United States General Accounting Office

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Fact Sheet for Congressional Requesters

February 1987

# SPACE FUNDING

# NASA's Appropriations and DOD's Funding Estimates for Space Programs

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**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**National Security and**
**International Affairs Division**

B-226100

February 26, 1987

The Honorable Donald W. Riegle, Chairman
The Honorable Larry Pressler, Ranking
Minority Member
Subcommittee on Science, Technology and Space
Committee on Commerce, Science and Transportation
United States Senate

In an August 8, 1986, letter from Senator Riegle and subsequent discussions with your offices, we were requested to define and compare the National Aeronautics and Space Administration's (NASA's) and the Department of Defense's (DOD's) funding for space programs. We briefed your offices on the status of our work on October 15, 1986, and December 17, 1986. This fact sheet summarizes the results of our work.

## NASA'S SPACE FUNDING

NASA receives funding for its space program through four separate appropriations: (1) Research and Development, (2) Space Flight, Control and Data Communications, (3) Construction of Facilities, and (4) Research and Program Management. From fiscal years 1981 through 1985, NASA's appropriations for space programs increased from $5 billion to $6.9 billion. NASA also received reimbursements for goods and services it provided to both commercial and government clients, including DOD. Total NASA reimbursements increased from $723 million to $1.8 billion during the same period. NASA's space funding is discussed in appendix I.

## DOD SPACE FUNDING

DOD does not have specific appropriations for its space programs. Rather, funding is provided through its regular appropriations, such as Procurement; Research, Development, Test and Evaluation; and Operations and Maintenance. DOD does, however, estimate its space funding. Annually, the Office of the Under Secretary of Defense (Research and Engineering) requests that the services and other DOD agencies identify their space funding. This information is then broken out into the following categories: navigation; communication; mapping, charting, and geodesy; tactical

warning and attack assessment; meteorology and oceanography; launch vehicle acquisition; ground support; supporting research and development; and general support. From fiscal years 1981 through 1985, DOD's estimates for space funding increased from $4.8 billion to $12.8 billion. According to DOD officials, this increase can be attributed to DOD's increasing reliance on space, strategic modernization, and the fact that DOD maintains operational capabilities requiring replenishment and upgrade to current systems. DOD's funding for space programs is discussed in appendix II.

## COMPARISON OF NASA'S AND DOD'S SPACE FUNDING

We compared NASA's and DOD's funding for space programs from fiscal year 1981, when funding levels were about the same, through fiscal year 1985, the latest year for the most complete DOD space funding estimates. DOD's estimated funding for space programs has exceeded NASA's appropriations since fiscal year 1982. The comparison is shown in current[1] and constant fiscal year 1985 dollars in table 1.

Table 1: Comparison of NASA's Appropriations and DOD's Estimated Funding for Space Programs

| Fiscal year | Current dollars | | Constant 1985 dollars | |
|---|---|---|---|---|
| | NASA | DOD | NASA | DOD |
| | (000,000 omitted) | | | |
| 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 | 10,568 |
| 1985 | 6,925 | 12,768 | 6,925 | 12,768 |

DOD officials commented that comparisons of NASA and DOD funding levels must consider the fact that the agencies' space missions are generally different. According to DOD officials, NASA generally builds and flies one-of-a-kind

[1]Current dollars are used throughout this fact sheet to refer to the funding levels in the year shown. Constant dollars are used in table 1 and appendix III to show the impact of inflation.

space systems, while DOD provides and operates satellite constellations.

## AGENCY COMMENTS

NASA and DOD provided official oral comments on a draft of this fact sheet. Both agencies agreed with the information presented and added some data to clarify it. We included this data where appropriate.

## METHODOLOGY

We developed the information in this fact sheet from a review of documents and discussions with officials at NASA and the Office of the Secretary of Defense. We did not verify the accuracy of the estimates provided by NASA and DOD. Such verification would have required tracing the estimates through many documents at several organizational levels in NASA and DOD. However, the estimates are generally the same data used by NASA and DOD to support budget requests.

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

If you have any questions, please contact me on 275-4268.

Harry R. Finley
Senior Associate Director

# Contents

ABBREVIATIONS

| | |
|---|---|
| DOD | Department of Defense |
| NASA | National Aeronautics and Space Administration |
| R&D | Research and Development |
| SDI | Strategic Defense Initiative |

## NASA'S SPACE FUNDING

The overall mission of the National Aeronautics and Space Administration (NASA) is to conduct space and aeronautical activities for peaceful purposes and the benefit of all people and to enhance U.S. leadership in aeronautics, space research, exploration, and utilization. To accomplish this mission, NASA's budget provides for both space and aeronautical programs. The aeronautical research and technology program at NASA is directed toward the development of safe and efficient civil and military aircraft. To make NASA's data consistent with the Department of Defense's (DOD's) space funding estimates, we have excluded aeronautical program funding.[1]

## DESCRIPTION OF NASA'S APPROPRIATIONS

From fiscal years 1981 through 1983, NASA's budget consisted of three appropriations: Research and Development (R&D), Construction of Facilities, and Research and Program Management. In fiscal year 1984, a new appropriation category--Space Flight, Control and Data Communications--was created to separate shuttle production, operations, and tracking and data operations from the R&D appropriation. To provide a consistent display between appropriations over time, NASA provided reconstructed data on the allocations to the R&D and the new Space Flight appropriations for fiscal years 1981 through 1983.

NASA's fiscal year 1985 R&D appropriation was used to extend the knowledge of earth and the universe, expand the practical applications of space technology, and develop and improve manned and unmanned space vehicles, among other things. Examples of NASA's R&D programs include development of a U.S. space station (see fig. I.1); development of space shuttle capabilities; and execution of various scientific investigations designed to advance the knowledge of the earth, the sun, the planets, interplanetary and interstellar space, and other stars of the galaxy and universe (see fig. I.2).

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[1]Aeronautical expenses have averaged $563 million per year for fiscal years 1981 through 1985.

