NASA

National Aeronautics and
Space Administration

Budget Estimates

FISCAL YEAR **1987**

Volume III

Research and Program Management

Special Analyses

CONTENTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1986 ESTIMATES

VOLUME III

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RESEARCH AND
PROGRAM
MANAGEMENT

SUMMARY
INFORMATION

THIS DOCUMENT DOES NOT REFLECT: (1) THE FY 1986 REDUCTIONS THAT ARE LIKELY TO RESULT UNDER THE BALANCED BUDGET AND EMERGENCY DEFICIT CONTROL ACT OF 1985; OR (2) THE EFFECTS RESULTING FROM THE LOSS OF THE CHALLENGER AND CREW ON JANUARY 28, 1986. PROPOSED CHANGES IN PROGRAM PLANS AND BUDGET ESTIMATES WILL BE TRANSMITTED LATER.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

GENERAL STATEMENT

The Research and Program Management appropriation provides funds for the performance and management of research, technology and test activities at NASA installations, and the planning, management and support of contractor research and development tasks necessary to meet the Nation's ongoing objectives in aeronautical and space research. The objectives of the activities funded by the Research and Program Management appropriation are to (1) provide the civil service staff with the technical and management skills, to conduct the full range of programs for which NASA is responsible, (2) provide base maintenance of facilities and manage its use in support of research and development programs, and (3) provide effective and efficient technical and administrative support for the research and development programs. For 1987, an appropriation of $1,441,000,000 is requested.

The Research and Program Management appropriation provides funding for the 21,800 permanent and temporary civil service personnel at eight major installations and Headquarters. This civil service workforce is NASA's most important resource and is vital to future space and aeronautics research activities. About seventy percent of the Research and Program Management appropriation provides for the salaries and related costs of this civil service workforce. Two percent of this appropriation is used for travel, critical to manage successfully the Agency's in-house and contracted programs. The remaining amount of the Research and Program Management appropriation provides for the research, test and operational facility support, and for related goods and services necessary to operate efficiently and effectively the NASA installations and to accomplish NASA's approved missions.

NASA field centers report to the Program Associate Administrator responsible for the major portion of their technical programs. The principal roles assigned each installation based on demonstrated capabilities and capacities to meet NASA's overall program goals are as follows:

Office of Space Flight:

Johnson Space Center: Management of the integrated Space Shuttle program, including orbiter production and operation; selection and training of astronauts and mission specialists; Space Transportation System Operations including mission planning, operational procedures and flight control; and management of the integrated Space Station program and definition/development of Space Station hardware.

Kennedy Space Center: Launch of Space Shuttle flights; management of the ground operational phase of the Space Transportation System; the preparation and launch of payloads on the Space Shuttle and expendable launch vehicles, and Space Station operational readiness planning.

Marshall Space Flight Center: Management of the Space Shuttle main engine, solid rocket booster and external tank projects; management of NASA's activities on the Spacelab project; management of large automated spacecraft projects such as the Hubble Space Telescope; conduct and development of experiments in materials processing in space; and definition/development of the Space Station common module and laboratory outfitting.

National Space Technoloqy Laboratories: Support Space Shuttle engine procurement and testing; Earth resources research and technology transfer; and provision of support service functions for other Government agencies located on site.

Office of Space Science and Applications

Goddard Space Flight Center: Development and operation of Earth orbital flight experiments and automated spacecraft to conduct scientific investigations and demonstrate practical applications; management of tracking and data acquisition activities for Earth orbital missions; management of the Delta launch vehicle program; management and launch of sounding rockets and balloons; operation of an instrumented flight range for aeronautical and space research; and definition/development of the Space Station platforms and payload accommodations. The Wallops Flight Facility is an operational element and component installation of the Goddard Space Flight Center.

Office of Aeronautics and Space Technology:

Ames Research Center: Conduct of short haul aircraft and rotorcraft research and technology; computational fluid dynamics; responsible for computational aerodynamics and for the Transatmospheric Research and Technology program; planetary probe research; life sciences; aeronautical flight research and testing; and operation of an alternate landing site for Space Shuttle operational missions. The Dryden Flight Research Facility, an operational element and component installation of Ames located in the Mojave Desert, is the site of advanced flight testing and Shuttle landings.

Lanqley Research Center: Conduct of long haul aircraft research and technology, emphasizing fuel conservation, safety and environmental effects; aerospace structures technology; environmental quality monitoring by remote sensing; advanced space systems technology; and responsible for research in the areas of structures and materials, guidance and controls and airframe/propulsion integration of the Transatmospheric Research and Technology program.

Lewis Research Center: Conduct of aeronautical and space propulsion research and technology; responsible for research on propulsion for the Transatmospheric Research and Technology program; space communications research and technology; space energy systems research and technology; definition/development of the Space Station power system; and development of the Centaur cryogenic upper stage for use in the Space Shuttle and management of the Centaur expendable launch vehicle program.

The 1987 budget provides the necessary resources to apply these in-house capabilities to program activities. Detailed data on funding requirements are provided in the section on each installation. A summary description of, and the funding required by functional category, include:

1. Personnel and Related Costs *($980,865,000):* Includes salaries and benefits, the government's contribution to medicare for NASA permanent and temporary civil service employees, and for personnel of other Government agencies detailed to NASA. This category also includes other personnel related costs, such as moving expenses (excluding the associated travel of people), recruiting and personnel investigation services provided by the Office of Personnel Management, and the training of NASA civil service employees.

2. Travel *($33,700,000):* Includes the cost of transportation, per diem, and related travel expenses of civil service employees who travel for the direction, coordination and management of all NASA program activities including overseas launch and tracking sites; for contract management; for flight mission support; for meetings and technical seminars and symposia; and for permanent and temporary relocations. Payments to interagency motor pools are included under Operation of Installation (Management and Operations).

3. Operation of Installation *($426,435,000):* Provides a broad range of services, supplies, and equipment in support of each center's institutional activities. These are divided into three major subfunctional areas: Facilities Services, covering the cost of rental of real property, maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities; Technical Services, covering the cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, covering the cost of administrative communications, printing, transportation, medical, supply, and related services. The amounts by major subcategory are as follows:

A. Facilities Services *($231,694,000):* Includes rental of real property; the cost of maintenance, repair and related activities for facilities and equipment; custodial services; minor modifications and alterations; and utilities services. The Hazardous Substances Release Assessment activity ($5,000,000) to conduct a review of environmental problems in a planned and orderly manner is included in this function in *1987.*

B. Technical Services (86,380,000): Includes the cost of general purpose automatic data processing for management activities; education and informational programs; shops and other essential technical services. The Automated Systems Development program ($7,500,000) to be initiated in 1987 is included here.

C. Management and Operations ($108,361,000) : Includes the cost of administrative communications; printing and reproduction; administrative supplies; general purpose materials and equipment; transportation of equipment and supplies (including payments to interagency motor pools) ; medical services and other support.

SUMMARY OF ME BUDGET PLAN BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs.....	954,592	973,813 1/	969,104	980,865
II. Travel.....	29,704	31,000	31,000	33,700
III. Operation of Installation.....	347,484	382,187	361,896	426,435
A. Facilities Services..	(176,808)	(212,273)	(199,150)	(231,694) 2/
B. Technical Services.....	(60,652)	(66,071)	(65,838)	(86,380) 3/
C. Management and Operations.. ..	(110,024)	(103,844)	(96,908)	(108,361)
Total..	1,331,780	1,387,000 1/	1,362,000	1,441,000

1/ Adjusted to include $42,000 to cover the cost of the pay freeze vs. originally proposed pay cut in FY 1986
2/ Includes $5,000 for Hazardous Substances Release Assessments
3/ Includes $7,500 for the agencywide Automated Systems Development Program

SUMMARY OF CHANGES FROM THE 1986 BUDGET ESTIMATE TO THE 1986 CURRENT ESTIMATE

Of the 1986 Research and Program Management request of $1,387,000,000 (adjusted for the civil service pay freeze in lieu of the planned 5% pay cut), $1,362,000,000 has been appropriated. The changes from the original request are summarized as follows:

	(Thousands of Dollars)
1986 Budget Estimate..	$1,345,000
Adjustment for the Pay Freeze in Lieu of the Planned 5% Pay Cut.....	42,000
Congressional Action.....	-25,000
Appropriation and FY 1986 Current Estimate..	$1,362,000

Of the $25.0 million reduction from the adjusted request $4.7 million will be accomplished by adjusting Personnel and Related Costs in order to meet the requirement to calculate salaries based on 2087 hours and a refinement of the overall cost estimate. In Operation of Installation, cost reductions totalling $20.3 million will be achieved by the delay and deferral of the purchases of supplies, materials, equipment and contractual effort and by the rephasing of obligation plans for support service contracts. These reductions place a burden on NASA in providing adequate institutional support to the research and development programs, but the actions planned are designed to mitigate adverse impact as much as possible.

BASIS OF THE 1987 ESTIMATE

The 1987 budget estimate of $1,441,000,000, an increase of $79.0 million over the current 1986 estimate provides for: the personnel and related costs of 21,800 full-time equivalent (FTE) civil service workyears; a minimum level of travel to support Agency missions and programs; support service contractor effort at the anticipated wage-rates; a full year obligations for such contracts; utility usage consistent with programmatic requirements at projected rates; and supplies, materials, equipment and other minor contracts and services at anticipated price levels. The 1987 Research and Program Management Budget provide for three specific items not in the 1986 plan: $7.4 million for procurement of badly .needed administrative computers at Langley, Lewis, Goddard, and Headquarters; $5.0 million for Hazardous Substances Release Assessments; and $7.5 million to begin an Automated Systems Development Program. The balance of the changes in this appropriation request reflect a constant level of operations at expected price levels.

The Research and Program Management appropriation request for 1987, by functional category is summarized as follows:

1. Personnel and Related Costs ($980,865,000): The 1987 estimate for Personnel and Related Costs is $11.8 million higher than 1986. It is based on 21,800 FTE workyears and reflects the alteration in the mix between reimbursed and direct costs of civil service; and the normal costs associated with within-grades, career development, merit pay, etc.

2. Travel ($33,700,000): Because the vast majority of NASA funds are spent out of house, travel for both programmatic and management purposes is integral to the effective and economical accomplishment of program objectives. In addition, because NASA's civil service workforce is so heavily technical (over 50 percent of NASA's permanent personnel are degreed scientists and engineers) travel to scientific and technical meetings, seminars and symposia is important for the interchange of information. In 1987, the growth in travel over 1986 is the increase associated with the expected costs at a level of travel commensurate with programmatic responsibilities.

3. Operation of Installation ($426,435,000): The 1987 plan provides for anticipated changes in the price levels of support service contractor wage rates and utility rates, the alteration in the funding plans from reimbursable launch vehicles activities, the full year obligation of support service contracts, and in the price levels for supplies, materials, and equipment. In addition, funds are requested for badly needed administrative computer upgrades and additions at Langley, Lewis, Goddard, and Headquarters; for hazardous substances release assessments; and for an Automated Systems Development Program. The amounts by subcategory are as follows:

A. Facilities Services ($231,694,000): The 1987 estimate, an increase of $32,544,000 over the 1986 current estimate, covers the full year obligation of support service contracts, and anticipated rate and price increases for utilities, support contractor wage rates, supplies, materials, equipment and minor contractual effort. In addition, $5.0 million is included for hazardous substances release assessment which will provide for a systematic and comprehensive evaluation of potential hazardous environmental areas at NASA centers and other controlled sites. Funding of this activity has become imperative because of recent legislative, executive and judicial actions in the environmental field.

B. Technical Services ($86,380,000): The $20,542,000 increase in 1987 covers anticipated support service contractor wage-rates, the full year obligation for such contracts, and the anticipated cost of supplies, materials, equipment and minor contractual effort. Of the increase, $7.4 million is requested for the replacement and/or upgrading of administrative computing facilities at Langley, Lewis, Goddard, and Headquarters; and $7.5 million is requested to begin an Automated Systems Development Program designed to share technology and experience on an agencpwide basis to increase efficiency and reduce costs in developing administrative automated information systems. The Automated Systems Development Program will enable NASA to meet requirements of the Paperwork Reduction Act of 1980 and to respond to Reform 88 initiatives.

C. Management and Operations ($108,361,000) : The $11,453,000 increase in this subcategory is the result of increased costs of supplies, materials, equipment and minor contractual effort, the anticipated change in support service contractor wage-rates, and the full year obligation of such contracts.

In summary, the 1987 budget requirement of $1,441,000,000 is to provide for 21,800 full-time equivalent civil service workyears and to support the activities at eight NASA installations and Headquarters, consistent with the Research and Development, Space Flight, Control and Data Communications, and Construction of Facilities program plans.

DETAIL OF CONTENTS BY FUNCTION

I. PERSONNEL AND ELATED COSTS

A. COMPENSATION AND BENEFITS:

1. Compensation:

a. Permanent Positions: This part of Personnel and Related Costs covers the salaries of the full-time permanent civil service workforce and is the largest piece of this functional category.

b. Other Than Full-Time Permanent Positions: This category includes the salaries of NASA's non-permanent workforce. Programs such as students participating in cooperative training, summer employment, youth opportunity, and temporary clerical support are covered in this category.

c. Reimbursable Detailees: In accordance with existing agreements, NASA reimburses the parent Federal organization for the salaries and related costs of persons detailed to NASA.

d. Overtime and Other Compensation: Overtime, holiday, post and night differential, and hazardous duty pay are included in this category. Also included are incentive awards for outstanding achievement and superior performance.

2. Benefits: In addition to compensation, NASA, as authorized and required by law, makes the employer's contribution to personnel benefits. These benefits include contributions to the Civil Service Retirement Fund, employees' life and health insurance, payments to the Medicare fund for permanent employees, and social security contributions for non-permanent personnel. Payments to the civil service retirement fund for re-employed annuitants and for severance pay to former employees involuntarily separated through no fault of their own are also included.

B. SUPPORTING COSTS:

1. Transfer of Personnel: Provided under this category are relocation costs required by law, such as the expenses of selling and buying a home, and the movement and storage of household goods.

2. Office of Personnel Management Services: The Office of Personnel Management is reimbursed for activities such as security investigations on new hires, recruitment advertising, and career-maturity surveys.

3. Personnel Training: Training is provided within the framework of the Government Employees Training Act of 1958. Part of the training costs consists of courses offered by other Government agencies, and the remainder provides for training through nongovernment sources.

11. TRAVEL

A. Program Travel:

The largest part of travel is for direction, coordination and management of program activities including international programs and activities. The complexity of the programs and the geographical distribution of NASA installations and contractors necessitate the need for this category of travel. As projects reach the flight stage, support is required for prelaunch activities, including overseas travel to launch and tracking sites. The amount of travel required for flight projects is significant as it is directly related to the number of systems and subsystems, the number of design reviews, and the number and complexity of the launches and associated ground operations.

B. Scientific and Technical Development Travel:

Travel to scientific and technical meetings and seminars permits employees engaged in research and development to participate in both Government sponsored and nongovernment sponsored activities. This participation allows personnel to benefit from exposure to technological advances which arise outside NASA, as well as allowing personnel to present both accomplishments and problems to their associates and provides for the dissemination of technical results to the United States community. Many of the Government sponsored meetings are working panels convened to solve certain problems for the benefit of the Government.

C. Manaaement and Operations Travel:

Management and operations travel provides for the direction and coordination of general management matters and travel by officials to review the status of programs. It includes travel by functional managers in such areas as personnel, financial management and procurement. This category also includes the cost of travel in and around the Installations; travel of unpaid members of research advisory committees; and initial duty station, permanent change of assignment, and other family travel expenses. Payments to interagency motor pools are included in the Operation of Installation function (Management and Operations subfunction).

