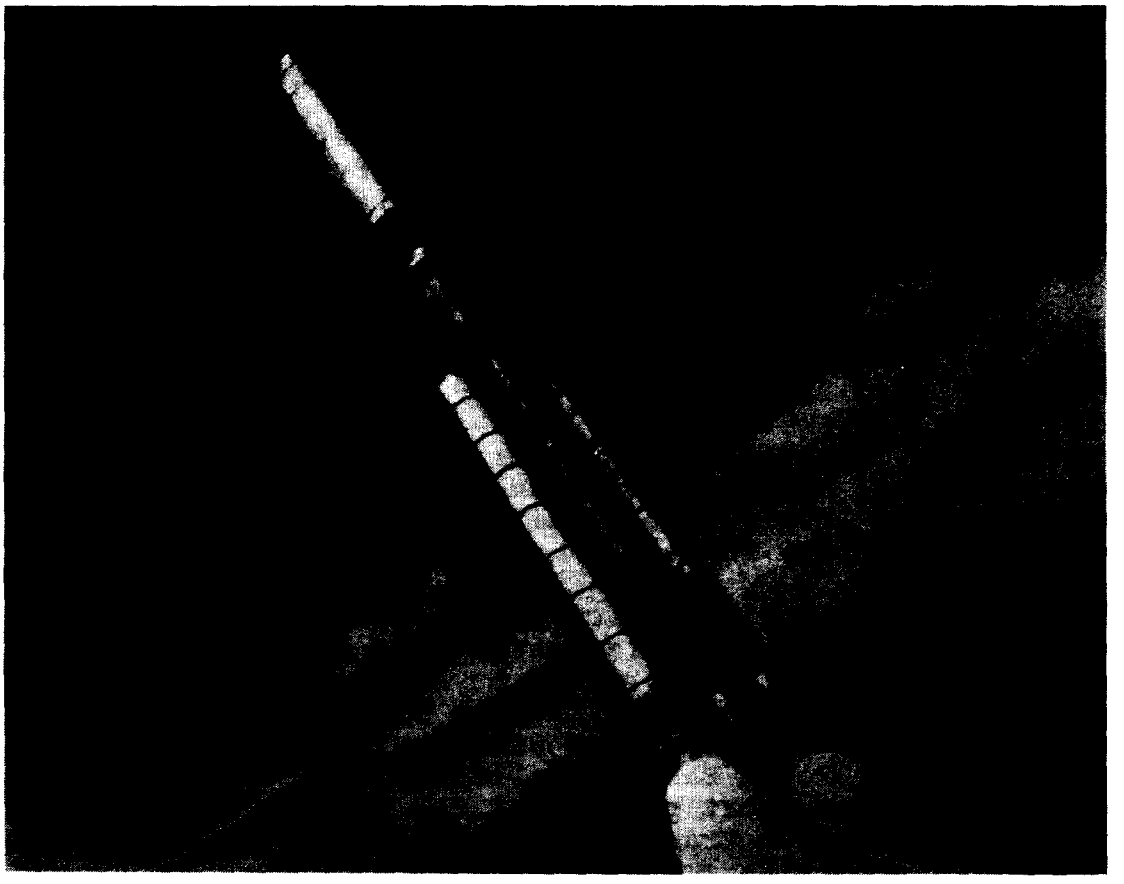
-- Launch vehicle acquisition covers an Air Force program for space boosters and space launch/shuttle support. The space booster portion of this program buys expendable launch vehicles, such as the Titan IV (see fig. III.3), for launch from Cape Canaveral Air Force Station in Florida or from Vandenberg Air Force Base in California. The space launch/shuttle support portion of the program provides related resources needed to transport Air Force space payloads to their mission orbits. It also funds the Vandenberg Launch Site for the space shuttle, which has not yet been used.

-- Ground support consists mainly of operations and maintenance funding necessary to support test ranges, satellite control, and spacetrack networks.

-- Supporting research and development supports mainly research, development, test, and evaluation projects, including the development and testing of launcher systems.

-- General support covers various functions such as technical and mission support for space-related activities and classified Air Force and Navy programs.

Figure III.3: A Titan IV Launch Vehicle



Source: DOD

INCREASED DOD FUNDING BY CATEGORY

The changes in DOD's space funding, by category, are shown in table III.3.

Table III.3: Changes in DOD's Space Funding by Category

Category	Fiscal year			Percent change		
	1981	1985	1989	81-85	85-89	81-89
	(millions)					
Navigation	$167	$564	$449	238	-20	169
Communication	687	1,575	1,463	129	-7	113
Mapping, charting, and geodesy	12	62	13	417	-79	8
Tactical warning and attack assessment	267	581	947	118	63	255
Meteorology and oceanography	87	293	307	237	5	253
Launch vehicle acquisition	759	1,466	1,774	93	21	134
Ground support	338	1,114	1,439	230	29	326
Supporting research and development	574	1,118	3,059	95	174	433
General support	1,939	5,995	6,388	209	7	229
Total	$4,828[a]	$12,768	$15,839	164	24	228

[a]This column does not add due to rounding.

The three largest space funding categories for 1989 are supporting research and development, launch vehicle acquisition, and general support. The first two categories increased to the levels shown primarily because of a policy change due to the shuttle accident, resulting in substantial growth in DOD's development and procurement of its own expendable launch vehicle systems. The last category increased primarily because of increases in the amount of Air Force and Navy classified programs.

RELATED GAO PRODUCTS

Space Science: Status of the Hubble Space Telescope Program (GAO/NSIAD-88-118BR, May 2, 1988).

Space Station: NASA Efforts to Establish a Design-To-Life-Cycle Cost Process (GAO/NSIAD-88-147, May 5, 1988).

Space Exploration: NASA's Deep Space Missions are Experiencing Long Delays (GAO/NSIAD-88-128BR, May 27, 1988).

Space Exploration: Cost, Schedule, and Performance of NASA's Ulysses Mission to the Sun (GAO/NSIAD-88-129FS, May 27, 1988).

Space Exploration: Cost, Schedule, and Performance of NASA's Magellan Mission to Venus (GAO/NSIAD-88-130FS, May 27, 1988).

Space Exploration: Cost, Schedule, and Performance of NASA's Mars Observer Mission (GAO/NSIAD-88-137FS, May 27, 1988).

Space Exploration: Cost, Schedule, and Performance of NASA's Galileo Mission to Jupiter (GAO/NSIAD-88-138FS, May 27, 1988).

Space Shuttle: The Future of the Vandenberg Launch Site Needs to Be Determined (GAO/NSIAD-88-158, August 3, 1988).

GAO Transition Series: NASA Issues (GAO/OCG-89-15TR, November 1988).

Civil Space: NASA's Strategic Planning Process (GAO/NSIAD-89-30BR, November 30, 1988).

Space Shuttle: Readiness of the Transoceanic Abort Landing Sites (GAO/NSIAD-89-22, December 16, 1988).

Solid Rocket Motors: Loss of Oxidizer Production Necessitates Emergency Allocation Procedures (GAO/NSIAD-89-66, December 16, 1988).

Space Shuttle: External Tank Procurement Does Not Comply With Competition in Contracting Act (GAO/NSIAD-89-62, December 28, 1988).

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