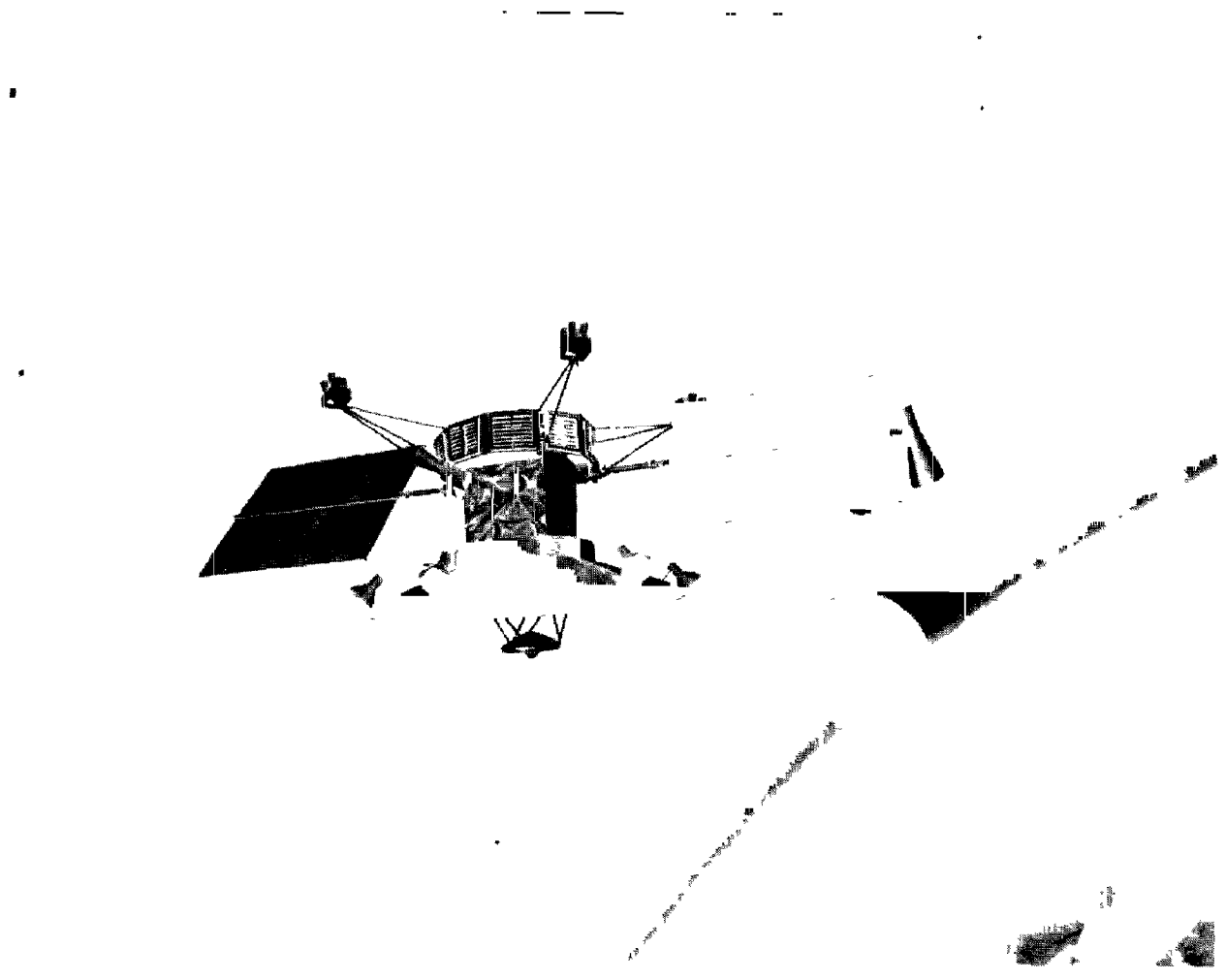
APPENDIX I

Figure I.1: Artist's Concept of a Space Station

Source: NASA

APPENDIX I

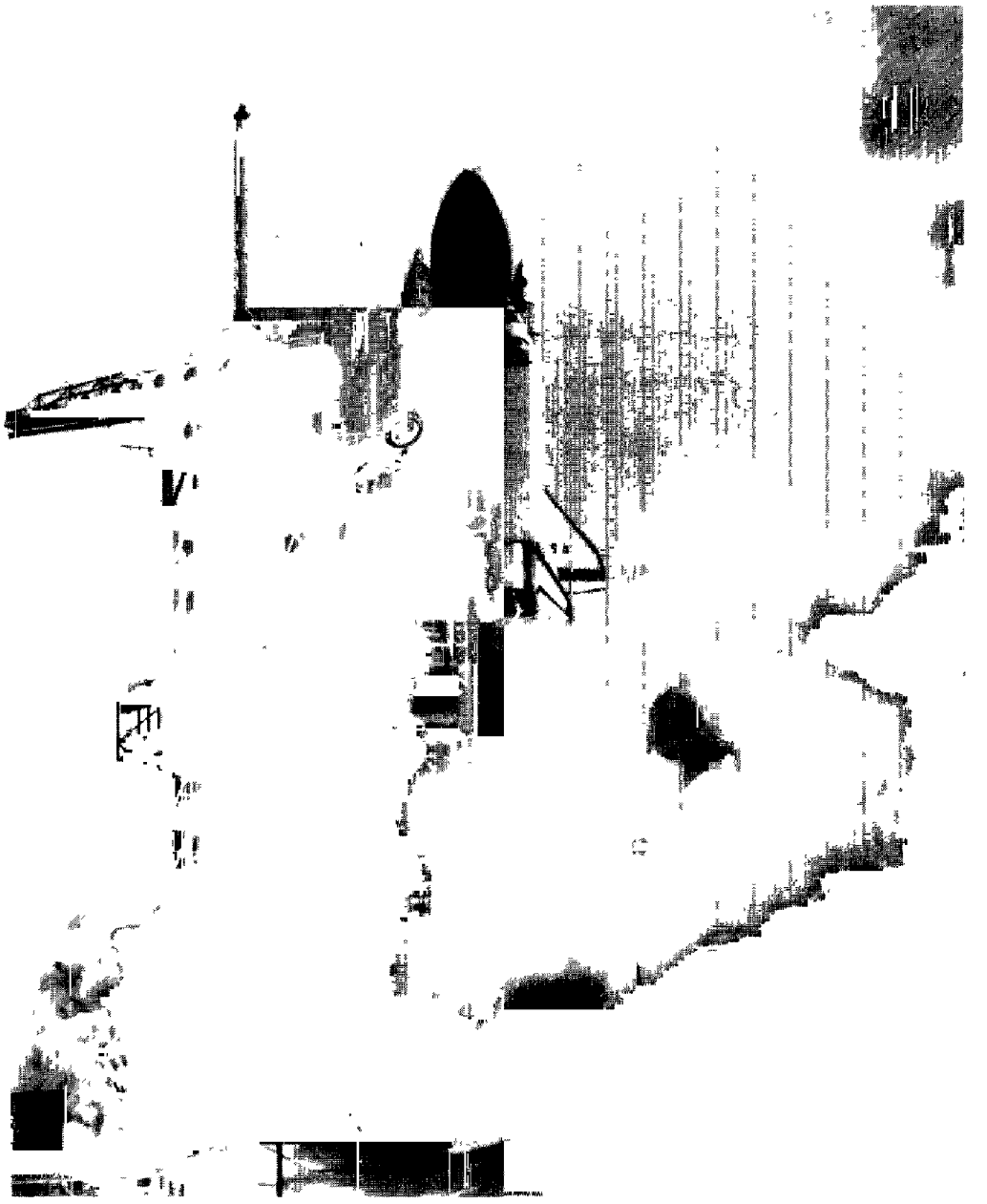
Figure 1.2: Artist's Concept of Proposed Spacecraft for the Venus Mapper