III. OPERATION OF INSTALLATION

Operation of Installation provides a broad range of services, supplies, and equipment in support of the centers' institutional activities. These are divided into three major subfunctional areas: Facilities Services (the cost of renting real property, maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities); Technical Services (the cost of automatic data processing for management activities, and the cost of educational and information programs and technical shops supporting institutional activities); and Management and Operations (the cost of administrative communications, printing, transportation, medical, supply, and related services). A description of each major subfunction follows:

A. Facilities Services:

1. Rental of Real Property: Rental of real property includes the rental of building space directly by NASA or throuqh the General Services Administration to meet offsite office, warehousinq, and other requirements which cannot otherwise be provided in existing buildings at the NASA Installation. Most of the funding is required for rental of the NASA Headquarters complex of buildings in the District of Columbia, and nearby Maryland and Virginia that are either Government-owned or leased. NASA must provide rental payments to the General Services Administration in accordance with P.L. 92-313 for these facilities.

2. Maintenance and Related Activities: Maintenance and related activities include the recurring day-to-day maintenance of facilities (grounds, buildings, structures, etc.) and equipment accomplished by non-Civil Service personnel. This involves the mowing and care of grassy areas, care of trees and shrubs, elevators, cranes, pressure vessel inspections, painting and protective coatings, general buildings maintenance, and the maintenance of installed mechanical, electrical, and other systems. In addition, this item includes feasibility studies, project design, construction supervision, inspection, and other institutional facility engineering functions. Included also are any applicable costs associated with recurring facility work as well as materials, hardware, and equipment used in facility maintenance activities, whether accomplished by civil service personnel or contractors. In the cost of equipment, related maintenance and other services are reflected for office, shop, laboratory and other facilities equipment as well as administrative internal communications and television monitoring equipment.

3. Custodial Services: Custodial services include janitorial and building cleaning services, pest control, fire protection services, security services including badging and identification, lock and safe repair, trash and refuse handling, window blinds and light fixture cleaning, and laundry and dry cleaning of facility related items.

4. Utilities Services: Utilities services include the purchase of utilities such as electricity, natural gas, fuel oil, coal, steam, propane, and other fuel commodities as well as water and sewage treatment services. Also included are the related maintenance and operating costs of the utility plants and systems.

B. Technical Services:

1. Automatic Data Processing:

a. Equipment: This category provides for the lease, purchase and maintenance of general purpose data processing equipment which supports institutional operations at each installation. Excluded is equipment dedicated to specific research or operational systems which is funded from the Research and Development or the Space Flight, Control and Data Communications appropriations.

b. Operations: Operations services include programming, computer operations and related services for institutional applications including payroll, financial management, security, maintenance, personnel, logistics, and procurement records and reports.

2. Scientific and Technical Information and Educational Programs:

a. Libraries: The technical libraries are established to provide installation staff with books, periodicals, technical reports and other scientific documentation.

b. Education and Information Programs: The educational and informational programs provide for the documentation and dissemination of information about the Agency's programs to the general public, the educational community at the elementary and secondary levels, and the mass comnunications media. Assistance to the mass comnunications media includes the assembly and exposition of newsworthy material in support of requests in the form of press kits, news releases, television and radio information tapes and clips, and feature material.

c. Shop and Support Services: Shop and support services include general fabrication shops, reliability and quality assurance activities, safety, photographic services, graphics, and audio-visual material.

C. Management and Operations:

1. Administrative Communications: Included in this category are costs not dedicated to a specific program or project, and cover leased lines, long distance tolls (including FTS charges), teletype services, and local telephone service.

2. Printing and Reproduction: Included in this category are the costs for duplicating, blueprinting, microfilming, and other photographic reproductions. Also included in this category are Government Printing Office printing costs, contractual printing and the related composition and binding operations.

3. Transportation: Transportation services include the operation and maintenance of all general purpose motor vehicles used by both civil service and support contractor personnel. The cost of movement of supplies and equipment by commercial carriers and payments to interagency motor pools are also in this category.

4. Installation Common Services: Installation common services include support activities at each installation such as: occupational medicine and environmental health; mail service; supply management; patent services; administrative equipment; office supplies and materials; and postage.

DISTRIBUTION OF PERMANENT CIVIL SERVICE WORKYEARS BY INSTALLATION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
Johnson Space Center	3. 247	3. 201	3. 252	3. 253
Kennedy Space Center	2. 064	2. 054	2. 035	2. 030
Marshall Space Flight Center	3. 263	3. 229	3. 229	3. 234
National Space Technology Laboratories	114	106	119	119
Goddard Space Flight Center	3. 559	3. 569	3. 576	3. 576
Ames Research Center	2. 044	2. 001	2. 029	2. 029
Langley Research Center	2. 824	2. 808	2. 812	2. 812
Lewis Research Center	2. 647	2. 582	2. 655	2. 655
Headquarters	1. 267	1. 292	1. 242	1. 242
Inspector General	94	97	97	97
Subtotal. Full-Time Permanent Workyears	21. 123	20. 939	21. 046	21. 047
Other Than Full-Time Permanent Workyears	870	861	754	753
Total. Ceiling Controlled Civil Service	21. 993	21. 800	21. 800	21. 800

SUMMARY OF BUDGET PLAN BY INSTALLATION
(Thousands of Dollars)

Johnson Space Center	214. 811	220. 403	209. 987	218. 110
Kennedy Space Center	184. 488	193. 419	194. 700	208. 096
Marshall Space Flight Center	198. 069	202. 363	200. 095	203. 847
National Space Technology Laboratories	10. 669	11. 356	10. 907	11. 453
Goddard Space Flight Center	196. 857	206. 628	203. 930	214. 338
Ames Research Center	120. 290	127. 992	124. 698	133. 913
Langley Research Center	147. 122	154. 216	150. 029	155. 033
Lewis Research Center	137. 383	144. 785	142. 977	150. 320
Headquarters	116. 866	120. 020	119. 166	127. 896
Inspector General	5. 225	5. 818	5. 511	5. 494
Agencywide Activities	---	---	---	12. 500
Total. Research and Program Management	1.331. 780	1.387.000 1/	1.362. 000	1.441. 000

1/ Includes add-back of $42. 000 for the pay freeze vs. a pay cut in FY 1986.

DISTRIBUTION OF PERMANENT CIVIL SERVICE WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	11.762	12.470	12.596	12.853
Space Station	1.164	1.830	1.768	2.128
Space Transportation Capability Development	1.447	1.367	1.487	1.504
Space Science and Applications	4.394	4.219	4.312	4.188
Physics and astronomy	2.414	2.334	2.460	2.252
Life sciences	287	251	253	251
Planetary exploration	191	179	181	180
Space applications	1.502	1.455	1.418	1.505
Commercial Programs	67	107	110	118
Technology Utilization	40	45	39	37
Commercial Use of Space	27	62	71	81
Aeronautics and Space Technology	4.661	4.916	4,889	4.885
Aeronautical research and technology	3.485	3.561	3.595	3.418
Space research and technology	1.176	1.355	1.294	1.275
Trans-atmospheric Research and Technology	---	---	---	192
Tracking and Data Acquisition	29	31	30	30
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS	4.493	3.838	3.868	3,613
Shuttle Production and Operational Capability	1.097	813	886	735
Space Transportation Operations	2;727	2.339	2.328	2.234
Space and Ground Network. Communications and Data Systems	669	686	654	644
Subtotal. Direct	16.255	16.308	16.464	16.466
CENTER MANAGEMENT AND OPERATIONS SUPPORT	4.868	4.631	4.582	4.581
Subtotal. full-time permanents	21.123	20.939	21.046	21.047
Other than full-time permanents	870	861	754	753
Total. Permanent Positions	21.993	21.800	21.800	21.800

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1987 ESTIMATES
RESEARCH AND PROGRAM MANAGEMENT
DISTRIBUTION OF BUDGET PLAN BY FUNCTION BY INSTALLATION

(THOUSANDS OF DOLLARS)

FUNCTION	TOTAL NASA	JOHNSON SPACE CENTER	KENNEDY SPACE CENTER	MARSHALL SPACE FLIGHT CENTER	NATIONAL SPACE TECHNOLOGY LABORATORIES	GODDARD SPACE FLIGHT CENTER	AMES RESEARCH CENTER	LANGLEY RESEARCH CENTER	LEWIS RESEARCH CENTER	HEADQUARTERS	INSPECTOR GENERAL	AGENCYWIDE ACT
PERSONNEL AND RELATED COSTS												
1985 ACTUAL	954,592	155,283	92,462	149,458	5,813	154,834	93,439	116,525	10 068	72,774	4,736	
1986 BUDGET	973,813	155,988	94,551	151,341	5,104	160,724	93,756	119,762	11 741	74,609	5,237	
1986 CURRENT	969,104	156,506	93,999	150,523	5,142	160,859	94,564	117,556	11 482	73,519	4,954	
1987 ESTIMATE	980,865	157,729	96,006	152,178	5,193	162,915	96,698	118,595	11,842	73,701	5.008	
TRAVEL												
1985 ACTUAL	29,704	4,756	2,510	5,075	190	4,458	2,513	2,735	2,626	4,623	218	
1986 BUDGET	31,000	4,963	2,350	5,300	200	4,314	2,720	3,175	2,726	5,000	252	
1986 CURRENT	31,000	4,808	2,464	5,228	200	4,600	2,717	2,935	2,622	5,187	239	
1987 ESTIMATE	33,700	5,350	2,870	5,670	210	4,900	2,983	3,220	2,897	5,355	245	
OPERATION OF INSTALLATION												
1985 ACTUAL	347,484	54,772	89,516	43,536	5,466	37,565	24,338	2[illegible] 82	2[illegible] 68	39,469	271	
1986 BUDGET	382,187	59,852	96,518	45,722	6,052	41,590	31,516	3[illegible] 29	2[illegible] 31	40,411	329	
1986 CURRENT	361,896	48,673	98,237	44,344	5,565	38,471	27,417	2[illegible] 58	2[illegible] 87	40,460	318	
1987 ESTIMATE	426,435	55,031	109,220	45,999	6,050	46,523	34,232	3[illegible] 28	3[illegible] 58	48,840	241	12,500
TOTAL												
1985 ACTUAL	1,331,780	214,811	184,488	198,069	10,669	196,857	120,290	147,122	137,383	116,866	5,225	
1986 BUDGET	1,387,000	220,403	193,419	202,363	11,356	206,628	127,992	154,216	144,785	120,020	5,818	
1986 CURRENT	1,362,000	209,987	194,700	200,095	10,907	203,930	124,698	150,029	142,977	119,166	5,511	
1987 ESTIMATE	1,441,000	218,110	208,096	203,847	11,453	214,338	133,913	155,833	150,320	127,896	5,494	12,500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

RESEARCH AND PROGRAM MANAGEMENT

For necessary expenses of research in Government laboratories, management of programs and other activities of the National Aeronautics and Space Administration, not otherwise provided for, including uniforms or allowances therefor, as authorized by law (5 U.S.C. 5901-5902); awards; lease, hire, maintenance and operation of administrative aircraft; purchase (not to exceed thirty-three for replacement only, and hire of passenger motor vehicles; and maintenance and repair of real and personal property, and not in excess of $100,000 per project for construction of new facilities and additions to existing facilities, repairs, and rehabilitation and modification of facilities; [$1,367,000,000] ***$1,441,000,000: Provided,*** That contracts may be entered into under this appropriation for maintenance and operation of facilities, and for other services, to be provided during the next fiscal year: ***Provided further,*** That not to exceed $35,000 of the foregoing amount shall be available for scientific consultations or extraordinary expense, to be expended upon the approval or authority of the Administrator and his determination shall be final and conclusive[: ***Provided further.*** That of funds provided for the National Aeronautics and Space Administration under this or any other account, 5400,000 shall be available for the activities of the National Commission on Space, established by the National Aeronautics and Space Administration Authorization Act, 1985 (Public Law 98–361; 98 Stat. 422)).

[SEC. 416. Notwithstanding any other provision of this Act, amounts otherwise provided by this Act for the following accounts and activities are reduced by the following amounts:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

"Research and program management", $5,000,000;] *(Department of Housing and Urban Development-Independent Agencies Appropriations Act, 1986; additional authorizing legislation to be proposed.)*

INSTALLATION
JUSTIFICATION

JOHNSON
SPACE CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

LYNDON E. JOHNSON SPACE CENTER

DESCRIPTION

The Lyndon B. Johnson Space Center (JSC) is located approximately 20 miles southeast of downtown Houston, Texas. Total NASA-owned land at the Houston site consists of 1,647 acres. The Center also utilizes an additional 54,080 acres at the White Sands Test Facility, Las Cruces, New Mexico. The total capital investment of the JSC, including fixed assets in progress and contractor-held facilities at various locations and the White Sands Test Facility, as of September 30, 1985 was $828,157,000.

CENTER ROLES AND MISSIONS

JSC was established in November 1961, in response to the need in NASA for a Center to manage the design, development and manufacture of manned spacecraft; for selection and training of astronaut crews; and the conduct of manned space flight missions. This need continued as the Nation proceeded toward more ambitious undertakings such as the Apollo program, the Skylab program, the Apollo-Soyuz Test Project, the Space Shuttle program, and currently the Space Station program. To meet this responsibility, JSC has developed unique areas of recognized technical excellence within the civil service staff and facilities of superior merit, which constitute a National resource. The principal and supporting roles are:

Space Station - lead center for management of the definiton phase contracts, in-house systems engineering and integration, utilization, advanced technology development, focused technology and operational readiness. Includes station configuration management, station subsystem development and overall system design.

Manned Vehicles - development of manned space vehicles and associated supporting technology, including:

Space Shuttle Production and Operations Capability - development of the Orbiter and lead Center for management of the Shuttle system; including Shuttle configuration management, Shuttle engineering and Orbiter operational procurement.

STS Operations - operational planning, crew selection and training, medical operations, STS flight control, experiment/payload flight control for attached payloads and STS utilization planning/payload accommodation studies.

Environmental and Crew Support Systems - develop and demonstrate Environmental Control and Life Support Subsystems (ECLSS) and Extravehicular Activity (EVA) systems suitable for STS and other advanced needs.

Environmental Effects Analysis - manage efforts to develop the data base and conduct analyses to ascertain any environmental impact of STS operations.

Supporting Technology Advanced Developments - development of prototypes, long lead time systems and new procedures and software for advanced systems.

Advanced Missions - manage studies to define advanced transportation and orbital systems.

Life Sciences:

Medical Research - establish human baseline data, investigate and develop countermeasures to solve space medicine problems, and develop information techniques and equipment to support medical operation and medical experiments.

Food Systems Technology - develop nutritional requirements and food processing systems in support of human space flight.

Spacelab Payload - development of Spacelab life sciences research capability through common operating research equipment development; definition and development of in-flight biomedical experiments.

Lunar and Planetary Geosciences - develop and maintain technical discipline base for lunar and planetary geosciences and planetary materials handling techniques.

Technology Experiments in Space - manage the Orbiter experiments program; definition and development of experiments in areas consistent with other JSC space roles.

