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NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

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The Honorable William Proxmire
United States Senate

Dear Senator Proxmire:

Subject: The National Aeronautics and Space Administration's
Fiscal Year 1985 Budget Requests That Support De-
partment of Defense Programs (GAO/NSIAD-84-120)

On February 23, 1984, you asked us to update for fiscal year
1985 our report to you entitled Analysis of NASA's Fiscal Year 1983
Budget Request for Research and Development to Determine the Amount
That Supports DOD's Programs (MASAD-82-33). Since that report, the
space shuttle, which was primarily funded under NASA's Research and
Development appropriation at the time of our earlier work, has
become operational. As a result, a new appropriation was created
entitled Space Flight, Control and Data Communications.

To address the Research and Development and the Space Flight,
Control and Data Communications appropriations, we requested NASA
program offices to prepare a breakout of their fiscal year 1985
budget requests as either DOD or civil supportive based on program
requirements and applications. Any funding supporting both civil
and DOD programs which could not be allocated separately was to be
identified as both civil and DOD supportive.

Starting with NASA's allocations, we made further allocations
using alternative methods which we believe provide a reasonable
measure of civil or DOD support. A comparison of NASA's
allocations and our allocations follows. A detailed discussion of
the differences is contained in the enclosure.

<u>Allocation made by</u>	<u>DOD support</u>	<u>Civil support</u>	<u>Civil & DOD support</u>	<u>Total</u>
NASA				
Dollars in millions	\$ 2.1	\$2,556.1	\$3,442.2	\$6,000.4
Percent of total	.04	42.6	57.4	100.0 ^a
GAO				
Dollars in millions	\$602.3	\$4,859.7	\$ 538.4	\$6,000.4
Percent of total	10.0	81.0	9.0	100.0

^a This line does not add to 100 percent due to rounding.

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The 10 percent that we identified as supporting DOD is primarily the result of our allocating the funding associated with the space shuttle procurements according to planned shuttle usage through 1994. NASA does not believe that shuttle costs should be allocated between civil and DOD users. According to NASA officials, the space shuttle program is a national program intended to satisfy national requirements rather than strictly civil or DOD needs and thus should not be allocated between the two users. Additionally, these officials stated that no precise basis exists for accurately allocating the shuttle program. While we agree that the shuttle is a national program, we think our approach roughly approximates the respective benefits civil and DOD shuttle users derive from the program and thus can be used to estimate the amount of support NASA is providing civil and DOD users.

The amount we allocated to DOD support declined from 20.5 percent in fiscal year 1983 to 10 percent in fiscal year 1985. This decline is mostly due to DOD's lower projected use of the shuttle through 1994--from 49 percent to 34 percent of the estimated total shuttle flights.

In addition to the Research and Development and the Space Flight, Control and Data Communications appropriations, we examined NASA's \$160 million Construction of Facilities budget request. We identified \$13.9 million, or about 9 percent, of this request for fiscal year 1985 as supporting DOD.

OBJECTIVES, SCOPE, AND METHODOLOGY

NASA's fiscal year 1985 budget request is composed of four appropriations--(1) Research and Development, (2) Space Flight, Control and Data Communications, (3) Construction of Facilities, and (4) Research and Program Management. Consistent with your request and subsequent discussions with your office, we focused on the first two appropriations which, before fiscal year 1984, were combined under the Research and Development appropriation. Our review of the Construction of Facilities appropriation was limited to reviewing the budget justification backup book and interviewing program management. As agreed with your office, we did not examine the Research and Program Management appropriation, which covers personnel and related costs, travel expenses, and operations of the various NASA centers.

While NASA prepared its allocations, we reviewed its budget backup books and selected fiscal year 1985 congressional testimonies, news articles, studies, and other publications to identify possible areas where NASA's programs support only DOD. We then

B-207165

discussed each program office's allocations with cognizant program officials to determine the assumptions and bases used in making their allocations and ways to further allocate those amounts categorized as supporting both civil and DOD programs.

We conducted our review during March and April 1984 in accordance with generally accepted government auditing standards, except as requested by your office we did not request official agency comments on the report. However, we did discuss a draft of the report with NASA officials and have incorporated their comments where appropriate.