Source: NASA

NASA's Space Flight Appropriation in fiscal year 1985 was used to provide the national fleet of space shuttle orbiters (see figure. 1.3); the standard operational support services for both the shuttle and expendable launch vehicles; and tracking, communications and data systems for all NASA flight projects.

Figure I.3: Space Shuttle Columbia Performs Orbital Test Flight



Source: NASA

The Facilities appropriation provided funding for, among other things, contractual services relating to the repair of existing facilities and the construction of new facilities. The Program Management appropriation in fiscal year 1985 provided funding for permanent, temporary, and contractor employees, as well as general operations support.

## NASA'S SPACE APPROPRIATIONS FOR FISCAL YEARS 1981 THROUGH 1985

As indicated in table I.1, NASA's annual space appropriations have increased from $4,996 million in fiscal year 1981 to $6,925 million in fiscal year 1985.

Table I.1: Annual Increases in NASA's Space Appropriations

| Fiscal year | Appropriations | Increase | Percent increase |
|---|---|---|---|
| | -------(000,000 omitted)-------- | | |
| 1981 | $4,996 | $ - | - |
| 1982 | 5,504 | 508 | 10 |
| 1983 | 6,289 | 785 | 14 |
| 1984 | 6,651 | 362 | 6 |
| 1985 | 6,925 | 274 | 4 |

Table I.2 shows the change in NASA's space appropriations between fiscal years 1981 and 1985. The reconstructed Space Flight appropriation increased 130 percent over the period due to increased space shuttle operations. In fiscal year 1981, NASA flew one shuttle mission; in fiscal year 1985, NASA flew eight.

Table I.2: Comparison of NASA's Space Appropriations

| | Fiscal year 1981 | Fiscal year 1985 | Change | Percent change |
|---|---|---|---|---|
| | ------(000,000 omitted)------ | | | |
| R&D | $2,499[a] | $2,126 | $ -373 | -15 |
| Space Flight | 1,564[a] | 3,594 | 2,030 | 130 |
| Facilities | 73 | 133 | 60 | 82 |
| Program Management | 860 | 1,072 | 212 | 25 |
| Total | $4,996 | $6,925 | $1,929 | |

[a]As discussed on page 6, these appropriation amounts were reconstructed by NASA.

NASA officials told us that the 15-percent decrease in the R&D appropriation between fiscal years 1981 and 1985 was due to the phase out of an R&D line item dedicated to the design, development, test, and evaluation of the space shuttle. The line item was dropped in fiscal year 1983 after the space shuttle's final developmental testing.

## REIMBURSEMENTS TO NASA

NASA receives reimbursements for goods and services it provides to both commercial and government clients. In fiscal year 1981, total reimbursements to NASA[2] were $723 million (see table I.3). This total included DOD reimbursements of $182 million (25 percent of the total). In fiscal year 1985, total reimbursements to NASA increased to $1,763 million. DOD's reimbursements were $1,210 million, or 69 percent of this total.

[2]All reimbursement figures are NASA estimates and, as with the other NASA data, all aeronautical goods and services have been excluded.

Table I.3: Reimbursements to NASA

| Fiscal year | Reimbursements | | | Percent of DOD to total |
|---|---|---|---|---|
| | DOD[a] | Other[b] | Total | |
| | --------(000,000 omitted)-------- | | | |
| 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 |

aThe amounts shown are part of DOD's space funding estimates discussed in appendix II.

bThis figure includes other federal agencies and commercial customers, both domestic and foreign.

DOD's reimbursements to NASA have been primarily for R&D and Space Flight. Table I.4 shows DOD's reimbursements by NASA appropriation for fiscal years 1981 through 1985.

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

| | Fiscal year | | | | |
|---|---|---|---|---|---|
| | 1981 | 1982 | 1983 | 1984 | 1985 |
| | ----------(000,000 omitted)---------- | | | | |
| R&D | $169 | $293 | $549 | $244 | $ 424 |
| Space Flight[a] | N/A | N/A | N/A | 443 | 756 |
| Facilities | 4 | 2 | 9 | 2 | 14 |
| Program Management | 8 | 9 | 11 | 13 | 16 |
| Total[b] | $182 | $304 | $569 | $703 | $1,210 |

aAs discussed on page 6, Space Flight did not exist as a separate appropriation until fiscal year 1984. Until then, it was part of the R&D appropriation.

bTotals may not add due to rounding.

## DOD'S SPACE FUNDING ESTIMATES

DOD does not have a separate space program appropriation, but it does receive congressional funding for space and space-related programs through its other appropriations. Therefore, for the purposes of this report, we have defined "funding estimates" as information developed by DOD. DOD annually develops estimates for its space funding in nine 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.