Remote Sensing - Testing spaceborne instruments used to measure various phenomena on or above the Earth from space. Includes development of techniques to process and understand the data received and to use it.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)		
I.	Personnel and Related Costs	155,283	155,988	156,506	157,729
II.	Travel	4,756	4,963	4,808	5,350
III.	Operation of Installation	54,772	59,452	48,673	55,031
	A. Facilities Services	(27,912)	(33,911)	(28,990)	(32,767)
	B. Technical Services	(8,521)	(8,916)	(7,983)	(8,560)
	C. Management and Operations	(18,339)	(16,625)	(11,700)	(13,704)
	Total, fund requirements	214,811	220,403	209,987	218,110

DISTRIBUTION OF PERMANENT WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	1,168	1,319	1,470	1,565
Space Station	422	620	714	815
Space Transportation Capability Development	530	489	572	563
Space Science and Applications	181	146	141	142
Physics and Astromony	24	0	25	25
Life Sciences	117	85	76	73
Planetary Exploration	33	31	33	33
Space Applications	7	30	7	11
Commercial Programs	2	6	7	6
Technology Utilization	1	1	2	1
Commercial Use of Space	1	5	5	5
Aeronautics and Space Technology	33	58	36	39
Aeronautical	0	5	1	1
Space	33	53	35	38
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS	1,550	1,394	1,313	1,219
Shuttle Production and Operations Capability	417	388	409	363
Space Transportation Operations	1,133	1,006	904	856
Total, direct workyears	2,718	2,713	2,783	2,784
CENTER MANAGEMENT AND OPERATIONS SUPPORT	529	488	469	469
Total, Full-time workyears	3,247	3,201	3,252	3,253
Other than Full-time	130	100	90	89
Total, workyears	3,377	3,301	3,342	3,342

PROGRAM DESCRIPTION

	Permanent Civil Service Workyears
RESEARCH AND DEVELOPMENT	
SPACE STATION	815

The fiscal year 1987 staffing provides for the necessary management activities to support the Space Station through the program definiton phase and initial development efforts for which JSC is responsible. It also provides for the continuing effort required in systems engineering and integration (SE&I), advanced technology development, focused technology, utilization, and operational readiness necessary to provide products to the definition and preliminary design contractors.

The Space Station program requires a coordinated effort across disciplines to insure that all functions are adequately addressed in the definition phase. NASA has made a commitment to undertake the SE&I of the total Space Station with civil servants, whereas on past programs, a majority of this effort was performed by contractors. This is necessary due to the lack of precedent for coordinating such a highly complex array of systems and sub-systems with the varied and intricate organizational structures involved in this program. SE&I products will provide the capability for simulations of docking and berthing, on-orbit assembly of large structures, total on-orbit operational simulations, integration of various elements such as the Space Transportation System (STS), Orbit Maneuvering Vehicle/Orbital Transfer Vehicle (OMV/OTV) and the systems, manipulators, extra-vehicular activity (EVA), human productivity, and applications software as well as management of the definition efforts pertaining to the overall structures and architecture of the Space Station systems, outfitting of the habitation module, definition of the EVA requirements, thermal management, mechanisms, airlock, data management, communications and tracking. In addition, JSC is responsible for the overall resources integration and analysis of all these efforts.

Utilization efforts will continue to develop and identify potential users and define functional and user requirements based on the payload needs for science, commercial and technology development missions, which will drive the design of the overall Space Station systems capabilities to provide user friendly and cost effective services.

Operational readiness of the Space Station will be dependent on the systems developed to support ground and on-orbit requirements. The integration of technical and user requirements to support long-term systems functions necessitate the beginning of operational readiness early in the life of the Space Station.

Crew involvement in the definition process provides insight into future payload operations on the Space Station as will defining Station and STS interfaces.

	Permanent Civil Service Workyears
SPACE TRANSPORTATION CAPABILITY DEVELOPMENT.....	563

The support of the Spacelab development effort includes establishing and controlling Shuttle interface with the Spacelab for overall safety requirements for the Shuttle/Spacelab, and support of the Marshall Space Flight Center in the performance of its assigned responsibilities. JSC is responsible for drew mission training in conjunction with flight hardware and the development and operation of Shuttle/Spacelab simulators and trainers, as well as Spacelab support resident in the Orbiter general purpose computer.

Payload integration activities involve both the upper stages project and the tethered satellite system. For the upper stages, duties include the efforts necessary to integrate the interface between the Orbiter and the payload. JSC is involved with planning the integration of the Interim Upper Stage, the Centaur G and G prime, the Transfer Orbit Stage, and the Payload Assist Module. JSC provides the support of payload-unique integration requirements to the Tethered Satellite System.

Payloads operations and support equipment provide optional services for payloads. These efforts involve performing analytical tasks for the payloads that require special analysis, and the building of modification of hardware for unique payloads, hardware that supports specific classes of payloads, or hardware that provides interfaces between the payload and the Orbiter.

The advanced programs activities at JSC are planned and administered to support current and future Agency programs. Major activities at JSC are designed to promote more efficient operations of the STS and emphasis has been placed on developing and enhancing satellite services to improve utilization of the Orbiter vehicle. Support to the development of upper stages and the integration of payloads have been and will continue to be major tasks of interest. Supporting technology activities are conducted to advance the use of artificial intelligence and its applications in pursuance of NASA's goals.

	Permanent Civil Service Workyears
SPACE SCIENCE AND APPLICATIONS	
PHYSICS AND ASTRONOMY	25

JSC has the role of mission manager for the Spacelab flights, and of providing mission support. This includes the integration of all physics and astronomy experiments that are placed in the Spacelab modules, pallets, and in the mid-deck. JSC integrates the experiments into other Spacelab pallets, such as the OAST Multi Purpose Experiment Structure (MPES) Pallet and the large format camera. In some cases, JSC also designs and develops the individual experiments to be used on the missions.

LIFE SCIENCES	73

The Center has the lead role in evaluating human physiological changes associated with the space environment and providing effective countermeasures to assure crew health and optimal performance, e.g., the Space Adaption Syndrome (SAS) activity which focuses on investigating the potential problems the Space Shuttle crew have in adjusting to the weightless environment of space. These experiments are also designed to utilize the space environment to accomplish medical and biological research.

PLANETARY EXPLORATION	33

The Center supports the Agency's planetary exploration program in the area of geosciences where a strong, active research group is required to support future programs, provide curatorial support, assist in information dissemination and interact with outside scientists. To provide this support, the research group pursues research on the compositions, structures and evolutionary histories of the solid bodies of the solar system. The Center has an ongoing program of analysis of planetary materials and of remote sensing data, a theoretical studies program and a program which is involved in the development of remote sensing instrumentation. The definition of geoscience requirements for future planetary flight missions involves extensive interaction with the planetary science community.

SPACE APPLICATIONS	11

Space applications flight projects responsibilities at JSC center around Shuttle payload instrument development. Responding to airborne measurement requirements, JSC is also developing and implementing an aircraft sensors plan involving testing, maintenance, and operation of a wide variety of report sensors to provide data to investigators. JSC is assigned mission management responsibilities for the Earthward-looking remote sensing Shuttle missions SRL-2 and SRL-3. This includes the mission planning, real-time mission control, mission requirements definition, and experiment integration.

	Permanent Civil Service Workyears
COMMERCIAL PROGRAMS	
TECHNOLOGY UTILIZATION	1

The Technology Utilization program transfers new knowledge and innovative technology resulting from NASA's research and development programs for application by the private and public sector.

COMMERCIAL USE OF SPACE	5

The objective of Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology space-based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use of and access to space.

AERONAUTICS AND SPACE TECHNOLOGY	
AERONAUTICAL RESEARCH AND TECHNOLOGY	1

The Center is continuing its joint effort with the Langley Research Center on a study for the development of Advanced Information Processing Systems (AIPS) architecture which will provide the highly reliable redundancy management required in distributed processing systems of future aircraft and space flight control systems.

SPACE RESEARCH AND TECHNOLOGY	38

JSC is undertaking the study of a family of technologies for space station subsystems and improved STS operations. The technologies include: improvement of man-machine interactions in space, advanced thermal concepts, evaluation of ADA language in NASA flight systems, environmentally controlled life support systems efficiencies, development of docking/berthing systems required for large space systems, data system architecture designs, and methodologies to improve cost effectiveness of guidance, navigation and control (GN&C) systems. In addition, space research and technology activities include space energy conversion, space flight systems, materials and structures and systems analysis.

Permanent Civil
Service Workyears

SPACE FLIGHT, CONTROL, AND DATA COMMUNICATIONS

SHUTTLE PRODUCTION AND OPERATIONAL CAPABILITY..... **363**

Activities consistent with the launch schedule and procurement of necessary flight and ground support equipment will be continued. The National Space Transportation System Program Office of JSC has program management responsibility for program control, overall systems engineering, and Space Shuttle system integration. Management of the "lead center" functions as related to the Space Shuttle and overall management of the production of the orbiter system is provided. This includes management of various orbiter systems (e.g., structures, propulsion, power, avionics, etc.) and to lower selected elements within the subsystems. Sustaining engineering for individual subsystems (line replaceable units such as the fuel cells and remote manipulator) of operational flight hardware will begin transitioning to the Kennedy Space Center during **1986.** JSC is responsible for management of a relatively large quantity of supporting equipment. Examples of such equipment are: extra-vehicular mobility unit, closed circuit television, survival radio sets, dosimetry, crew equipment, photographic camera systems, and bioinstrumentation.

To integrate all vehicle systems into an efficient operating system, many detailed interfaces and functional performance features must be identified and defined. Specific interface control documents are identified and established, including both flight systems and flight to ground system. General capability and performance criteria are established for special areas of consideration such as electromagnetic compatibility and lightning protection. Systems operations require the preparation of systems performance data and operations information.

Since the Orbiter represents an integrated complex of technical and engineering disciplines, specific subtasks have been assigned to a variety of technical organizations at JSC. Included in these tasks are: providing technical expertise in the Orbiter life support systems; performing engineering analysis and performance evaluation for communication and tracking systems ground testing; providing expertise in guidance, navigation, control, instrumentation and electrical power distribution; analysis of vehicle attachment and separation systems; analysis of total Shuttle systems, Shuttle/payload interface, crew station evaluation, and engineering analysis to determine overall vehicle performance characteristics in the area of aerodynamic performance, flight characteristics, performance, and dynamics including aeroelasticity.

The successful flight and operational performance of the Space Shuttle is dependent on the proper functioning of integrated electronic equipment. Collectively, these are termed the Integrated Avionics System. Avionics provides the Shuttle pilots and crew with the total assessment and command capability necessary to fly, and operate the vehicle. Because of the critical nature of this system, very close attention is given to the identification of performance requirements and integrated performance.

A variety of avionic elements are included within the Space Shuttle system, each of which requires the attention of a group of technical experts. These elements include: guidance, navigation and control, data processing, communication and tracking, instrumentation, displays and control, solid rocket booster interface, electrical power distribution and control, and external tank instrumentation interface.

	Permanent Civil Service Workyears
SPACE TRANSPORTATION OPERATIONS	856

Space transportation operations staffing provides for Shuttle operational flight program management including vehicle system integration; Mission Control Center (MCC) operations; crew equipment and crew training; flight mission planning and operations; and procurement of orbiter flight spares and hardware. The management and procurement of orbiter flight spares will transition to Kennedy Space Center during 1986.

Mission flight support includes a wide variety of planning activities ranging from operational concepts and techniques to detailed systems operational procedures and checklists. Tasks include preparation of development system and software handbooks, flight rules, detailed crew activity plans and procedures, development of MCC and network systems requirements, and operations input to the planning for the selection and operation of Shuttle payloads.

Operations flight design includes: the identification of operational requirements for the design of planned and improved spacecraft systems; the development of flight techniques for utilization of these systems; and the development of nominal and contingency flight profiles for all Shuttle missions. This covers conceptual level profile development and analysis, beginning about two years before the flight, and operational profile development and analysis, accomplished immediately prior to the flight. The software activities for operational flights also include the continued development, definition, and verification support of the guidance, targeting, and navigation systems software requirements of the Orbiter and MCC. Software changes for Orbiter improvements will upgrade vehicle capabilities and performance.

Specific flight planning activity encompasses the flight design, flight analysis, and software activities. The flight design tasks include supporting the crew training simulations and development of flight techniques. Flight design products include conceptual flight profiles and operational flight profiles which are issued for each flight. The software activities include the development, formulation,

and verification support for the guidance, targeting, and navigation systems software requirements in the Orbiter and MCC. In addition, the flight dependent data co-located in the eraseable memory (mission-to-mission changes) is developed from the flight design process for incorporation into the Orbiter software and MCC systems.

Avionics and software testing and checkout in the Electronics Systems Test Laboratory and the Shuttle Avionics Integration Laboratory will continue. The purpose of these laboratories is to verify the functional performance of the Shuttle Integrated Avionics Systems, validate the system design, and verify compatibility of the various radio frequency communication links.

Orbiter avionics software development will provide payload support. This will include general capabilities for Spacelab and Upper Stages, with flexibility available to implement specific payload requirements as optional services.

Reconfiguration tools (hardware and software systems) to permit support of the high flight rates are being implemented in the Shuttle Mission Simulator complex and procedures training facility. The capability for near-continuous training of a number of flight crews for different types of missions with different payload requirements and on different Orbiters requires management and utilization of a very high volume of data. Therefore, automated tools are essential to support this pace of training. In addition, simulator system upgrades must be continuously being made to keep up with changes to the Orbiter.

Furthermore, there is provision for rapid handling of mission-to-mission software changes (flight dependent data in eraseable memory) and associated verification on a "near production line" basis because of the greater mission rates. To accommodate the production-line type of work, emphasis is being place on software tools and the associated automatic data processing equipment hardware to support the Software Production Facility.

	Permanent Civil Service Workyears
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	*469*

Center Management and Operations Support is provided to all JSC organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved in this support include the following:

Director and Staff - The Center Director, Deputy Director and immediate staff, e.g, Comptroller, Legal, Personnel, Equal Opportunity, Technical Planning, and Public Affairs.

Management Support - Those who will provide information and control service supporting all levels of Center manaqement, both program and functional. Specific functions include resources and financial management, -program control, contracting and procurement, property management, and management systems and analysis.

Operations Support - Those who manage or provide for the operation and maintenance of institutional facilities, buildings, systems, and equipment, including those who provide technical services such as automatic data processing, reliability and quality assurance, medical care, and photographic support.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
I. PERSONNEL AND RELATED COSTS	**155.283**	**155.988**	**156.506**	**157.729**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	129.042	130.309	130.517	129.006
b. Other than full-time permanent	2.301	1.937	1.763	1.748
c. Reimbursable detailees	3.813	3.853	4.186	5.957
d. Overtime and other compensation	2,797	2.783	2.931	3.182
Subtotal. Compensation	137.953	138.882	139.397	139.893
2. Benefits	15.468	15.862	15.713	15.913
Subtotal. Compensation and Benefits	153.421	154.744	155.110	155.806
B. Supporting Costs				
1. Transfer of personnel	960	409	401	623
2. Personnel training	902	835	995	1.300
Subtotal. Supporting Costs	1.862	1.244	1.396	1.923
Total. Personnel and Related Costs	155.283	155.988	156.506	157.729

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
A. Compensation and Benefits	153,421	154,744	155,110	155,806
1. Compensation	137,953	138,882	139,397	139,893
a. Full-time permanent	129,042	130,309	130,517	129,006

The current estimate for 1986 reflects a change from the 1986 budget estimate due to the 1985 pay raise, cost increases associated with career advances.

Basis of Cost for Full-time Workyears

In 1987, the cost of full-time workyears will be $129,006,000.