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Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its date. At that time, we will send copies to interested parties and make copies available to others upon request.

Sincerely yours,



Frank C. Conahan
Director

Enclosure

NASA'S FISCAL YEAR 1985 BUDGET
REQUESTS THAT SUPPORT DOD PROGRAMS

We reviewed NASA's two largest appropriations (Research and Development and Space Flight, Control and Data Communications), totalling \$6,000.4 million or about 80 percent of its \$7,491.4 million fiscal year 1985 budget requests to determine the amounts supporting DOD programs, civil programs, and both civil and DOD programs. A comparison of our allocation with NASA's allocation follows.

<u>Allocation made by</u>	<u>DOD support</u>	<u>Civil support</u>	<u>Civil & DOD support</u>	<u>Total</u>
NASA				
Dollars in millions	\$ 2.1	\$2,556.1	\$3,442.2	\$6,000.4
Percent of total	.04	42.6	57.4	100.0 ^a
GAO				
Dollars in millions	\$602.3	\$4,859.7	\$ 538.4	\$6,000.4
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a This line does not add to 100 percent due to rounding.

As shown above, NASA believes that most of its budget request benefits both civil and DOD programs. NASA officials said that dividing these programs and designating portions to solely a DOD or civil beneficiary is inappropriate. We believe, however, that most NASA funds can be allocated as supporting either DOD or civil efforts.

A detailed comparison of our and NASA's allocation of Research and Development and Space Flight, Control and Data Communications is contained on page 5 and discussed below. Where appropriate, we identify how our allocations differ from NASA's. We also provide information on our allocation of NASA's Construction of Facilities appropriation.

RESEARCH AND DEVELOPMENT APPROPRIATION

This appropriation supports the following NASA programs: Space Station, Space Transportation Capability Development, Space Science and Applications, Technology Utilization, Aeronautical Research and Technology, Space Research and Technology, and Tracking and Data Advanced Systems. The differences between our and NASA's allocations for each of the program elements are discussed in the following sections.

GAO's and NASA's Allocation of NASA's FY 1985 Request for
Research and Development and Space Flight, Control and
Data Communications

Program	GAO'S allocation				NASA's allocation			
	DOD support	Civil support	DOD support	Total	DOD support	Civil support	DOD support	Total
	(millions)				(millions)			
RESEARCH AND DEVELOPMENT								
Space Station	\$ -	\$ 150.0	\$ -	\$ 150.0	\$ -	\$ 150.0	\$ -	\$ 150.0
Space Transportation Capability Development:								
Spacelab	-	69.3	-	69.3	-	69.3	-	69.3
Upper Stages	-	89.4	3.0	92.4	-	92.4	-	92.4
Engineering and Technical Base	34.1	66.3	5.3	105.7	-	-	105.7	105.7
Payload Operations & Support Equipment	12.0	49.3	-	61.3	-	26.0	35.3	61.3
Advanced Programs	-	-	14.5	14.5	-	-	14.5	14.5
Tether Satellite Systems	-	18.2	-	18.2	-	18.2	-	18.2
Subtotal	46.1	292.5	22.8	361.4	-	205.9	155.5	361.4
Space Science and Applications:								
Physics/Astronomy	-	677.2	-	677.2	-	676.9	.3	677.2
Life Sciences	-	33.8	29.5	63.3	-	63.3	-	63.3
Planetary Exploration	-	286.9	-	286.9	-	286.6	.3	286.9
Space Applications	.2	343.9	-	344.1	-	341.6	2.5	344.1
Subtotal	.2	1,341.8	29.5	1,371.5	-	1,368.4	3.1	1,371.5
Technology Utilization	-	9.5	-	9.5	-	9.5	-	9.5
Aeronautical Research and Technology:								
Research and Technology Base	1.3	4.3	227.7	233.3	1.3	4.3	227.7	233.3
Systems Technology	.8	3.2	105.1	109.1	.8	3.2	105.1	109.1
Subtotal	2.1	7.5	332.8	342.4	2.1	7.5	332.8	342.4
Space Research and Technology:								
Research and Technology Base	-	.5	135.5	136.0	-	1.0	135.0	136.0
Systems Technology	-	-	9.1	9.1	-	-	9.1	9.1
Standards and Practices	-	4.9	-	4.9	-	3.5	1.4	4.9
Subtotal	-	5.4	144.6	150.0	-	4.5	145.5	150.0
Tracking and Data Advanced Systems	-	15.3	-	15.3	-	15.3	-	15.3
Total	48.4	1,822.0	529.7	2,400.1	2.1	1,761.1	636.9	2,400.1
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS								
Shuttle Production and Operational Capability	494.9	970.7	-	1,465.6	-	8.0	1,457.6	1,465.6
Space Transportation Operations:								
Flight Hardware	6.1	751.9	-	758.0	-	-	758.0	758.0
Flight Operations	28.8	287.2	-	316.0	-	-	316.0	316.0
Launch and Landing Operations	24.1	240.9	-	265.0	-	-	265.0	265.0
Subtotal	59.0	1,280.0	-	1,339.0	-	-	1,339.0	1,339.0
Space & Ground Network, Comm. & Data Systems:								
Space Network	-	386.5	-	386.5	-	386.5	-	386.5
Ground Network	-	214.9	8.7	223.6	-	214.9	8.7	223.6
Communications and Data Systems	-	185.6	-	185.6	-	185.6	-	185.6
Subtotal	-	787.0	8.7	795.7	-	787.0	8.7	795.7
Total	553.9	3,037.7	8.7	3,600.3	-	795.0	2,805.3	3,600.3
Grand total	\$602.3	\$4,859.7	\$538.4	\$6,000.4	\$2.1	\$2,556.1	\$3,442.2	\$6,000.4
Percent	10.0	81.0	9.0	100.0	.04	42.6	57.4	100.0 ^a