## DOD'S PROCESS FOR ESTIMATING SPACE FUNDING

Between fiscal years 1981 and 1985, the Office of the Under Secretary of Defense (Research and Engineering) requested the services and defense agencies that have space and space-related programs to provide funding estimates for these programs. DOD officials provided the following criteria for including programs in the space funding estimates: programs should include space-based system elements; have system elements with a mission that is in any way space related; have a support infrastructure (i.e., management, administrative, and logistic support) involved with space missions; or contribute to space technology or capability.

Action officers in the services and defense agencies decide what programs should be included in the space estimates and the percentage of each. This information is then sent back to a service or defense agency coordinator who reviews it for completeness. The coordinator may also make judgments on the inclusion of a program and the proportion of the program that should be included.

Each service's or agency's response historically has been submitted to the Office of the Under Secretary of Defense (Research and Engineering) where it is reviewed and compiled. The service coordinators from the Army, Navy, and Air Force told us that judgments may be made on the inclusion of programs and the proportions of each.[3] A DOD official told us that the information is not validated. However, the data is used as a tool for describing the scope, size, commitment, and content of DOD's space efforts. Also, the estimates are used to support data provided in the annual Aeronautics and Space Report of the

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[3]About 89 percent of DOD fiscal year 1985 space funding estimates were for Army, Navy, and Air Force programs.

President, which provides information on NASA's, DOD's, and other agencies' space programs.

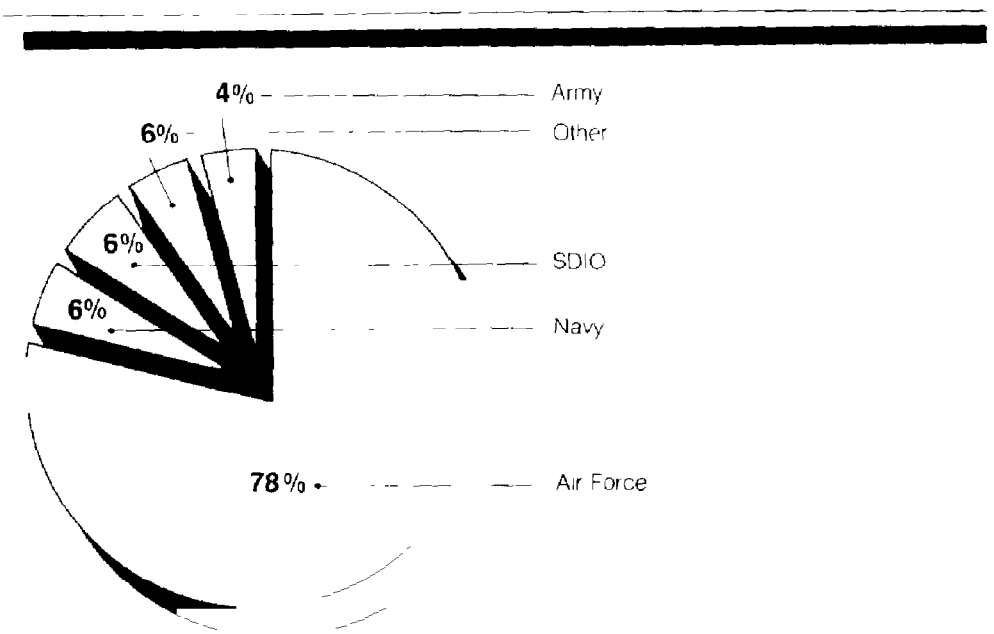
From fiscal years 1981 through 1985, DOD's space funding estimates increased from $4,828 million to $12,768 million. The increases in DOD's space funding estimates are shown in table II.1.

Table II.1: DOD's Space Funding Estimates

| Fiscal year | Funding estimates | Increase | Percent increase |
|---|---|---|---|
| | ------(000,000 omitted)----- | | |
| 1981 | $ 4,828 | $ - | - |
| 1982 | 6,575 | 1,747 | 36 |
| 1983 | 8,551 | 1,976 | 30 |
| 1984 | 10,195 | 1,644 | 19 |
| 1985 | 12,768 | 2,573 | 25 |

For fiscal year 1985, space funding estimates included programs in the Army, Air Force, Navy, and Marine Corps and in other defense agencies (i.e., Defense Mapping Agency, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and Defense Communications Agency). They also included the Strategic Defense Initiative (SDI) program and classified programs. As shown in figure II.1, the Air Force's space programs represented 78 percent of DOD's fiscal year 1985 space funding estimates. The Air Force is the executive agent for DOD's space program.