Cost of full-time workyears in 1986		130,517
Cost increases in 1987		
Within grade and career advances		2,368
Full year cost of 1986 actions	1,199	
Part year cost of 1987 actions	1,169	
Cost decreases in 1987		-3,879
Full year effect of 1986 turnover savings	-2,581	
Part year effect of 1987 turnover	-1,298	
Cost of full-time permanent workyears in 1987		129,006

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent				
1. cost	2,301	1,858	1,763	1,748
2. Workyears	173	144	136	135

The distribution of 1986 workyears is as follows:

Distribution of Other than Full-Time Workvears

Program	Workyears
Development programs	78
Summer programs	0
Other temporary programs	11
Youth Opportunity Programs	46
Total	135

The reductions from the 1986 budget estimate and 1986 to 1987 are the result of a decrease in FTEs.

c. Reimbursable detailees	3,813	3,853	4,186	5,957

The miliary personnel detailed to the Johnson Space Center on a reimbursable basis are individuals experienced in manned space flight and related fields. Each individual performs a function essential and critical to current and future programs. The increase from the 1986 budget estimate to the 1986 current estimate is due to a revision of reimbursable rates plus the increase of one detailee. FY 1987 is higher due to the inclusion of additional military retirement costs in the rates, plus one additional detailee.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		'(Thousands	of Dollars)	
d. Overtime and other compensation.....	2,797	2,783	2,931	3,182

Overtime in 1987 will be used primarily in support of Shuttle flights; e.g., crew training, trajectory optimization, data reduction integration laboratory, and related support activities. The increase from the 1986 estimate to the 1986 current estimate reflects 1985 experience and the increased Shuttle flight rate. The increase in 1987 is likewise attributed to the increased Shuttle flight rate.

2. Benefits.....	15,468	15,862	15.713	15,913

The following are the amounts of contribution by category:

Civil Service Retirement Fund.....	9,060	9,078	9,164	9,168
Employee Life Insurance.....	309	346	311	314
Employee Health Insurance.....	3,511	3,752	3,532	3,528
Workmen's Compensation.....	633	609	675	675
FICA.....	482	624	541	738
Medicare.....	1,435	1,431	1,452	1,452
Other benefits.....	38	22	38	38
Total.....	15,468	15,862	15,713	15,913

The changes from the 1986 budget estimate to the 1986 current estimates are due primarily to increased contributions to Civil Service retirement and Medicare based on the mix between permanent and non-permanent personnel. The increase in 1987 is due almost exclusively to social security contributions FICA for employees new to the Government system who do not contribute to Civil Service retirement.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. Supporting Costs	1,862	1,244	1,396	1,923
1. Transfer of Personnel	960	409	401	623

The transfer of personnel includes movement of household goods, subsistence and temporary expenses, real estate and miscellaneous moving expenses related to change of duty stations. The increase from the 1986 budget to FY 1987 reflects expected increases in the number of accessions.

2. Personnel Training	902	835	995	1,300

The purpose of the JSC training program is to continue to develop the skills and knowledge of civil service employees in order to maintain a state-of-the-art technology to more efficiently support JSC roles and missions. The change from the 1986 budget estimate to the 1986 current estimate reflects a small increase in the level of training, as well as an increase in projected tuituion and other costs. The 1987 change reflects increases in nearly all training categories.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**4,756**	**4,963**	**4,808**	**5,350**

Summary of Fund Requirements

A.	Program Travel	3,863	3,933	3,879	4,373
B.	Scientific and Technical Development Travel	351	507	370	390
C.	Management and Operations Travel	542	523	559	587
	Total, Travel	4,756	4,963	4,808	5,350

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		

Explanation of Fund Requirements

A. Program Travel.....	3,863	3,933	3,879	4,373

Program Travel is specifically required for the accomplishment of the Center's mission and accounts for approximately 82 percent of the travel budget for 1987. The 1986 and 1987 travel supports the planned increase of support to Space Station activities. All other program travel remains unchanged. Travel is required to support operations activity including launch, mission support, coordination of engineering and technical activities, and support of payload technical integration. The 1986 current estimate reflects reductions based on actuals for 1985 and approximately the same requirement level. The 1987 estimate reflects expected increases in transportation costs and increases in Space Station requirements.

B. Scientific and Technical Development Travel....	351	507	370	390

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. The reduction to the current estimate reflects lower requirements than previously expected. The increase in 1987 is for increased transportation costs.

C. Management and Operations Travel.....	542	523	559	587

Management and operations travel is used for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management, and procurement activities; travel of the Center's top management to NASA Headquarters and other NASA Centers; and local transportation. The increases from the 1986 budget estimate to the 1986 current estimate and 1987 reflect nominal airfare escalation.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
III. OPERATION Of INSTALLATION.....	**54,772**	**59,452**	**48,673**	**55,031**

Summary of Fund Requirements

A. Facilities Services.....	27,912	33,911	28,990	32,767
B. Technical Services.....	8,521	8,916	7,983	8,560
C. Management and Operations.	18,339	16,625	11,700	13,704
Total, Operation of Installation.....	54,772	59,452	48,673	55,031

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Center's institutional. activities. These are divided into three major functional areas: Facilities Services, the cost of maintaining and repairing institutional facilities and equipment, and the cost of 'custodial services and utilities; Technical Services, the cost of automatic data processing for management activities; and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, medical, supply, and related services.

The change from the 1986 budget estimate to the 1986 current estimate is primarily due to realignment of support contractor obligation plans, delays and deferrals in provision of goods and services to accommodate the reduction in the overall NASA R&PM appropriation and changes in communciations and logistics cost allocations to portray more accurately the cost of these services, along with a decrease in anticipated utility costs. The increase in 1987 is due to estimated contractor wage escalation, utilities consumption and rates, expected price levels for other goods and services, and the full year funding of support service contracts.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. **FACILITIES SERVICES**	**27,912**	**33,911**	**28,990**	**32,767**

This physical plant supports an average daily on-site population of approximately 8,200 personnel plus an additional 3,000 personnel located at nearby facilities and Ellington Air Force Base. These budget estimates also include resources associated with the physical plant requirements of the White Sands Test Facility and for facilities used at Ellington Air Force Base.

Summary of Fund Requirements

1. Maintenance and Related Services	9,397	11,368	8,530	10,987
2. Custodial Services	5,374	5,687	5,779	6,070
3. Utility Services	13,141	16,856	14,681	15,710
Total, Facilities services	27,912	33,911	28,990	32,767

Explanation of Fund Requirements

1. Maintenance and Related Services	9,397	11,368	8,530	10.987

This activity involves routine maintenance and facilities support for JSC at Houston, as well as White Sands Test Facility and Ellington Air Force Base, and includes such activities as support for utility systems; administrative office alterations and painting; ground maintenance; and other facility and system design and modification tasks.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			

The decrease from the 1986 budget estimate to the 1986 current estimate is the result of less than full year obligations of support service contract, and an overall reduction and deferral in facility maintenance and equipment replacement due to budget reductions. The increase in 1987 is due to contractor rate escalation, replacement of equipment and the full year funding of support service contracts.

2. Custodial Services.....	5,374	5,687	5,779	6,070

This activity involves support contractor effort at JSC to provide security guard services such as protection of government facilities, equipment, and classified information and badging for all on-site personnel and official visitors; janitorial services (including highly specialized cleanroom services); and fire protection services such as maintenance of alarms and fixed fire fighting equipment, and industrial safety and inspection. The increase from the 1986 budget estimate to the 1986 current estimate reflects current support service contractor wage rates. The increase in 1987 is due to escalation in contractor rates.

3. Utility Services.....	13,141	16,856	14,681	15,710

This category includes purchased utilities and support contractor effort for the operation and maintenance of the utility distribution system. The increase from the 1985 actual to the 1986 current estimate is the result of increased consumption due to occupancy of the modular office buildings that are to be completed in the second quarter of FY 1986. The net decrease from the 1986 budget estimate to the 1986 current estimate is due to lower utility cost rate based on 1985 experience offset by a higher expected utility consumption in 1986. The increase in 1987 is due to increased consumption to support planned Shuttle training and flight requirements, and the full year funding of support service contracts.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
B. TECHNICAL SERVICES	**8,521**	**8,916**	**7,983**	***8,560***
Summary of Fund Requirements				
1. Automatic Data Processing..	4,969	4,955	4,560	4,912
a. Equipment	0	595	452	480
b. Operations	4,969	4,360	4,108	4,432
2. Scientific and Technical Information	2,574	2,810	2,510	2,688
3. Shop and Support Services	978	1,151	913	960
Total, Technical Services	8,521	8,916	7,983	8,560
Explanation of Fund Reauirements				
1. Automatic Data Processing	4,969	4,955	4,560	4,912

This activity provides support to all JSC administrative ADP functions; included within this area are institutional portions of lease and maintenance costs of hardware systems within the Central Computer Facility, as well as contractor effort for computer programming, operations, keypunch, and other support personnel. The ADP systems supported include institutional management, finance and accounting, procurement, contract status and tracking, personnel management, and utility tracking than previously anticipated. The decrease from the 1986 budget estimate to the 1986 current estimate is due to lower than estimated support service contractor wage rate increases in 1986, and a rephasing of contract obligation plans. The 1987 increase reflects estimated support contractor rates for the contractor workforce needed to operate the administrative ADP systems and a full year funding of these contracts.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
2. Scientific and Technical Information.....	2,574	2,810	2,510	2,688

This activity provides for a public affairs educational and informational program and support to the Center in provision of various scientific and technical information services. Included in the public affairs program are: motion picture production from script to screen; film clip preparation; exhibit management and refurbishment; visitor orientation tours; lecturing; mail answering service; and other public affairs activities. The decrease from the 1986 budget estimate to the 1986 current estimate is due to lower than estimated support service contractor wage rate increases in 1986, and a rephasing of contract obligation plans. The increase in 1987 reflects expected contract rate increases.

3. Shop and Support Services.....	978	1,151	913	960

These funds provide for a support contractor who provides JSC graphics and photographic services. Graphic materials are prepared for use in presentations and senior management reviews. Various kinds of films are processed and reproductions and reprints made. The decrease from'the 1986 budget to the 1986 current estimate is due to reduction in contractor workyears. The increase in 1987 is due to contractor rate increase.

	1985 Actual	1986 Budqet Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. **MANAGEMENT AND OPERATIONS**	**18,339**	**16,625**	**11,700**	**13,704**
1. Administrative Communications	6,494	5,122	2,498	3,026
2. Printing and Reproduction	180	259	217	230
3. Transportation	2,521	2,566	2,160	2,283
4. Installation Common Services	9,144	8,678	6,825	8,165
Total, Management and Operations	18,339	16,625	11,700	13,704

Explanation of Fund Requirements

1. Administrative Communications	6,494	5,122	2,498	3,026

Communications support for JSC and WSTF consists of local. and long distance telephone service and other communications services. Local service includes Centrex lines and telephones at JSC and WSTF. Long distance service includes the cost for FTS, commercial toll calls, and a small number of dedicated voice circuits. Other communications services include teletype and wire news services; the operation and maintenance of a closed circuit TV system; and local radio networks for fire, security and custodial uses.

The reduction from the 1986 budget to the 1986 current estimate is due to the realignment of the funding of the Central Telecommunications System to reflect actual usage and the increased impact of data transmission. The change in 1987 is for an estimated rate increase.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Printing and Reproduction	180	259	217	230

Printing services are provided by on-site and off-site facilities. The on-site printing plant, operated by JSC personnel, produces approximately 60 million units each year. In addition to this on-site printing plant, JSC also purchases printing from private firms through Government Printing Office contracts, about 52,000,000 units each year. Purchased printing is overflow requirements that cannot be handled on-site, and printing which requires capabilities not avilable at the on-site plant. The decrease from 1986 budget to the 1986 current estimate is based on actual costs incurred in FY 1985 and anticipated FY 1986 requirements. The increase in 1987 is an increase in supplies and materials costs.

3. Transportation	2,521	2,566	2,160	2,283

Transportation includes administrative aircraft maintenance and fuel costs, lease of passenger vehicles and trucks, including GSA drivers and dispatchers and maintenance of vehicles. The reduction from the 1986 budget to the 1986 current estimate is due to an decrease in administrative aircraft specialized maintenance costs and realignment of truck lease rental costs. The increase in FY 1987 is due to expected increases in vehicle lease, fuel and maintenance costs.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
4. Installation Common Services.....	9,144	8,678	6,825	8,165

These services support center management and staff activities, provide medical services, and cover various installation support services. Center management and staff functions include legal, personnel, procurement, and EEO activities. Medical services provided include occupational medicine and environmental health, consisting of the operation of the JSC on-site clinic; emergency assistance at Ellington Field; providing physicals for JSC personnel at Downey, California; medical consultation and crew test support; industrial hygiene; radiological health; and an environmental health laboratory. Installation support services include administrative supplies, materials and equipment at the Center and at White Sands Test Facility; JSC share of operating costs at Ellington Field and miscellaneous administrative support. The decrease from the 1986 budget to the 1986 current estimate is due to a decrease for the purchase of new and repair of existing administrative equipment, the realignment of logistical services, and a realignment in the obligation of support service contracts. The increase in 1987 results from anticipated price levels and the full year funding of support service contracts.