^a This line does not add to 100 percent due to rounding.

Space Station

NASA requested \$150 million for the Space Station program and allocated all of this request as supporting solely civil activities. We made the same allocation. We found no evidence of any current DOD requirements for a space station. According to a NASA official, this request will fund NASA's development of the station's mission and user requirements which as yet do not include DOD.

Space Transportation Capability Development

NASA requested \$361.4 million for the Space Transportation Capability Development program. This program provides for the development and use of the space shuttle and related capabilities.

Our allocations are the same as NASA's allocations for three of the six program elements--Spacelab, Advanced Programs, and Tether Satellite Systems. According to NASA officials, DOD currently has no requirements for the Spacelab and Tether Satellite Systems. Both were categorized as supporting civil only programs. Additionally, the Advanced Programs involves advanced research into future space transportation systems that could potentially benefit both civil and DOD programs. This program element's funding was allocated as supporting both civil and DOD programs. The three program elements which we allocated differently from NASA are discussed below.

Upper Stages

NASA allocated the entire \$92.4 million requested for this program element as civil supportive. Except for \$3 million of this \$92.4 million, we also allocated the requested funds as civil supportive. The \$3 million supports a Centaur engine enhancement program that could benefit both DOD and civil users. As a result, we believe categorizing this \$3 million as both civil and DOD supportive better reflects the resulting shared benefits. The remaining \$89.4 million supports the development and operation of NASA's upper stages projects. Using these funds, NASA will procure its fourth Inertial Upper Stage and two Centaur G-Prime vehicles to support NASA missions. Although the Centaur project is a joint NASA/DOD effort, both DOD and NASA will purchase their own Centaur vehicles.

Engineering and Technical Base

NASA allocated the \$105.7 million requested for this program element to the civil and DOD category. We allocated a portion of this program element to each of the three categories.

About \$100.4 million of this program element provides the baseline support capability required to sustain an engineering and development base for the shuttle program. We think this element will benefit all shuttle users over the long term. Consequently, we allocated \$34.1 million to DOD support and \$66.3 million to civil support based on NASA's long-term projection of shuttle usage, a 10-year flight schedule upon which NASA based its fiscal year 1985 budget request. According to this schedule, DOD will require 73 of the estimated 215 shuttle flights through 1994, or approximately 34 percent of the flights.

We allocated the remaining \$5.3 million as supporting both civil and DOD programs.