Figure II.1: Distribution of DOD's Space Funding Estimates for Fiscal Year 1985




## COMPARISON OF DOD'S TOTAL FUNDING TO DOD'S SPACE FUNDING ESTIMATES

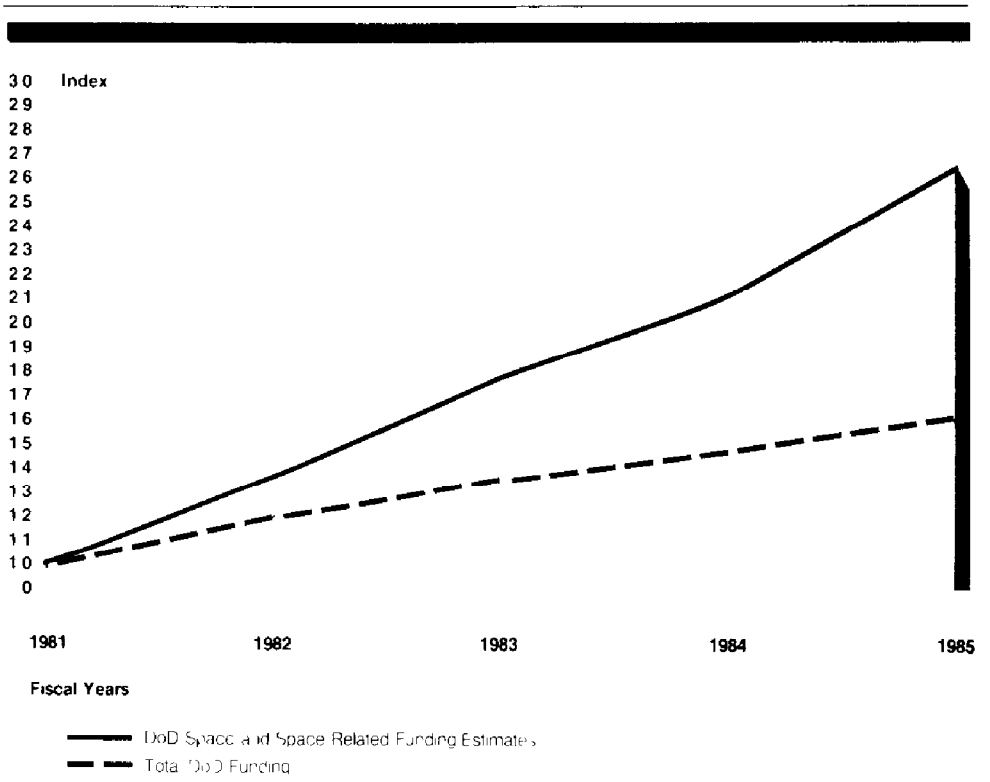
Between fiscal years 1981 and 1985, total DOD funding increased from $175,556 million to $278,629 million. During the same period, DOD's space funding estimates increased from $4,828 million to $12,768 million. The increases by fiscal year are shown in table II.2.

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

| Fiscal year | DOD total funding | | | DOD space funding | | |
|---|---|---|---|---|---|---|
| | Amount | Increase | Percent | Amount | Increase | Percent |
| | (000,000 omitted) | | | (000,000 omitted) | | |
| 1980 | $142,001 | $ - | - | $ 3,848 | $ - | - |
| 1981 | 175,556 | 33,555 | 24 | 4,828 | 980 | 26 |
| 1982 | 211,014 | 35,458 | 20 | 6,575 | 1,747 | 36 |
| 1983 | 237,293 | 26,279 | 13 | 8,551 | 1,976 | 30 |
| 1984 | 257,592 | 20,299 | 9 | 10,195 | 1,644 | 19 |
| 1985 | 278,629 | 21,037 | 8 | 12,768 | 2,573 | 25 |

Another way to compare increases in DOD's total funding to DOD's space funding estimates is through the use of growth indexes. Figure II.2 shows this comparison. DOD officials stated that comparisons of total DOD funding to DOD space funding must consider the fact that, during this period, DOD began increasing its space-related activities and the fact that DOD maintains operational capabilities requiring replenishment and upgrade. Increases in DOD's space funding estimates are discussed below.

Figure II.2: Comparison of DOD's Total Funding to DOD's Space Funding Estimates (1981 = 1.00)



## DOD'S MAJOR SPACE FUNDING CATEGORIES

DOD's space funding estimates are divided into nine categories, briefly described below:

-- Navigation. This category consists mainly of the Navstar and Global Positioning System satellite program (see fig. II.3), a joint Army, Navy, and Air Force program. 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. This category includes such programs as the Defense Satellite Communication System and Milstar, which are designed to ensure that national command authorities have essential wartime communication capability for command and control of strategic and tactical forces through all levels of conflict.

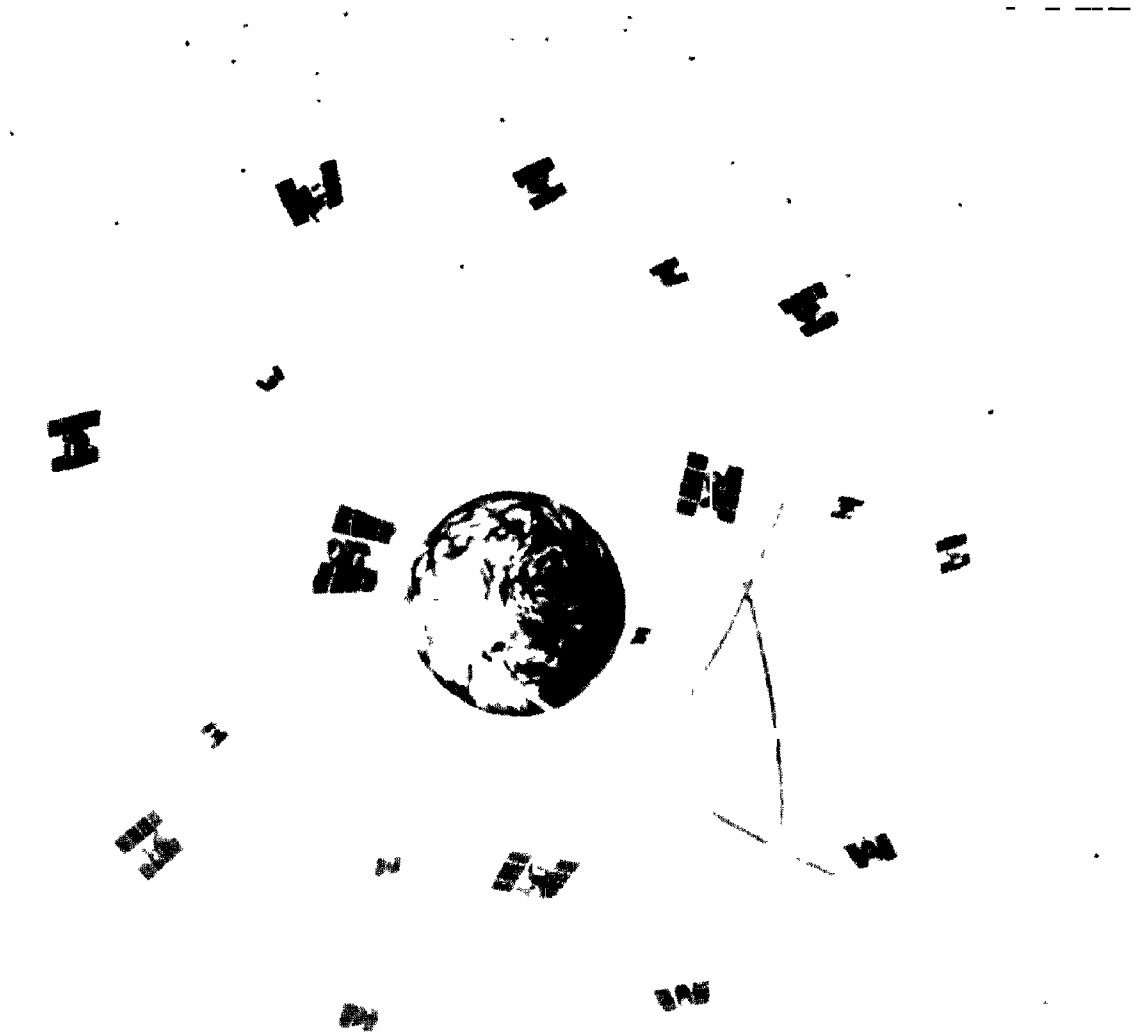
-- Mapping, charting, and geodesy. This category includes funding to obtain more accurate data for maps and charts, providing geophysical information to support strategic and tactical weapon systems. It includes programs to refine knowledge of the size, shape, and gravity field of the earth in supporting ballistic missile forces.