JOHNSON SPACE CENTER

STAFFING SUMMARY

	FY86	FY87
SES		59
GS/GM-15		207
GS/GM-14		455
ALL OTHER GS/GM		2469
WAGE GRADE		13
TOTAL		3283

DIRECTOR
DEPUTY DIRECTOR
ASSOCIATE DIRECTOR

	FY86	FY87
SES	4	4
GS/GM-15	1	1
GS/GM-14	0	0
ALL OTHER GS/GM	8	8
TOTAL	13	13

TECHNICAL PLANNING OFFICE

	FY86	FY87
SES	1	1
GS/GM-15	0	0
GS/GM-14	0	a
ALL OTHER GS/GM	0	a
TOTAL	1	1

NATIONAL SPACE TRANSPORTATION SYSTEM OFFICE

	FY86	FY87
SES	3	3
GS/GM-15	1	1
GS/GM-14	1	1
ILL OTHER GYM	13	13
TOTAL	18	18

PERSONNEL OFFICE

	FY86	FY87
SES	0	0
GS/GM-15	1	1
GS/GM-14	4	4
ALL OTHER GS/GM	45	45
TOTAL	50	50

EQUAL OPPORTUNITY PROGRAMS OFFICE

	FY86	FY87
GS/GM-14		
ALL OTHER GS/GM		
TOTAL	6	6

LEGAL OFFICE

	FY86	FY87
SES	1	1
GS/GM-15	2	2
GS/GM-14	6	6
ALL OTHER GS/GM	8	8
TOTAL	17	17

PUBLIC AFFAIRS OFFICE

	FY86	FY87
SES	1	1
GS/GM-15	0	0
GS/GM-14	3	3
ALL OTHER GS/GM	24	24
TOTAL	28	28

STS ORBITER AND GFE PROJECTS OFFICE

	FY86	FY87
SES	4	4
GS/GM-15	19	19
GS/GM-14	37	31
ALL OTHER GS/GM	62	62
TOTAL	122	122

STS INTEGRATION AND OPERATIONS OFFICE

	FY86	FY87
SES	4	4
GS/GM-15	22	22
GS/GM-14	41	41
ALL OTHER Gym	61	61
TOTAL	128	128

OFFICE OF THE COMPTROLLER

	FY16	FY87
SES	0	0
GS/GM-15	5	5
GS/GM-14	8	8
ALL OTHER GS/GM	83	83
TOTAL	96	96

SPACE STATION PROGRAM OFFICE

	FY86	FY87
SES	6	6
GS/GM-15	22	22
GS/GM-14	33	33
ALL OTHER GS/GM	107	107
TOTAL	168	168

SPACE STATION PROJECTS OFFICE

	FY86	FY87
SES	2	2
GS/GM-15	9	9
GS/GM-14	22	22
ALL OTHER GS/GM	34	34
TOTAL	61	61

DIRECTOR. SAFETY, RELIABILITY. AND QUALITY ASSURANCE

	FY86	FY87
SES	2	2
GS/GM-15	15	15
GS/GM-14	12	12
ALL OTHER GS/GM	110	110
TOTAL	139	139

DIRECTOR OF SPACE OPERATIONS

	FY86	FY87
SES	2	2
GS/GM-15	0	0
GS/GM-14	0	0
M L OTHER GS/GM	2	2
TOTAL	4	4

DIRECTOR OF RESEARCH AND ENGINEERING

	FY86	FY87
SES	1	1
GS/GM-15	0	0
GS/GM-14	2	2
ILL OTHER GS/GM	2	2
TOTAL	5	5

DIRECTOR OF CENTER SUPPORT

	FY86	FY87
SES	1	1
GS/GM-15	0	0
GS/GM-14	0	0
UL OTHER GS/GM	1	1
TOTAL	2	2

DIRECTOR. FLIGHT CREY OPERATIONS

	FY86	FY87
SES	3	3
GS/GM-15	30	30
GS/GM-14	18	18
ALL OTHER GS/GM	98	98
TOTAL	149	149

O IRECTOR. MISSION OPERATIONS

	FY86	FY87
SES	4	4
GS/GM-15	33	33
GS/GM-14	50	50
ALL OTHER GS/GM	354	354
TOTAL	441	441

O IRECTOR. MISSION SUPPORT

	FY86	FY87
SES	2	2
GS/GM-15	26	26
GS/GM-14	38	38
U L O M GS/GM	249	249
TOTAL	315	315

DIRECTOR. ENGINEERING

	FY86	FY87
SES	9	9
GS/GM-15	46	46
GS/GM-14	93	93
ALL OTHER GS/GM	469	469
TOTAL	617	617

O IRECTOR. SPACE AND LIFE SCIENCES

	FY86	FY87
SES	3	3
GS/GM-15	30	30
GS/GM-14	39	39
ALL OTHER GS/GM	167	167
TOTAL	239	239

O IRECTOR. ADMINISTRATION AND PROGRAM SUPPORT

	FY86	FY87
SES	3	3
GS/GM-15	14	14
GS/GM-14	26	26
ALL OTHER GS/GM	228	228
TOTAL	271	271

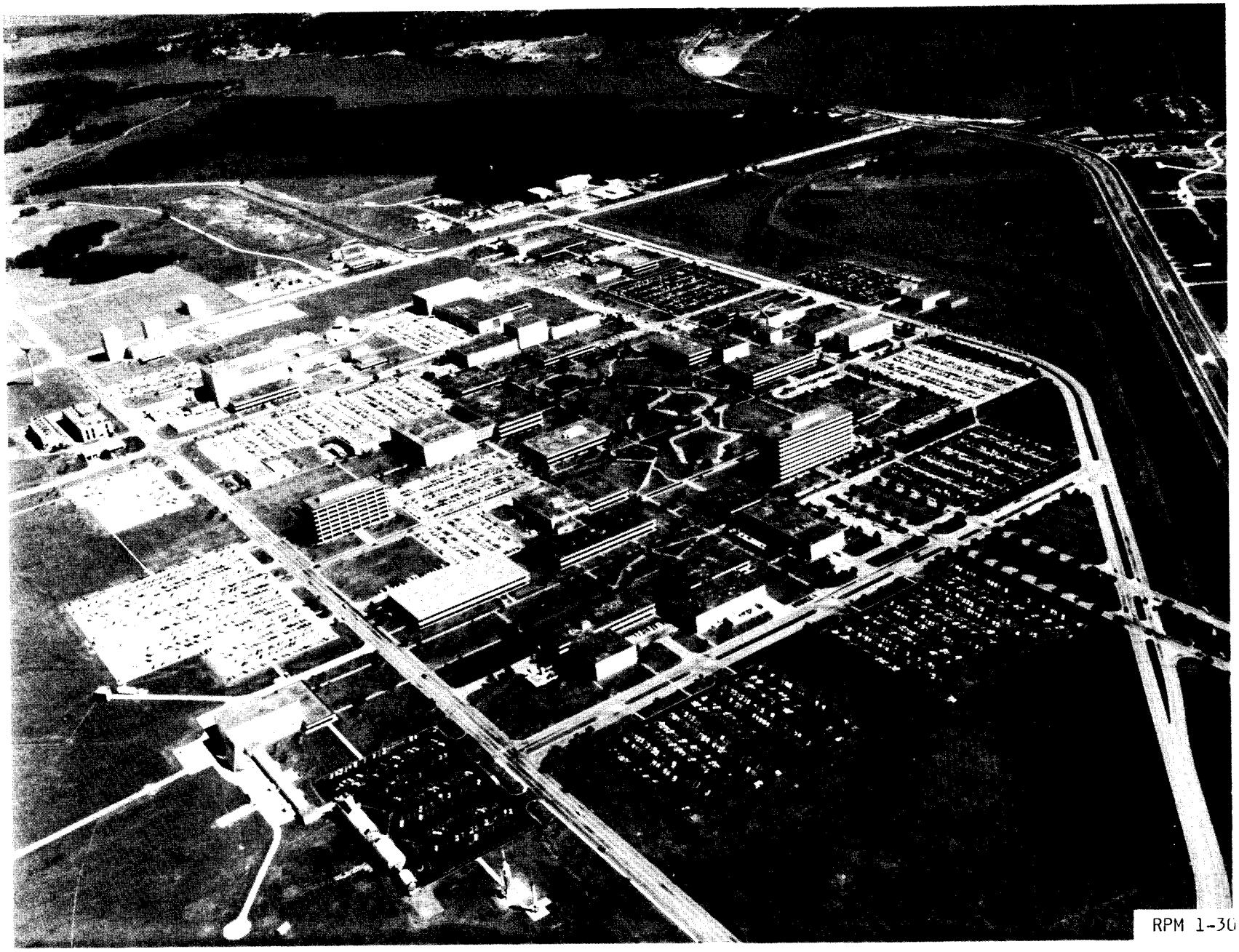
D IRECTOR. CENTER OPERATIONS

	FTW	FY87
SES	2	2
GS/GM-15	8	8
GS/GM-14	15	15
ALL OTHER GS/GM	304	304
WAGE GRADE	13	13
TOTAL	342	342

TRBTTEASANDSY

	FY86	FY87
SES	1	1
GS/GM-15	3	3
GS/GM-14	6	6
ALL OTHER GS/GM	35	35
TOTAL	45	45

Lyndon B. Johnson Space Center
Houston, Texas 77058



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KENNEDY
SPACE CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

JOHN F. KENNEDY SPACE CENTER

DESCRIPTION

The John F. Kennedy Space Center (KSC) is located 50 miles east of Orlando, Florida. The total land and water area occupied by the installation is 139,305 acres. NASA owns 82,943 acres of that total. The remainder is comprised of the Banana River Causeway Easement (271 acres), the Indian River Causeway Easement (296 acres), and Florida-owned submerged lands with Deed of Dedication (55,795 acres).

Space Shuttle flights began at KSC in 1981 and will begin at Vandenberg Air Force Base, California in 1986. Expendable launch vehicle operations are conducted at both the Air Force's Eastern Space and Missile Center, at Cape Canaveral Air Force Station, Florida, and the Western Space and Missile Center at Vandenberg Air Force Base, California, which is located six miles west of Lompoc, California. Activities at Vandenberg are accomplished within a host-tenant agreement with the Air Force.

The NASA capital investment at KSC, Cape Canaveral Air Force Station, and Vandenberg Air Force Base, including fixed assets in progress and contractor-held facilities as of September 30, 1985, was $1,677,523,000.

CENTER ROLES AND MISSIONS

The Launch Operations Center was established at Cape Canaveral, Florida, in July 1962 to serve as the primary NASA center for the test, checkout, and launch of space vehicles. In late 1963, it was named the John F. Kennedy Space Center and in 1964 the Center was relocated to Merritt Island. This site was chosen because of its unique geographical characteristics, climate, local growth capability, accessibility, and availability. The Center has since become the major free world launch site with a unique civil service staff of unparalleled expertise in the test, checkout, and launch of space vehicles and in the design of associated ground support equipment. The technical facilities developed at KSC represent a recognized national resource. The principal roles of the Center are:

Space Transportation System (STS) Ground Operations - includes Space Shuttle launch preparation, launch, landing and refurbishment; Spacelab and Spacelab payloads ground processing; Cargo/experiment integration and processing; upper stages ground processing; and operation and maintenance of ground support equipment. Orbiter sustaining engineering and logistics responsibilities will begin transitioning from the Johnson Space Center during 1986.

Expendable Launch Vehicle Operations - includes launch preparation, checkout and launch for the current inventory of launch vehicles on a reimbursable basis.

Space Station - Space Station effort at KSC will consist of activities in four major areas: utilization, advanced technology development, system engineering and integration, and operational readiness.

SUMMARY OF RESOURECES REQUIREMENTS

FUNDING PLAN BY FUNCTION

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
I.	Personnel and Related Costs.....	92,462	94,551	93,999	96,006
II.	Travel.....	2,510	2,350	2,464	2,870
III.	Operation of Installation.....	89,516	96,518	98,237	109,220
	A. Facilities Services..	(50,446)	(58,583)	(59,337)	(65,671)
	B. Technical Services..	(10,068)	(10,683)	(13,247)	(14,052)
	C. Management and Operations..	(29,002)	(27,252)	(25,653)	(29,497)
	Total, Fund Requirements	184,488	193,419	194,700	208,096

DISTRIBUTION OF PERMANENT CIVIL SERVICE WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	492	761	601	680
Space Station	65	366	146	244
Space Transportation Capability Development	273	271	312	310
Space Science & Applications	144	114	138	121
Physics & Astronomy	138	108	126	108
Life Sciences	6	6	12	13
Commercial Programs	5	5	5	5
Technology Utilization	2	2	2	2
Commercial Use of Space	3	3	3	3
Space Research and Technoloav	5	5	-	-
SPACE FLIGHT, CONTROL AND DATA COMMUNCIATIONS	1,062	800	946	862
Shuttle Production and Operational Capability	201	66	116	61
Space Transportation Operations	861	734	830	801
Subtotal, direct	1,554	1,561	1,547	1,542
CENTER MANAGEMENT AND OPERATIONS SUPPORT	510	493	488	488
Total, full-time workyears	2,064	2,054	2,035	2,030
Other than full-time workyears	89	90	82	82
Total, permanent workyears	2,153	2,144	2,117	2,112

PROGRAM DESCRIPTION

	Permanent Civil Service Workyears
RESEARCH AND DEVELOPMENT	
SPACE STATION	244

Space Station efforts will consist of definition and integration studies and activities in the areas of advanced technology development and operational readiness.

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT	310

The upper stages currently consist of the Inertial Upper Stage (IUS), Centaur, and the Payload Assist Module (PAM). These upper stages are expendable, propulsive stages intended for use in the deployment of Space Shuttle transported payloads to high energy orbits not attainable by the Space Shuttle alone.

The PAM has been developed, checked out and mated to a payload by the commercial developer, McDonnell Douglas. The Center has responsibility for integration of the PAM and its payload into the Shuttle payload bay. KSC is currently engaged in modifying the launch site facilities to accommodate the use of the Centaur as a Shuttle upper stage. These modifications, which affect all major launch facilities and in particular the launch pads and mobile launcher platforms, are planned for completion to support the Galileo and Ulysses missions in 1986.

The Center's role in the Spacelab program is similar to that of the Space Shuttle; that is, KSC is responsible for launch site development and for ground operations leading to the launch. KSC has responsibility for verifying that the Spacelab flight and ground systems are compatible with the Spacelab, with each other, and with safety requirements. During 1985, dedicated Spacelab flights included the second development flight and the first operational flight. The first Spacelab flight unit flew aboard STS-9 in November 1983.

KSC will provide facilities and support to the various customers during processing of their payload. KSC, in concert with other NASA organizations, must analyze potential payload users' requirements and activities. Based on experience gained during the Expendable Launch Vehicle program and thus far in the Shuttle program, KSC will monitor payload activity from conception; participate in design reviews to ensure compatibility with KSC facilities; and provide support coordination during the payload checkout and launch at KSC.

	Permanent Civil Service Workyears
PHYSICS AND ASTRONOMY	108

KSC is responsible for planning and coordinating the integration of the Spacelab experiment with the Spacelab hardware system (Level IV integration). Interfaces are established and maintained with the NASA discipline program offices, the principal investigators, and appropriate engineering groups to assure that scientific objectives of the mission are met.

LIFE SCIENCES	13

KSC will continue its support role in the definition, development and integration of biomedical experiments into Space Shuttle for life sciences research. Included is the responsibility for providing and managing a Life Sciences Principal Investigator Support Facility and assisting in the conduct of life sciences synchronous ground control experiments and procedures required for these payloads. Experiments are designed to use the environment of space to accomplish medical and biological research.

COMMERCIAL PROGRAMS

TECHNOLOGY UTILIZATION	2

The objective of the Technology Utilization program is to encourage the use of and to expedite the application of new NASA technology to private and public sectors outside the Agency.

COMMERCIAL USE OF SPACE	3

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology space-based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use of and access to space.

	Permanent Civil Service Workyears
SPACE FLIGHT, CONTROL AND DATA COMMUNCIATIONS	
SHUTTLE PRODUCTION AND OPERATIONAL CAPABILITY.....	61

With the *1986* initial use of Launch Pad B and Mobile Launch Platform *3,* construction of most new launch support facilities and modifications of most existing facilities will be complete. The design, modification or acquisition, installation and checkout of equipment and facilities to be used in support of increased launch rate requirements will continue. This includes equipment provided by KSC contractors, as well as equipment to be supplied by development contractors as part of their flight vehicle responsibilities.

The first Space Shuttle landed at KSC in February *1984.* Although installation and checkout of initial operational systems are complete and the ground support equipment installed, there are ongoing new. requirements and modifications to existing systems, including the Launch Processing System (LPS).

Support will continue for Launch Pad B construction activities, Launch Complex *39* modifications, and other modifications to facilities or equipment to meet Space Shuttle requirements including modification of existing facilities to support the Centaur upper stage program.

SPACE TRANSPORTATION **OPERATIONS**.....	*801*

The operations role includes the test and checkout of each flight element as it arrives for flight; the integration of the elements (Orbiter, External Tank, Solid Rocket Boosters and their subsystems) into the Space Shuttle vehicle, and the integrated testing of the stacked configuration, propellant loading, and launch. Subsequent to landing, the Orbiter is refurbished by KSC in preparation for the next mission. KSC is responsible for retrieval and disassembly of the expended Solid Rocket Boosters. The Center will also continue the refurbishment of selected existing support equipment for reuse in the Space Shuttle system. KSC is responsible for the operation and maintenance of worldwide contingency and secondary landing sites and for ferrying the Orbiter back to KSC.

Orbiter Vehicle (OV) 102, used in the orbital flight test program and for the first operational flight, was modified during *1983* at KSC for the initial Spacelab mission flown in November *1983.* Orbiter Vehicle *099* arrived at KSC in July *1982;* Orbiter Vehicle *103* arrived at Kennedy in late *1983;* and Orbiter Vehicle 104 arrived in *1985.*

The Center is responsible for the launch preparation, checkout, support coordination during the payload checkout, and launch of the current inventory of expendable launch vehicles. This includes the Atlas

Centaur and Delta vehicles. Launches at both the Eastern Space and Missle Center (ESMC) and Vandenberg Air Force Base (VAFB) are the responsibility of KSC.

CENTER MANAGEMENT AND OPERATIONS SUPPORT..... 488

Center Management and Operations Support provides support to all Kennedy Center organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved are:

Director and Staff - The Center Director, Deputy Director, and the immediate staff, e.g., Legal, Patent Counsel, Equal Opportunity, and Public Affairs.

Management Support - The part of the KSC civil service workforce that provides information and control services supporting all levels of center management, both program and functional. Specific functions include resources and financial management, program control, contracting and procurement, property managment, personnel management, and management systems and analysis.