Payload Operations and Support Equipment

NASA allocated \$35.3 million of the \$61.3 million to the civil and DOD support category and the remaining \$26 million to civil. According to NASA officials, the \$35.3 million supports flight demonstrations and payload support equipment which will enhance the shuttle's payload capabilities. Therefore, we allocated \$12 million to DOD support and \$23.3 million to civil support based on NASA's 10-year shuttle flight schedule. Total civil support in this category is thus \$49.3 million.

Space Science and Applications

NASA requested \$1,371.5 million for Space Science and Applications. This funding provides for expanding NASA's knowledge of the earth's environment, the solar system, and the universe and for developing the technology to use space capabilities. It supports the following four program elements: Physics and Astronomy, Life Sciences, Planetary Exploration, and Space Applications. The differences between our allocations and NASA's are discussed below.

Physics and Astronomy

NASA allocated \$676.9 million of the Physics and Astronomy program element as civil supportive and \$0.3 million as both civil and DOD supportive. We made the same allocation except for the \$0.3 million which we allocated to the civil category. This \$0.3 million relates to the Combined Release and Radiation Effects Satellite (CRRES), a joint NASA/DOD project that will support chemical release and radiation research. Under this project, NASA is basically funding the satellite's launch from the shuttle, scheduled for fiscal year 1986, and the chemical release experiments, while DOD is funding the satellite hardware and the radiation experiments. According to NASA officials, the fiscal year 1985 funding for this project will support essentially NASA experiments. Therefore, we categorized this funding as civil supportive.

Life Sciences

NASA allocated the \$63.3 million Life Sciences budget request to the civil category. In contrast, we allocated \$29.5 million of this amount as both civil and DOD supportive. The \$29.5 million approximates NASA's funding of research, analysis, and flight experiments in the Operational Medicine and Biomedical Research program areas. The objective of these program areas is to enhance man's presence and productivity in space. As a result, we believe that DOD will benefit from these programs.

Planetary Exploration

NASA allocated \$286.6 million to the civil category and \$0.3 million to the civil and DOD category. We made the same allocation except for the \$0.3 million NASA allocated to the civil and DOD category. According to NASA officials, this funding relates to the joint NASA/DOD CRRES project and supports essentially NASA dedicated experiments. As a result, we allocated this \$0.3 million as supporting civil programs.

Space Applications

NASA allocated \$341.6 million to the civil support category and \$2.5 million to the civil and DOD category. Our allocation differed in that we further allocated the \$2.5 million--\$2.3 million to the civil support category because it relates to the CRRES project and \$0.2 million to the DOD category because it relates to the Large Format Camera (LFC) project.

The LFC can provide high resolution photographs of the earth. NASA plans to fly the LFC on the shuttle in 1984. NASA officials stated that DOD is expressly interested in the LFC, and it is because of this interest that NASA will continue to fund the project in fiscal year 1985. These officials further stated that NASA considers the LFC project a low priority and probably would not fly it in fiscal year 1985 without the DOD requirement. However, one official stated that NASA in the interest of science would eventually have to refly the LFC to determine its utility.

Technology Utilization

NASA allocated the entire \$9.5 million to the civil category. We made the same allocation. This program transfers aerospace research to the non-aerospace industries through NASA publications and university-supported research centers. NASA officials emphasized that this program is specifically not geared to DOD since NASA and DOD routinely share aerospace research through other means.

Aeronautical Research and Technology

NASA requested \$342.4 million for Aeronautical Research and Technology. Under this program, NASA conducts research applicable to general classes of advanced military and civil aircraft.

NASA allocated \$2.1 million as DOD supportive. We made the same allocation. The \$1.3 million for Research and Technology Base projects included in this allocation are (1) \$0.4 million for the decoupler pylon project to understand the aerodynamics of fighter aircraft wings carrying missiles and (2) \$0.9 million for DOD's use of NASA's wind tunnel to test military aircraft. The \$0.8 million under Systems Technology is for the Advanced Fighter Technology Integration program for the Air Force's F-16. According to NASA officials, these efforts are in direct response to DOD requirements.