-- Tactical warning and attack assessment. This category is composed of various satellite programs and ground programs, which together provide national command authorities with attack warning information.

-- Meteorology and oceanography. This category mainly consists of the defense meteorological satellite program and other environmental programs that supply all services and operational commanders with timely weather information to help them effectively employ forces.

-- Launch vehicle acquisition. This category covers an Air Force program that provides funding for space boosters, space launch support, and space shuttle support. The space booster program provides funding for the Titan 34D expendable launch vehicle, the 34D7 (see fig. II.4), launches at Cape Canaveral Air Force Station in Florida, the Titan II space launch vehicle, and the Atlas-E launches of Air Force satellites from the Vandenburg Launch Site in California. The space launch

Figure II.3: Artist's Concept of the Navstar Global Positioning System Satellite Constellation



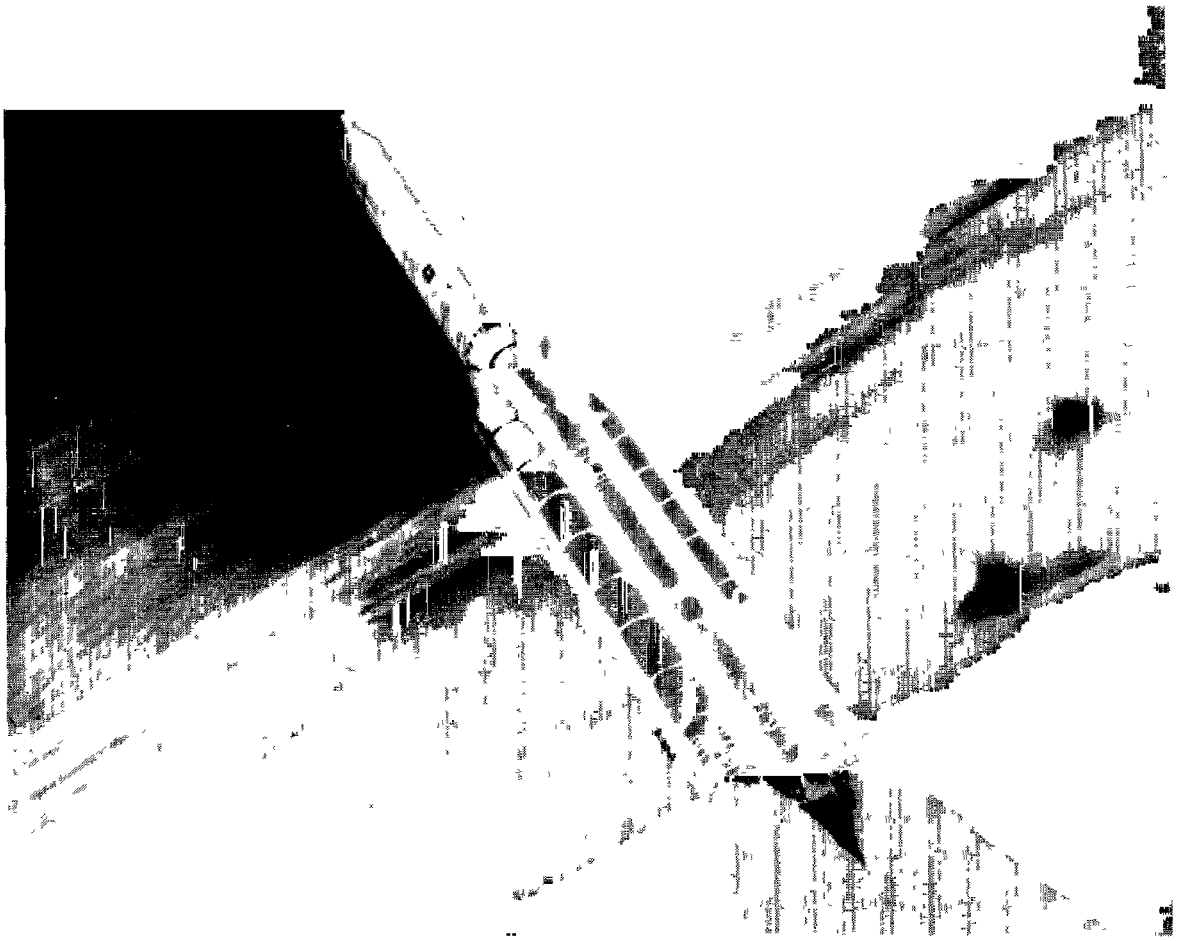
support program provides the space shuttle with related resources needed to transport Air Force space payloads to their mission orbits. This category includes payment for NASA flight charges and funding for the Vandenburg Launch Site (see fig. II.5).

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

-- Supporting research and development. This category mainly supports research, development, test, and evaluation projects in DOD, including the development and testing of the antisatellite system.