Operations Support - The part of the KSC civil service workforce that provides for the operational and maintenance of institutional facilities, buildings, systems and equipment, including those who manage or provide technical services such as automatic data processing, reliability and quality assurance, medical care, and photographic support.

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		'(Thousands of	[redacted]	
I. PERSONNEL AND RELATED MSTS	***92.462***	***94.551***	***93.999***	***96.006***
Summary of Fund Requirements				
A. Compensation and Benefits	91. 337	93. 144	92. 202	93. 517
1. Compensation				
a. Permanent positions	77. 157	78. 640	77. 760	78. 691
b. Other than full-time permanent positions	1.492	1.533	1,526	1.503
c. Reimbursable detailees	87	48	54	85
d. Overtime and other compensation	3,053	2. 759	3. 190	3,468
Subtotal. Compensation	81. 789	82. 980	82. 530	83. 747
2. Benefits	9. 548	10,164	9. 672	9. 770
Subtotal. Compensation and Benefits	91. 337	93. 144	92. 202	93. 517
B. Supporting Costs				
1. Transfer of personnel	422	785	649	1.141
2. Personnel training	703	622	1,148	1.348
Subtotal. Supporting Cqsts	1.125	1.407	1.797	2.489
Total. Personnel and Related Costs	92. 462	94,551	93. 999	96. 006

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	91,337	93,144	92,202	93,517
1. Compensation	81,789	82,980	82,530	83,747
a. Permanent Positions	77,157	78,640	77,760	78,691

The current estimate for 1986 reflects a change from the 1986 budget estimate due to a refinement of the estimates.

Basis of Cost for Permanent Positions

In 1987, the cost of permanent positions will be $78,691,000, an increase of $931,000 over 1986. The increase is calculated as follows:

Cost of Full-time Permanent Workyears in 1986		77,760
Cost increases in 1987:		1,768
Within-grade and career advances:		
Full year cost of 1986 actions	879	
Part year cost of 1987 actions	484	
Change in reimbursements received	405	
Cost decreases in 1987		-837
Turnover savings and abolished positions:		
Full year cost of 1986 actions	-241	
Part year cost of 1987 actions	-596	
Cost of Full-time Permanent Workyears in 1987		78,691

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
(1) cost	1,492	1,533	1,526	1,503
(2) Workyears	120	121	113	113

The distribution of 1987 workyears is as follows:

Distribution of Other than Full-Time Permanent Workvears

Program	Workyears
Other temporary programs	76
Youth Opportunity Programs	31
Summer Program	6
Total	113

The increase in costs and the decrease in workyears from the 1986 budget estimate to the 1986 current estimate reflects a change in emphasis in this program. The program is now using fewer, but higher skilled, and therefore higher cost employees.

c. Reimbursable detailees	87	48	54	60

The military personnel detailed to Kennedy Space Center on a reimbursable basis are in the Shuttle Systems Engineering Office. The increase in the 1986 current estimate over the 1986 budget estimate is due to military pay raises. The 1987 estimate incorporates the cost of military retirement.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation	3,053	2,759	3,190	3,468

This item includes primarily overtime, holiday pay, night differential, Sunday premium and incentive awards. Changes are due to increases in the launch schedule.

2. Benefits	9,548	10,164	9,672	9,770

The following are the amounts of contribution by category:

Civil Service Retirement Fund	5,649	5,757	5,683	5,712
Employee Life Insurance	213	220	214	215
Employee Health Insurance	2,323	2,321	2,338	2,349
Workmen's Compensation	215	244	282	340
FICA	166	60	170	152
Medicare	923	985	925	930
Other Benefits	59	577	60	72
Total	9,548	10,164	9,672	9,770

The decrease from the 1986 budget estimate to the 1986 current estimate is due to the change in compensation estimates. The increase in 1987 is due to the increases in compensation.

B. Supporting Costs	1,125	1,407	1,797	2,489
1. Transfer of personnel	422	785	649	1,141

Transfer of personnel includes actual expenses involved in the movement and storage of employee's household goods. The decrease in the 1986 current estimate reflects lower than anticipated relocations. 1987 reflects an increase in the number of anticipated relocations.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		-(Thousands of Dollars)		
2. Personnel training	703	622	1,148	1,348

The increase in the 1986 current estimate and the 1987 budget estimate is due to a reevaluation of KSC's training needs related to new employees, and the need to upgrade fully the shells of existing civil service personnel.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
11. TRAVEL	**2,510**	**2,350**	**2,464**	**2,870**
Summary of Fund Requirements				
A. Program Travel	1,731	1,681	1,858	2,218
B. Scientific and Technical Development Travel	70	213	70	74
C. Management and Operations Travel	709	456	536	578
Total, Travel	2,510	2,350	2,464	2,870
Explanation of Fund Requirements				
A. Program Travel	1,731	1,681	1,858	2,218

Program travel is directly related to the accomplishment of KSC's mission and accounts for approximately 75 percent of the Center's travel budget. Program travel reflects the continued involvement in launch site operations; the design, manufacturing, and testing of ground system equipment, and construction of facilities; and the activation of systems manufactured at off-site locations.

The increase from the 1986 budget estimate to the 1986 current estimate is due to increased program requirements for the transition of orbiter sustaining engineering and logistics from Johnson Space Center, Kennedy Space Center, Vandenberg Launch Support Resident Office at Vandenberg Air Force Base, and increased procurement activities. The increase in 1987 provides continued launch support for Spacelab and payload flights, Orbiter Sustaining Engineering & Logistics transfer, and Space Station Support.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Development Travel.....	70	213	70	74

Scientific and Technical Development Travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows personnel to benefit from exposure to technological advances outside KSC, as well as to present both accomplishments and problems to associates. Many of the meetings are working panels convened to solve certain problems for the benefit of the government. The decrease in 1986 current estimate from the 1986 budget estimate reflects a reduction based on 1985 actuals. The increase in 1987 reflects anticipated price levels.

C. Management and Operations Travel.....	709	456	536	578

Management and Operations Travel is used for the direction and coordination of general management matters. It includes travel concerning such areas as personnel, financial management, and procurement activities; travel of the Center's top management to NASA Headquarters, and other NASA Centers; and local transportation. Local travel includes personal travel in and around the official station of the employer, including tolls, parking fees, and taxis. Non-NASA travel includes transportation of persons, per diem and other incidental expenses for all non-NASA employees, such as unpaid advisory committee members and preemployment interviews for NASA SES positions. The increase from the 1986 budget estimate to the 1986 current estimates and to the 1987 budget estimate is due to travel support concerning Kennedy Data Management System; an increase in Permanent Change in Station (PCS) for transferees and new hires; and travel for productivity requirements.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION.....	**89,516**	**96,518**	**98,237**	**109,220**
Summary of Fund Requirements				
A. Facilities Services.....	50,446	58,583	59,337	65,671
B. Technical Services.....	10,068	10,683	13,247	14,052
C. Management and Operations.....	29,002	27,252	25,653	29,497
Total, Operation of Installation.....	89,516	96,518	98,237	109,220

Explanation of Fund Requirement

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Center's institutional activities. These are divided into three major functional areas: Facilities Services, the cost of renting real property, maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities; Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, medical, supply, and related services.

The increase in the 1986 estimate from that originally submitted results from the higher than expected contract wage rates, and the more difficult than estimated implementation of the information system integration task, partly offsst by a rephasing of contract obligation plans, and by the delay and deferral of the purchase of other goods and services. The increase from the 1986 current estimate to the 1987 budget estimate results from the full year funding of support service contracts and the expected price levels for such contracts, utilities and other goods and services required to operate the Kennedy Space Center.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. FACILITIES SERVICES	50,446	58,583	59,337	65,671
Summary of Fund Requirements				
1. Rental of Real Property	0	12	0	0
2. Maintenance and Related Services	5,673	6,233	7,019	7,851
3. Custodial Services	20,198	23,892	24,004	26,508
4. Utility Services	24,575	28,446	28,314	31,312
Total, Facilities Services	50,446	58,583	59,337	65,671

Explanation of Fund Reauirements

1. Rental of Real Property	0	12	0	0

This provides for the rental of off-site facilities for news and other media centers for NASA launches. We now provide space for the news and media center on site. The decrease from the 1986 budget estimate to the 1986 current estimate is due to not having to rent off-site facilities.

2. Maintenance and Related Services	5,673	6,233	7,019	7,851

This activity involves the management, supervision, engineering, operation and maintenance required to plan, initiate, and perform services on institutional facilities, systems, and equipment. It includes ground maintenance; the development and implementation of a maintenance program for all institutional government furnished and contractor acquired systems, facilities, and equipment; the operations and maintenance at the Kennedy Vandenberg Resident Office at Vandenberg Air Force Base, CA; and the general management and supervision of the operations and maintenance of the power, lighting, HVAC, water and sewer systems. Also, the contractor will implement and manage energy conservation projects, programs, audits, and inspections on institutional facilities to insure conformance of energy conservation policy and to identify new energy initiatives in such areas as modification, operational changes, energy studies and awareness. These funds also provide materials and equipment needed to support these functional needs.

The increase in 1986 from the budget estimate results from a reestimate of the cost of providing operation and maintenance support for the additional facilities coming on-line last year and this year, partly offset by a rephasing of support service contract obligation plans. The increase in 1987 is due to the full year funding of support service contracts at expected contractor wage rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Custodial Services.....	20,198	23,892	24,004	26,508

This category includes janitorial services, fire protection, and security. Funding provides janitorial services to highly specialized clean room areas and orbiter support equipment; conducting fire drills and fire inspections of facilities and equipment and fighting fires. Security protection of personnel and property involves: support of hazardous tests and operations; badging of all on-site personnel and official visitors; safeguarding flight hardware and other items of high intrinsic value; protection of classified information; and maintaining area surveillance and traffic control. Other activities in this category consist of pest control services, laundry services, and supplies and equipment used by the support contractor performing the function. The increase from the 1986 budget estimate to the 1986 current estimate is due to higher than expected support costs for new facilities coming on-line in 1985 and 1986, partially offset by the rephasing of support service contract obligation plans, and the delay and deferral of the purchase of other goods and services. The increase in 1987 results from the full year funding of support service contracts at expected price and wage levels.

4. Utility Services.....	24,575	28,446	28,314	31,312

The major utility is electrical energy purchased from Florida Power and Light Company through an Air Force contract. Fuel oil is purchased from a local supplier. Steam service is provided by the Air Force. Water services are purchased from the City of Cocoa and sewage treatment is accomplished on-site. Utility plant operations and maintenance and utility distribution systems maintenance are provided by a support contractor and by the Air Force. At the Kennedy Vandenberg Resident Office at Vandenberg Air Force Base, CA., utilities are purchased through the United States Air Force.

The decrease from the 1986 budget estimates to the 1986 current estimate reflects support service contractor wage rates and utility rates not as high as previously anticipated, partially offset by an increase in energy use.

The increase from the 1986 current estimate to the 1987 budget estimate is for anticipated support contractor wage rates, projected purchased utility rates and projected utility consumption for increased launches and support of additional facilities.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. TECHNICAL SERVICES	10,068	10,683	13,247	14,052
Summary of Fund Requirements				
1. Automatic Data Processing	7,244	8,645	10,104	10,932
a. Equipment	660	458	600	650
b. Operations	6,584	8,187	9,504	10,282
2. Scientific and Technical Information	1,100	1,220	1,341	1,220
a. Library	715	690	806	852
b. Education and information	385	530	535	368
3. Shop and Support Services	1,724	818	1,802	1,900
Total, Technical Services	10,068	10,683	13,247	14,052
Explanation of Fund Requirements				
1. Automatic Data Processing	7,244	8,645	10,104	10,932

The Base Operations contractor provides programming services for payroll, general accounting, supply, procurement, preventive maintenance, contract surveillance, personnel, security, resources and financial management reports and related management information. The contractor also provides for the development and maintenance of general management ADP programs which include the lease, purchase, and maintenance of ADP equipment, and programming and operations services. The increase from the 1986 budget estimate results from higher costs due to the more difficult than estimated implementation of information system integration. At KSC, the Engineering Management Information System, the Integrated Management Information System, the KSC Inventory Management System, and the Configuration Management Data System will be tied together to make greater use of ADP to improve the Center's management effectiveness. The task of integrating and operating these systems was not adequately provided for in the 1986 budget estimate. The increasein 1987 reflects anticipated price levels for goods and services required in this area.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Scientific and Technical Information.....	1,100	1,220	1,341	1,220

This funding provides for operation of a technical library at KSC and for technical and administrative documentation services, including support to the public affairs educational and information program.

The Base Operations contractor operates the library facilities, which provide technical and management books and periodicals, and military, federal, and professional society specifications and standards. The contractor also operates an STS and Spacelab documents repository which catalogs, classifies, and indexes documents, and provides document reference and distribution services. Public Affairs support provides for the gathering and dissemination of information about the agency's program to the mass communications media, the general public, and the educational community at the elementary and secondary levels. The increase from the 1986 budget estimate to the 1986 current estimate reflects the one time costs of providing adequate library support commensurate with the needs of the KSC and contractor technical staff. The 1987 estimate reflects continuing services at anticipated price levels for needed goods and services.

3. Shop and Support Services.....	1,724	818	1,002	1,900

These funds provide for the Eastern Space and Missile Center photographic services for NASA's Public Affairs Office and any other institutional support. These funds also provide for the institutional part of the mishap reporting system. The support contractor also provides the necessary management of a comprehensive safety program. This includes the establishment and development of both short and long-range work plans, emergency plans and schedules in support of KSC base operations. The increase from the 1986 budget estimate to the 1986 current estimate is due to the reassignment of the safety program from the Management and Operations subfunction to this area. The increase from the 1986 current estimate to the 1987 budget estimate is for anticipated support service contractor wage rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. MANAGEMENT AND OPERATIONS	29,002	27,252	25,653	29,497
Summary of Fund Requirements				
1. Administrative Communications	2,983	2,979	3,061	3,217
2. Printing and Reproduction	642	1,017	743	777
3. Transportation	5,304	5,507	4,925	5,246
4. Installation Common Services	20,073	17,749	16,924	20,257
Total, Management and Operations	29,002	27,252	25,653	29,497
Explanation of Fund Requirements				
1. Administrative Communications	2,983	2,979	3,061	3,217

These funds provide for the costs of local telephone service, Federal Telecommunications System (FTS), long distance tolls, and special communication services in support of all NASA civil service and institutional contractor personnel located at KSC, ESMC, and VAFB. NASA contractors and other institutions who conduct official business with KSC are widely dispersed throughout the United States. KSC utilizes FTS and other leased lines to minimize costs. Special services include teletype, wire news services and lease and maintenance of various small electrical/electronic systems such as printers which support major communications systems. The Base Operations Contractor will perform liaison activities for administrative communications systems and equipment which are installed and maintained by others and used by various contractor and government organizations at KSC and ESMC. The contractor also is responsible for performing operation and maintenance activities for other administrative communications systems and equipment and for operation of communications centers at KSC and ESMC. The increase from the 1986 budget estimate to the 1986 current estimate is due to rate increases. The increase from the 1986 current estimate to the 1987 budget estimate reflects anticipated rate changes.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Printing and Reproduction	642	1,017	743	777

This category includes printing services which are performed by the Government Printing Office (GPO) and minor commercial firms contracted by GPO. These items include KSC reproduction, the house organ, the telephone directory, and Public Affairs brochures and miscellaneous launch support material. Also included are printing and copier services at VAFB. The decrease from the 1986 budget estimate to the 1986 current estimate is due to reduced requirements for Government printed paper and forms based on the 1985 actuals. The increase in 1987 is due to anticipated rate changes.