NASA allocated, as we did, \$7.5 million to civil programs. This amount includes \$2.3 million for general aviation and \$5.2 million for noise reduction in commercial aircraft. NASA officials stated that the general aviation project supports a variety of efforts such as developing small engines that will accommodate alternative fuels that a general aviation aircraft may encounter at a remote airport. They also stated that DOD would not have a need for such an engine since it provides its own fuel. With respect to the noise project, NASA officials stated that DOD does not presently have a similar requirement for reducing take-off and cabin noise.

NASA allocated \$332.8 million to the civil and DOD category. We made the same allocation. NASA is responsible for advancing aeronautical technology. NASA officials recognize that many of their research efforts, particularly in the high performance aircraft areas, involve the use and application of military aircraft. However, they believe that the technology developed will provide a national capability and that the military aircraft used represent "vehicles of opportunity" for conducting their research.

Space Research and Technology

NASA requested \$150 million for Space Research and Technology. This program develops disciplinary and systems technologies to create new space opportunities. It consists of the following program elements: Research and Technology Base, Systems Technology, and Standards and Practices.

Research and Technology Base

NASA allocated \$1 million of the total \$136 million request as civil supportive. The \$1 million relates to the Sensors project which focuses on advanced remote sensing instruments in space

for earth science and planetary missions. However, a NASA official stated that the technology developed could benefit DOD and that both civil and DOD requirements are considered to ensure that all are met. We categorized the \$1 million as both civil and DOD supportive.

NASA also allocated \$0.5 million that relates to the CRRES chemical release research effort to the civil and DOD category. According to NASA officials, fiscal year 1985 funding for the CRRES project supports essentially NASA experiments. Therefore, we categorized this amount as civil supportive.

Systems Technology

NASA allocated the \$9.1 million for Systems Technology to the civil and DOD support category. We made the same allocation. According to NASA, all of this element is generic and is geared toward advancing the space technology base to continue U.S. preeminence in space.

Standards and Practices

NASA allocated \$3.5 million to the civil support category. This funding provides agency-wide support in the safety, systems engineering, and quality assurance areas. According to NASA officials, this work is NASA-specific and has no DOD applications. We made the same allocation.

NASA also allocated \$1.4 million to the civil and DOD support category. Because this funding supports the CRRES project, we categorized it as civil supportive.

Tracking and Data Advanced Systems

NASA allocated the \$15.3 million as civil supportive. We made the same allocation. This program is responsible for assessing and utilizing the state-of-the-art changes in telecommunications and computer technology. In fiscal year 1985, NASA will be developing tracking prototypes for its planetary missions and a next-generation communications satellite. Program officials explained that this program has no DOD applications.

SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS

This appropriation request funds three programs--Shuttle Production and Operational Capability, Space Transportation Operations, and Space and Ground Network, Communications and Data Systems. The methods we used to further allocate NASA's breakout and a discussion of our differences with NASA's allocations follow.

Shuttle Production and Operational Capability

We agree with the \$8 million that NASA identified as civil supportive. This funds the Mission Control Center improvements at the Johnson Space Center to provide support for simultaneous orbiter operations (flights, tests, or simulations). According to NASA officials, these upgrades will support only civil missions as DOD is funding its own facility to support DOD missions.

The other \$1,457.6 million provides for the acquisition of the shuttle fleet and will benefit all shuttle users over the long term. According to the 10-year shuttle flight schedule, DOD will require approximately 34 percent of the shuttle flights through 1994. Consequently, on the basis of this percentage, we allocated \$494.9 million as DOD supportive and \$962.7 million as civil supportive.

Space Transportation Operations

NASA requested \$1,339 million for Space Transportation Operations. This funding, in combination with shuttle user reimbursements, will provide support services for standard operational space shuttle flights through fiscal year 1987. NASA allocated the total amount to the civil and DOD category. However, we allocated \$59 million to the DOD category and \$1,280 million to the civil category. Each of the program elements is discussed below.

Flight Hardware

NASA allocated the entire \$758 million funding request as both civil and DOD supportive. However, we believe \$6.1 million of this amount is DOD supportive.