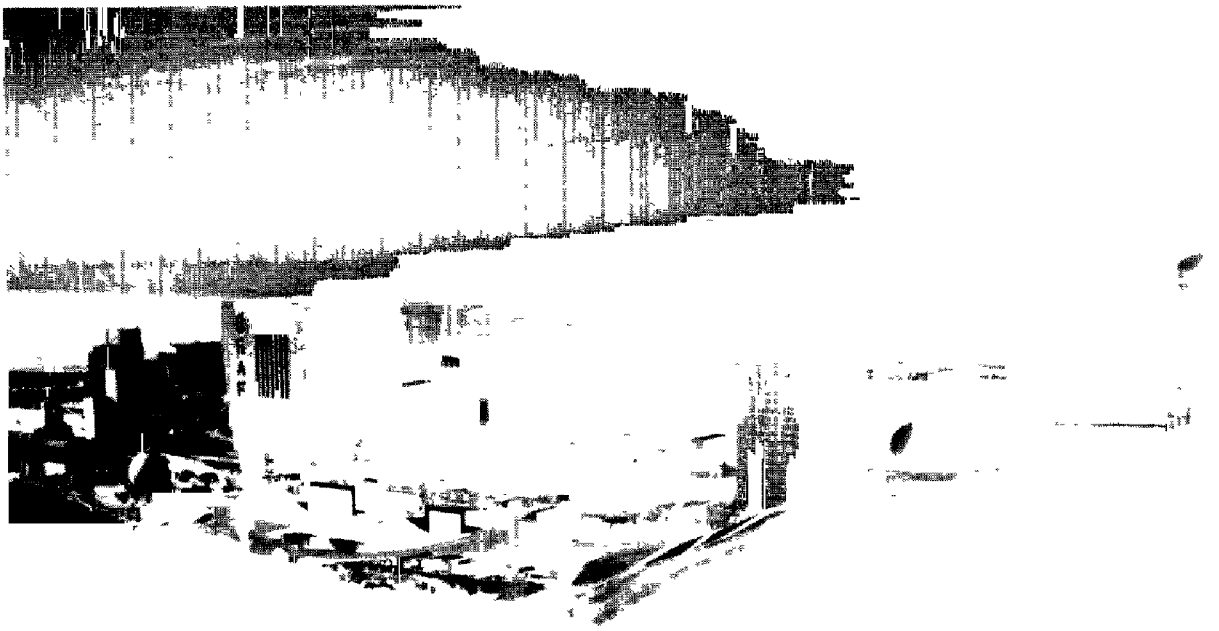
-- General support. This category includes funds for various functions, such as technical and mission support for space-related activities, including classified Air Force and Navy programs.

Figure II.4: Artist's Concept of a Titan 34D7 Launch Vehicle



Source: DOD

Figure II.5: Vandenberg Launch Site



Source: DOD

## INCREASED DOD FUNDING BY CATEGORY

The increases in DOD's space funding estimates, by category, are shown in table II.3.

Table II.3: Increase in DOD's Space Funding Estimates by Category

| Categories | Fiscal year 1981 | Fiscal year 1985 | Increase | Percent increase |
|---|---|---|---|---|
| | ---(000,000 omitted)--- | | | |
| Navigation | $ 167 | $ 564 | $ 397 | 238 |
| Communication | 687 | 1,575 | 888 | 129 |
| Mapping, charting, and geodesy | 12 | 62 | 50 | 435 |
| Tactical warning and attack assessment | 267 | 581 | 314 | 117 |
| Meteorology and oceanography | 87 | 293 | 207 | 239 |
| Launch vehicle acquisition | 759 | 1,466 | 707 | 93 |
| Ground support | 338 | 1,114 | 776 | 230 |
| Supporting research and development | 574 | 1,118 | 544 | 95 |
| General support | 1,939 | 5,995 | 4,057 | 209 |
| Total[a] | $4,828 | $12,768 | $7,940 | 165 |

[a]Totals may not add due to rounding.

Some of the reasons for the increases in DOD's funding estimates are outlined below.

-- The navigation category increased primarily because funding for the Navstar Global Positioning System grew during the period.

-- The communication category increased primarily because the Air Force added funding for several new programs, including (1) Milstar, (2) Worldwide Military Command and Control Architecture, (3) Post Attack Command and Control System, (4) National Emergency Command Post, and (5) satellite communication terminals. The Air Force also increased funding for the Defense Satellite Command System. Also, the Navy added funding estimates for satellite communications systems.

-- The mapping, charting, and geodesy category increased primarily because of added funding for research and development work and operations and maintenance at the Defense Mapping Agency.

-- The tactical warning and attack assessment category increased primarily because the Air Force provided funding to increase system capability and to replace warning systems that were costly to maintain. These systems included warning systems for land and submarine-launched ballistic missiles.

-- The meteorology and oceanography category increased primarily because of the need to procure replacement satellites in the Air Force's defense meteorological satellite program.

-- The launch vehicle acquisition category grew primarily because of investments in space transportation systems. Funding estimates for the space launch support program accounted for most of the increase. For example, as DOD increased planning, preparation, and integration of all national security payloads onto the shuttle, space launch support grew from $47 million to $826 million between fiscal years 1981 and 1985. This growth also included funding increases for the Vandenburg Launch Site and missile procurement.

-- The ground support category increased primarily because of the investment in the consolidated space operations center program. Increases were also caused by new programs, such as Army missile range funding and Air Force funding for the Space Command.

-- The supporting research and development category increased primarily because of the startup of SDI. Funding estimates for SDI started in fiscal year 1984. SDI funding estimates were $432 and $734 million in fiscal years 1984 and 1985, respectively.

-- The general support category increased primarily because of increases in Air Force and Navy classified programs.

## COMPARISON OF NASA'S APPROPRIATIONS AND DOD'S SPACE FUNDING ESTIMATES

Between fiscal years 1981 and 1985, NASA's space funding increased from $4,996 million to $6,925 million. During the same period, DOD's space funding estimates increased from $4,828 million to $12,768 million. Some of the increases can be attributed to inflation. To show that impact, we compared increases in both NASA's and DOD's programs in current dollars and in fiscal year 1985 constant dollars. Table III.1 shows this comparison.