3. Transportation	5,304	5,507	4,925	5,246

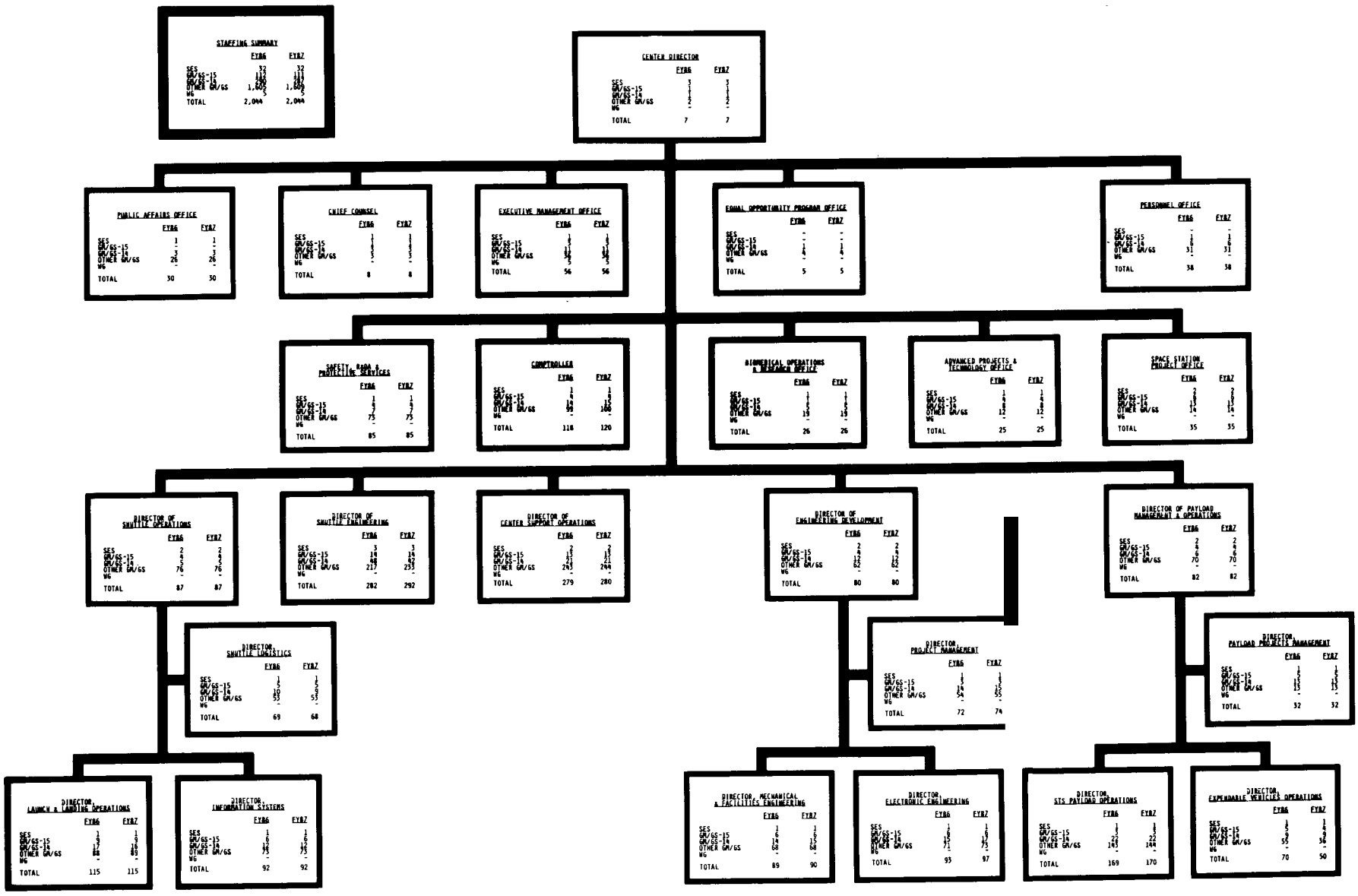
Funding covers the transportation management function, performed by the Base Operations Contractor, which includes coordination, check, inspection, and document control of all shipments, delivery of in-bound shipments, and the operation of heavy transportation equipment. The maintenance of KSC's administrative aircraft is also included, as well as the cost of passenger and cargo type vehicles used by civil service personnel, and supplies, materials, and equipment used by the support contractor performing the function.

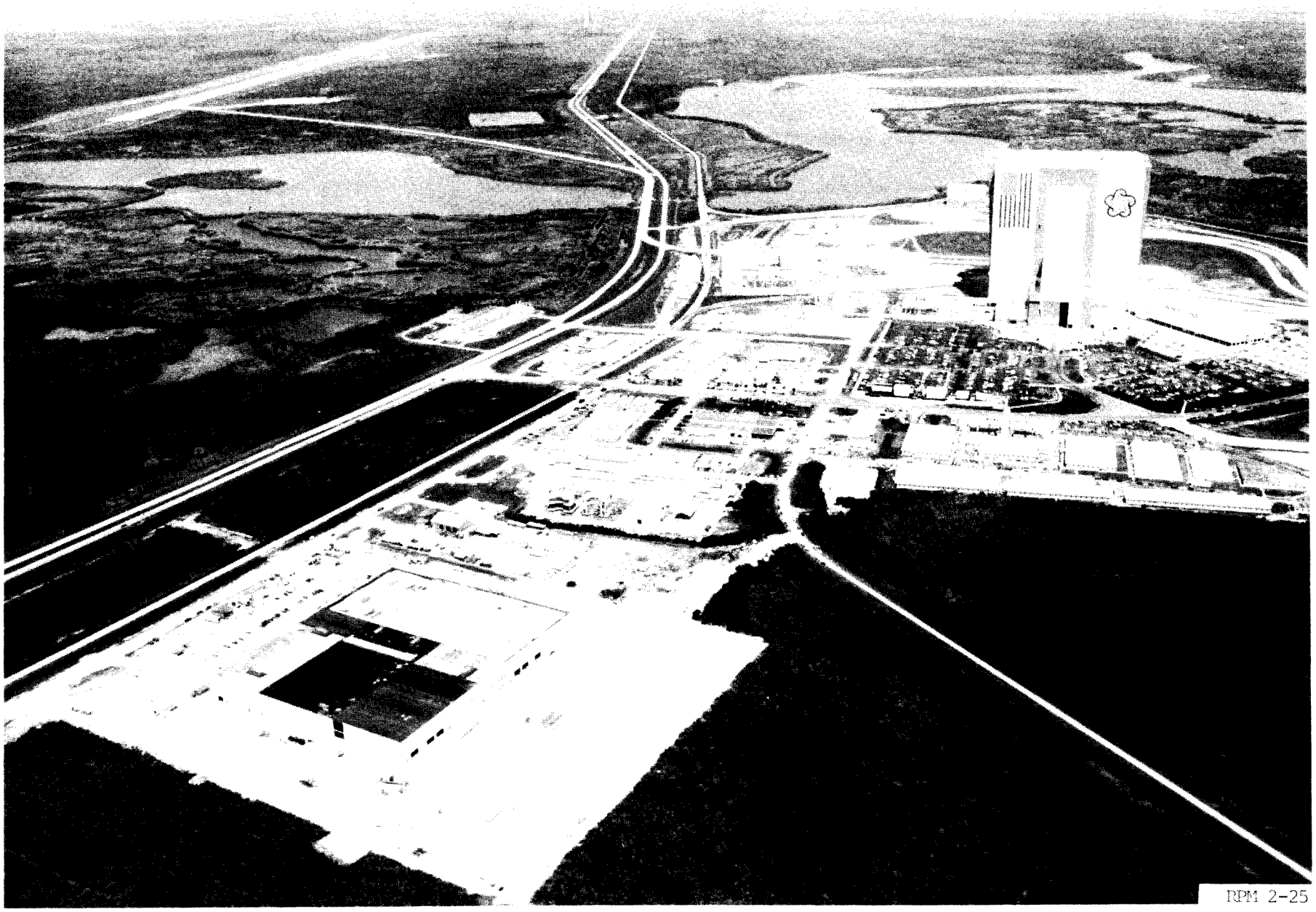
The decrease from the 1986 budget estimate to the 1986 current estimate reflects KSC's reassessment of needs in this area. The increase from the 1986 current estimate to the 1987 budget estimate is for anticipated support contractor and vehicle maintenance rate increases. Also, the estimate provides for a major engine overhaul of the KSC Gulfstream I due to FAA regulations.

4. Installation Common Services	20,073	17,749	16,924	20,257

These funds provide for management and logistics services, mail and distribution services, medical services, and a wide variety of minor contracts for special and one-time services. The Base Operations Contractor provides management for the following areas: procurement, resources, maintenance, logistics, energy, data and information, staffing and training, planning and scheduling, and safety. This includes the estimating, planning, budgeting, authorizing, controlling, accumulating, and reporting of all costs and manpower associated with contract activities; and the necessary management, supervisory, and administrative personnel required to plan, initiate, and perform the services and operations.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER





RPM 2-25

MARSHALL
SPACE FLIGHT
CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

GEORGE C. MARSHALL SPACE FLIGHT CENTER

DESCRIPTION

Operations at Marshall Space Flight Center (MSFC) are conducted at three primary locations.

The principal MSFC site is near Huntsville, Alabama, on Army property at the Redstone Arsenal. The Center occupies 1,841 acres under a non-revocable use permit from the Army. The Huntsville location is connected by deep water access to its component Michoud Assembly Facility via the Tennessee, Ohio, and Mississippi Rivers.

The Michoud Assembly Facility, located 15 miles east of New Orleans, Louisiana, is where the External Tanks for the Space Shuttle are being produced and where activities for other Federal agencies are conducted. The Michoud Facility occupies 832 acres and provides 3,634,344 gross square feet of space, including the main assembly plant. The facility is located on the Gulf Intracoastal Waterway and has deep water access via the Mississippi River.

The Slidell Computer Complex, located at Slidell, Louisiana, 20 miles northeast of the Michoud Assembly Facility, occupies 14 acres and provides centralized computer services for MSFC, Michoud, other NASA Centers, and associated contractors, as well as other government agencies.

A number of individual facilities at MSFC and its component installations are unique within NASA, and the Nation. The combined capability of the science and engineering laboratories, special development facilities, and test facilities provide a unique national resource for designing, developing, and testing large, complex space systems. The total capital investment of the Marshall Space Flight Center and its installations in Louisiana, including fixed assets in progress and contractor-held facilities at various locations as of September 30, 1985, was $836,689,000.

CENTER ROLES AND MISSIONS

The Marshall Space Flight Center serves as one of NASA's primary centers for the design and development of Space Transportation Systems, orbital systems, scientific and applications payloads, and other systems for present and future space exploration. MSFC has the principal role within NASA for large rocket propulsion systems. The Center also has a principal role for the design and development of manned vehicle systems; for Spacelab mission management and payload definition and development; for design and development of large, complex, and specialized automated spacecraft; and management of materials processing in space activities;

for solar and magnetospheric physics; and for astrophysics. MSFC has a primary role within NASA for the development and processing of space science and applications experiments. In addition, MSFC conducts a vigorous research and technology program and is involved in the study and definition of future programs, including significant roles contributing to the development of large, complex space structures, space propulsion systems, materials and engineering, materials processing in space, power systems, guidance and control, fundamental electronics, advanced optical systems, and payload systems analysis and integration.

In addition to on-site activities at Huntsville, Alabama, MSFC manages the Michoud Assembly Facility at New Orleans and the Computer Complex at Slidell, Louisiana. Resident offices are maintained at other centers and in conjunction with major industrial sites in various locations throughout the nation, and in Europe. The principal and supporting roles are:

PRINCIPAL

Propulsion Svstems - design, develop and procure propulsion-oriented systems and subsystems. Current focus' is on Space Transportation Systems, including Space Shuttle Main Engine, Solid Rocket Booster, External Tank, Orbital Maneuvering Vehicle, Inertial Upper Stage in cooperation with the Air Force, procurement of upper stages for NASA missions and monitoring of commercially developed and produced upper stages such as the Payload Assist Module by McDonnell Douglas and the Transfer Orbit Stage by Orbital Sciences Corp. Advanced program efforts are focused on analysis and definition of propulsion/transportation systems to meet national needs for the next 25 years. The Center has a key role in joint NASA-DOD activities to identify promising systems and to implement technologies to ensure a vigorous national posture in space transportation. This includes propulsion/transportation systems for Space Shuttle replacement, unmanned launch vehicles, heavy-lift launch vehicles, orbit transfer vehicles and propulsion technologies for future high performance systems.

Manned Space Vehicle Development - design, development, and procurement of manned vehicle systems as assigned.

- Spacelab - focus is on program management, systems engineering, development of related payload carriers, procurement, flight and ground operations sustaining engineering, and implementation of a payload operational control center on-site.

- Advanced Development - technology advances focused on advanced missions.

Space Transportation System (STS) Sustaininq Enqineering - provide sustaining engineering for STS propulsion system hardware and software to assure maintenance of the original design requirements throughout the life of the STS program, decrease the unit cost of manufacturing through design improvements, and upgrade operational performance capabilities through product improvement redesign.

Spacelab Payload Development and Mission Management - management of EASE/ACCESS mission, ASTRO missions, Materials Science Laboratory missions, Earth Observations missions, Spacelab J mission, Sunlab/Dark Sky missions, International Microgravity Laboratory missions, Space Plasma Laboratory missions, Space Technology Experiments Platform mission, and other dedicated and partial payload missions as assigned. Definition and development of payloads, facilities, experiments and instruments for space science and applications missions as assigned.

Specialized Automated Spacecraft - design, development, and procurement of large, complex and/or specialized automated spacecraft as assigned. Current focus is on assembly and verification of the Space Telescope, including science instrument integration and overall systems engineering. Other projects include the Tethered Satellite System in cooperation with Italy's National Research Council, and the Combined Release and Radiation Effects Satellite in cooperation with the U.S. Air Force. Studies are also being conducted on potential future missions such as the Advance X-Ray Astrophysics Facility.

Space Station - completion of space station design and definition studies and initiation of the development of the common module; logistics and laboratory module outfitting; propulsion system, environmental control and life support system, and accommodations for the Orbital Maneuvering Vehicle and the Orbit Transfer Vehicle.

Geostationary Platform Studies - identify and define concepts with associated attached payloads.

Space Processinq - development of space processing discipline base, enlistment of user interest in potential applications, and developing and management of space processing experiments and facilities.

Science - engage in space research as necessary to maintain a peer group to act as a focal point for interaction with the scientific community in programs of interest, such as Spacelab, the Advanced X-Ray Astrophysics Facility and the Space Station.

SUPPORTING

Space Structures and Materials - contributing to the development of large, complex space structures and materials technology base; developing and testing technology for advanced optical systems.