Through this program element, NASA generally pays for shuttle consumables (e.g., external tank, solid rocket boosters, propellants, etc.). According to NASA officials, these consumables are funded over a 3-year period (20 percent 2 years prior to launch, 35 percent 1 year prior to launch, and 45 percent in the launch year). Thus, only 45 percent of NASA's fiscal year 1985 budget request relates to fiscal year 1985 launches.

DOD reimbursements for shuttle use are intended to offset the consumables cost. Based on NASA figures, DOD reimbursements for the fiscal year 1985 launch are about \$13.7 million less than consumables costs. As a result, 45 percent of the \$13.7 million unrecouped costs or \$6.1 million is funded from NASA's 1985 funding request. We allocated the \$6.1 million as DOD supportive.

We categorized the remaining \$751.9 million as civil supportive because this portion relates to either NASA launches or NASA subsidies of foreign and commercial launches.

Flight Operations and Launch and Landing Operations

NASA allocated \$581 million to the civil and DOD category for these two program elements--\$316 million for Flight Operations and \$265 million for Launch and Landing Operations. We believe \$52.9 million of this \$581 million is DOD supportive and \$528.1 million is civil supportive.

NASA officials stated that the operational costs associated with these program elements are generally incurred in the year of launch. Of the 11 shuttle flights scheduled in fiscal year 1985, only 1, or about 9 percent, supports DOD. Using this percentage, we categorized \$52.9 million for these two program elements as DOD supportive and \$528.1 million as civil supportive.

Space and Ground Network, Communications and Data Systems

This program provides tracking, telemetry, command, and data acquisition support to all NASA flights. NASA allocated \$787 million to the civil support category and \$8.7 million to the civil and DOD support category. We made the same allocations.

The \$787 million funds NASA's tracking, communication, and data acquisition support for primarily non-DOD missions. Although DOD does occasionally use the capability, NASA officials said that such usage is reimbursed.

The \$8.7 million relates to ground network support for aeronautical programs managed by NASA's Ames Research Center. According to NASA officials, the \$8.7 million supports activities having both civil and DOD applications.

CONSTRUCTION OF FACILITIES

The Construction of Facilities appropriation provides contractual services for meeting the facility requirements for the space shuttle and its payload support operations. It also provides for the repair, rehabilitation, modification, and minor construction of other NASA facilities as well as for facility planning and design activities.

Based on our analysis of this appropriation request, we believe \$13.9 million, or 8.7 percent of the \$160 million, is DOD supportive. This \$13.9 million relates to four space shuttle facility projects and one aeronautical test facility project.

Space Shuttle Facilities

NASA's \$160 million budget request for Construction of Facilities includes \$31.2 million for four space shuttle facility projects. These four are (1) modifications to the site electrical

substation at the Johnson Space Center, (2) modifications to the test facility for the space shuttle main engine at the National Space Technology Laboratories, (3) construction of a solid rocket booster assembly and refurbishment facility at the Kennedy Space Center, and (4) construction of a shuttle logistics facility at the Kennedy Space Center.

We believe \$9.8 million of the \$31.2 million is DOD supportive. Based on NASA's 10-year shuttle flight schedule, DOD will require about 34 percent of all the shuttle flights. Using this percentage, we categorized \$7.2 million relating to the first three projects as DOD supportive. However, since the shuttle logistics facility will benefit only those shuttle flights launched from the Kennedy Space Center and since DOD will only require about 26 percent of these flights, we categorized \$2.6 million for this project as DOD supportive. We based our allocations on the fact that the shuttle projects will benefit all shuttle users over the long term and the fact that the shuttle flight schedule is NASA's best projection of long-term shuttle usage. NASA officials agreed that to the extent that the shuttle program supports DOD, the associated facilities can also be viewed as supporting DOD.

Aeronautical Test Facility

NASA's \$160 million budget request also includes \$13.8 million for modifications to an 8-foot high temperature tunnel at the Langley Research Center. These facility modifications will provide additional testing capability for both NASA and DOD. In fact, NASA officials explained that the sole reason NASA included this project in its fiscal year 1985 budget request was because of an urgent DOD requirement for the ramjet/scramjet and missile testing capability the modified tunnel will provide.

According to NASA officials, DOD will use the tunnel approximately 30 percent of the time. On the basis of this percentage, we categorized \$4.1 million as DOD supportive.