Table III.1: Comparison of NASA's Space Funding With DOD's Space Funding Estimates

| Fiscal year | Current dollars | | Contant dollars | |
|---|---|---|---|---|
| | NASA | DOD | NASA | DOD |
| | ----------(000,000 omitted)---------- | | | |
| 1981 | $4,996 | $ 4,828 | $5,894 | $ 5,729 |
| 1982 | 5,504 | 5,575 | 6,144 | 7,343 |
| 1983 | 6,289 | 8,551 | 6,759 | 9,174 |
| 1984 | 6,651 | 10,195 | 6,905 | 10,568 |
| 1985 | 6,925 | 12,768 | 6,925 | 12,768 |

Figure III.1 shows the relative increases in NASA's and DOD's space funding estimates in current dollars. Figure III.2 shows the increases in constant 1985 dollars. DOD officials commented that comparisons of NASA and DOD funding levels must consider the fact that the agencies' space missions are generally different. According to these officials, NASA generally builds and flies one-of-a-kind space systems, while DOD provides and operates satellite constellations. These missions and associated funding levels were discussed in appendixes I and II.

Figure III.1: Comparison of NASA's Space Funding With DOD's Space Funding Estimates (Current Dollars)

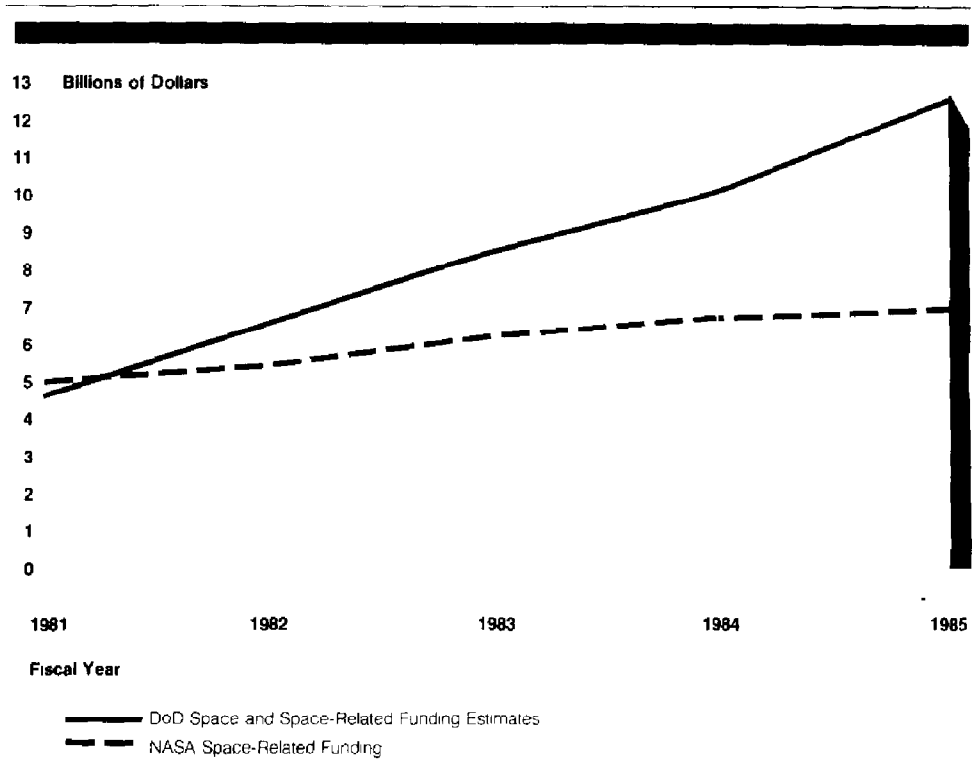
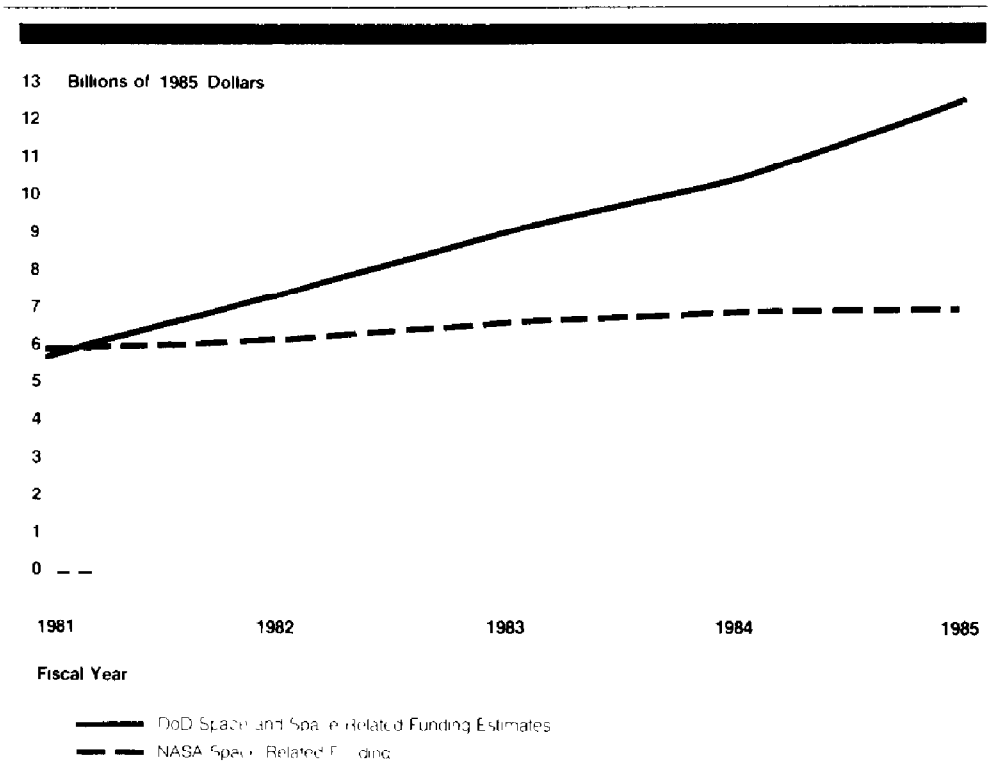


Figure III.2: Comparison of NASA's Space Funding With DOD's Space Funding Estimates (Constant 1985 Dollars)

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