Propulsion Technology - developing and evaluating alternate propulsion systems, techniques, and propellants for advanced launch systems and spacecraft.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan By Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)		
I.	Personnel and Related Costs.....	149,458	151,341	150,523	152,178
II.	Travel.....	5,075	5,300	5,228	5,670
III.	Operation of Installation.....	43,536	45,722	44,344	45,999
	A. Facilities Services..	(20,362)	(22,480)	(21,080)	(22,159)
	B. Technical Services..	(8,761)	(9,532)	(9,554)	(9,445)
	C. Management and Operations..	(14,413)	(13,710)	(13,710)	(14,395)
	Total, fund requirements.....	198,069	202,363	200,095	203,847

Distribution of Permanent Civil Service Workyears By Program

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
RESEARCH AND DEVELOPMENT	1.886	2. 118	2. 088	2. 138
Space Station	242	390	360	455
Space Transportation Capability Development	410	423	404	445
Space Science and Applications	1,140	1,138	1,163	1,045
Physics and Astronomy	952	915	988	858
Life Sciences	-	2	-	-
Space Applications	188	221	175	187
Commercial Programs	8	20	25	35
Technology Utilization	7	7	5	5
Commercial Use of Space	1	13	20	30
Aeronautics and Space Technology	86	147	136	158
Aeronautics	-	1	-	-
Space	86	146	136	158
SPACE FLIGHT. CONTROL AND DATA COMMUNICATIONS	855	622	652	607
Shuttle Production and Operational Capability	448	339	342	292
Space Transportation Operations	407	283	298	303
Space & Ground Network Communications & Data Sys	-	-	12	12
Subtotal. Direct workyears	2, 741	2, 740	2, 740	2, 745
CENTER MANAGEMENT AND OPERATIONS SUPPORT	522	489	489	489
Total. Full-Time Workyears	3, 263	3. 229	3. 229	3, 234
Other than Full-Time	86	98	90	90
Total, Workyears	3, 349	3. 327	3,319	3, 324

'ROGR/ DESCRIPTION

Permanent Civil
Service Workvears

RESEARCH AND DEVELOPMENT

SPACE STATION..... 455

1987 activities include the completion of the definition and preliminary design studies and the inititiation of developmental efforts. Advanced technology development, utilization, operational readiness, and systems engineering and integration technology activities will be continued.

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT..... 445

Spacelab

Activities include continuation of program management; completion of final deliveries on follow-on production hardware procured from the European Space Agency (ESA) Consortium; integration of ESA and NASA provided hardware and software; and mission integration and preparation of five Spacelab flights, plus other missions involving Spacelab hardware (i.e., Igloo, Pallets, etc.). Also, the development of the capability to fly mixed cargoes will be completed with demonstration missions using Igloo Pallet, Multiplexer De-Multiplexer Pallet, and Hitchhiker configurations.

Inertial Upper Stages (IUS)

Activities involve one IUS/TDRS mission which will require support for (1) A series of readiness reviews conducted to assure the flight readiness of the IUS prior to launch, (2) the conduct of joint integrated flight simulations prior to launch, (3) the launch and flight operations support, and (4) the post flight evaluation of the IUS performance.

Payload Assist Module (PAM)

Activities include technical monitoring of design, development, and production of the PAM-D, PAM-DII, and PAM-A by McDonnell Douglas (the commercial development organization) to insure compatibility in NASA's customer service and marketing activities. A major part of this effort is the Solid Rocket Motor Nozzle Engineering Verification (to provide additional near term insight into existing design and manufacturing processes and their impact on the quality of finished parts) and technology studies (understand processes and material variables and establishment of a material data base). Also perform feasibility studies relative to the utilization of various PAM configurations for future NASA missions.

Tethered Satellite System

Activities include continued technical and programmatic management involving the United States Deployer and instrument development, and overall systems engineering activities for the cooperative effort by the United States and Italy on the Tethered Satellite System. Activities in 1987 will include completion of final assembly and verification of deployer, delivery of the satellite to the prime U.S. contractor, and delivery and integration of the science instruments.

Advanced Programs

The Advanced Programs effort at MSFC includes the definition and implementation of in-house and contracted system studies to establish the fundamental planning and decision making data needed prior to proposing future space programs. Major FY 1987 advanced study activities include: (1) advanced transportation including reusable evolutionary upper stages and shuttle derived launch vehicle systems; (2) platforms and facilities in low-earth and geosynchronous orbit such as tethered satellite systems application and geostationary platform; (3) orbital services such as satellite servicing applications and in-orbit assembly, maintenance and repair; and (4) Shuttle flight demonstrations such as the aeroassist flight experiment.

	Permanent Civil Service Workyears
SPACE SCIENCE AND APPLICATIONS	
PHYSICS AND ASTRONOMY.....	858

Hubble Space Telescope

The objective of the Hubble Space Telescope (HST) project is to place in orbit a high quality optical 2.4-meter telescope system by the Space Shuttle for use by the astronomical community in conjunction with NASA. MSFC is the lead center for the management of the Hubble Space Telescope project and has overall implementation responsibility under the Office of Space Science and Applications for meeting cost, schedule, and technical performance of the project. This includes technical assessment and evaluation of contracted activities for system refurbishment. After the HST launch and orbital verification in 1986, the operations phase will be managed/controlled by Goddard Space Flight Center. The total HST project responsibility, including management, operations, and maintenance and refurbishment, will be phased over to the Goddard Space Flight Center by September 30, 1987.

Gamma Ray Observatory

The objective of the Gamma Ray Observatory (GRO) mission is to measure gamma radiation from the universe and to explore the fundamental physical processes powering it. MSFC has responsibility for the design and development of the Burst and Transient Source Experiment (BATSE) which is one of the four experiments being developed to attain the GRO objectives. Hardware fabrication will be completed in 1986 with system testing beginning in late 1986 and completion in early 1987. In 1987 the BATSE hardware will be delivered for GRO integration and test activities at the GRO integration contractor facility.

Spacelab Payload Mission Management

In 1987, MSFC will be responsible for managing the ongoing activities of the Astro missions, Materials Science Laboratory missions, Earth Observations missions, Spacelab 3 mission, Sunlab/Dark Sky missions, International Microgravity Laboratory missions, Space Plasma Laboratory missions, Space Technology Experiments Platform mission, and other dedicated and partial payload missions as assigned. The Marshall Center is also responsible for definition and development of selected payloads, facilities, experiments, and instruments to be flown on these missions.

Mission management responsibility begins with the definition of the payload complement and ends with the dissemination and analysis of the experiment data and materials resulting from the flight. During 1987, MSFC will continue to manage the assigned mission planning and definition activities, as well as development of the required instruments and supporting hardware and software. Missions scheduled for launch in 1986 include Astro 1, EOM 1/2, and Materials Science Lab missions. Missions scheduled for launch in 1987 include Materials Science Lab Missions, International Microgravity Lab, and Astro 2.

Interfaces will continue to be maintained during 1987 with the appropriate NASA program offices, the Principal Investigators, and other appropriate organizations to assure accomplishment of the scientific objectives of the assigned missions. MSFC will continue to participate in and manage the analysis of the requirements, objectives, and constraints of the STS systems and payload complements in order to develop requirements for all levels of integration to insure physical, functional, and operational compatibility for all assigned missions.

	Permanent Civil Service Workyears
SPACE APPLICATIONS	187

Microgravity Science and Applications

The Microgravity Science and Applications program emphasizes the fundamental science and technology of processing materials under conditions that allow detailed examination of the constraints imposed by gravitational forces. These studies are directed towards selected materials and processes which will best identify the limitations due to gravity, as well as demonstrate the enhanced control that may be possible by the weightless environment of space. In 1987, MSFC will continue to embody research and development activities in such area as: (1) crystal growth, (2) containerless processing, (3) fluid and chemical processing, and (4) solidification of metals and alloys. Continuing activities include ground based research, engineering and scientific analyses, advanced studies, definition, design, development, and operation of materials processing payloads.

Combined Release and Radiation Effects Satellite (CRRES)

The CRRES activities in 1987 will support a launch in the summer of 1987. These activities include integration of DOD and NASA experiments, integration of the CRRES SRM to the Spacecraft, and System Verification Testing. NASA will perform active experiments in low earth orbit to further its understanding of the Earth's upper atmosphere and ionosphere.

Atmospheric Supporting Research

Theoretical, field, and laboratory experimental research will be conducted in the global weather, severe storms, and local weather areas. Efforts will be concentrated on improving understanding of severe storms, mesoscale and global scale weather systems, and in defining Shuttle free flyer and Space Station missions to obtain data required to understand and predict this phenomena.

COMMERCIAL PROGRAMS

TECHNOLOGY UTILIZATION	5

This program transfers new knowledge and innovative technology resulting from NASA's R&D programs for application in industry, medicine, and other public and private sector areas. Civil service engineering and science personnel provide a source of technical skills necessary to accomplish technology transfer to the public sector.

	Permanent Civil Service Workyears
COMMERCIAL USE OF SPACE	30

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology space and ground-based research and development. This effort established an organizational focal point to initiate a program specifically intended to foster commercial use and access to space.

SPACE RESEARCH AND TECHNOLOGY	158

The Space Research and Technology activities are in space energy conversion, controls and guidance, space data and communications, propulsion, aeroassist technology, advanced SSME technology, and systems analysis. The primary effort in 1987 will be on developing technology for future high performance systems and large space systems.

SPACE FLIGHT, CONTROL, AND DATA COMMUNCIATIONS

SHUTTLE PRODUCTION AND OPERATIONAL CAPABILITY	292

This effort will provide main engines for a national fleet of four Space Shuttle Orbiters; provide sufficient ground support equipment, launch site equipment and support to launch operations; and to establish a logistic support capability to provision spares and repair/overhaul flight hardware. Plans are to continue with the development of additional Shuttle performance capability and the identification of improvements to make space transportation more economical.

SPACE TRANSPORTATION OPERATIONS	303

This activity provides the standard operational support services for the Space Shuttle in the operations phase. Primary activities for 1987 will include the production, overhaul, and acquisition of hardware for operational flights. The flight hardware program element provides for the procurement of external tanks (ET), solid rocket motors (SRM), booster hardware, and propellants; spare components for the main engine; and flight hardware elements. Typical functions will be production engineering, manufacturing, sustaining engineering, anomaly resolution, logistics configuration management, systems level analysis, test and integration tasks, ground operations, and contract management.

	Permanent Civil Service Workvears
SPACE AND GROUND NETWORKS.....	12

MSFC operates the Program Support Communications Network and serves as its major switching control point. This network interconnects by means of leased voice, data and wideband circuits at the NASA centers, Headquarters and major contractor locations for the transfer of programmatic and administrative information.

CENTER MANAGEMENT AND OPERATIONS WPPORT.....	489

Center Management and Operations Support is provided to all MSFC organizations and includes the following:

Director and Staff - The Center Director, Deputy Director, and immediate staff, e.g., Comptroller, Administrative Operations, Legal Patent Counsel, Equal Opportunity, Public Affairs, and Safety.

Manaqement Support - Those who provide management and support services to all levels of Center management, both program and functional. Specific functions include resources and financial management, program control, contracting and procurement, property management, personnel management, and management systems and analysis.

Operations Support - Those who manage or provide for the operation and maintenance of institutional facilities, buildings, systems and equipment, including those who manage or provide technical services such as automatic data processing, reliability and quality assurance, medical care, and photographic support.

RESWRCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**149,458**	**151,341**	**150,523**	**152,178**
Basis of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	128,507	129,220	128,958	129,071
b. Non-permanent	1,463	1,948	1,573	1,573
c. Overtime and other compensation	1,716	2,006	1,953	2,066
Subtotal, Compensation	131,686	133,087	132,484	132,710
2. Benefits	16,321	16,867	16,419	16,821
Subtotal, Compensation and Benefits	148,007	150,041	148,903	149,531
B. Supporting Costs				
1. Transfer of personnel	710	448	736	1,405
2. Personnel training	741	852	884	1,242
Subtotal, Supporting Costs	1,451	1,300	1,620	2,647
Total, Personnel and Related Costs	149,458	151,341	150,523	152,178

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits.....	148,007	150,041	148,903	149,531
1. Compensation	131,686	133,174	132,484	132,710
a. Permanent positions	128,507	129,220	128,958	129,071

The decrease from the 1986 budget estimate to the 1986 current estimate is due primarily to a refinement of the estimates.

Basis of Cost for Permanent Positions

In 1987 the cost of permanent positions will be $129,071,000, an increase of $113,000 from 1986. This increase is calculated as follows:

Cost of permanent positions in 1986.....		128,958
Cost increases in 1987.....		2,651
Within grade advances and career development		
Full year effect of 1986 actions.....	1,174	
Partial year effect of 1987 actions.....	1,477	
Cost decreases in 1987.....		-2,538
Turnover savings and abolished positions:		
Full year effect of 1986 actions.....	-1,320	
Partial year effect of 1987 actions.....	-1,218	
Cost of permanent positions in 1987.....		129,071

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		'(Thousands	of Dollars)	
b. Non-permanent				
(1) cost	1,463	1,878	1,573	1,573
(2) Man-years	122	151	129	129

The decrease from the 1986 budget estimate to the 1986 current estimate reflects reduced requirements from previous estimates. The cost of non-permanent positions from 1986 to 1987 is the same.

Distribution of Other Than Full Time Permanent Workyears

Program	Workyears
Cooperative education programs	74
Other temporary programs	16
Youth opportunity programs	39
Total	129

c. Overtime and Other Compensation	1,716	2,006	1,953	2,066

The decrease reflected in 1986 current estimate is due to a refinement of the estimates. A small increase for 1987 is because of increased program requirements.

2. Benefits	16,321	16,867	16,419	16,821

The distribution of these costs by major categories is as follows:

Category of Cost				
Civil Service Retirement Fund	8,999	8,962	8,600	8,515
Employee life insurance	329	362	380	440
Employee health insurance	3,706	3,902	3,723	3,864
FICA	289	529	550	683
Unemployment Compensation	1	5	5	5
Workmen's Compensation	1,543	1,512	1,587	1,624
Medicare	1,454	1,595	1,574	1,690
Total	16,321	16,867	16,419	16,821

The 1986 current estimate is changed from the 1986 budget estimate due to decreases in Civil Service retirement costs partially offset by increased FICA costs for new Government employees. The 1987 increase reflects benefits costs commensurate with compensation estimates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. Supporting Costs	1,451	1,300	1,620	2,647
1. Transfer of personnel	710	448	736	1,405

This estimate provides for personnel relocation costs, such as the expenses of selling and buying a home and the movement of household goods. The currently estimated levels for 1986 and 1987 reflect the estimated cost of anticipated relocations.

2. Personnel training	741	852	884	1,242

The purpose of the MSFC training program is to continue the development of skills and knowledge of civil service employees in order to more efficiently support MSFC's roles and missions in the Space Program. The benefits to be derived by NASA from the training and educational programs conducted at MSFC include: enhancement of scientific and engineering leadership in the scientific community; maintenance of a high degree of professional competency with the administrative and clerical work force; development of needed skills and knowledge required in MSFC mission activities; and extending MSFC work force capability and increasing productivity. Increases in the 1987 requirements are primarily to support the Center's increasing computer capabilities, and scientific and engineering related requirements in areas such as robotics, optical systems, software engineering, and propulsion technology.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)-		
II. TRAVEL	***5,075***	***5,300***	***5,228***	***5,670***
Summary of Fund Requirements				
A. Program Travel	4,525	4,611	4,669	5,088
B. Scientific and Technical Development Travel.	99	250	120	132
C. Management and Operations Travel	451	439	439	450
Total Travel	5,075	5,300	5,228	5,670
Explanation of Fund Requirements				
A. Proqram Travel	4,525	4,611	4,669	5,088

Program travel is directly related to the accomplishment of the Center's mission, and accounts for almost ninety percent of the total travel. Travel requirements include those for ongoing programs such as the STS Operations, Spacelab, Space Station, Upper Stages development and operations, Space Telescope, Spacelab Payloads, Space Science and Applications payloads and basic supporting research and technology, as well as support to the planning and definition of potential new programs. The increase in the 1986 current estimate is based on the current requirements and using 1985 actuals to project 1986 costs. The increase in 1987 is primarily due to increased cost of travel and holding the number *of* trips level.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. Scientific and Technical Development Travel	99	250	120	132

Scientific and technical related travel permits employees to participate in meetings and technical seminars with representatives of the aerospace community. This participation allows them to maintain and to grow in technical excellence, and benefit from exposure to technological advances outside MSFC, as well as to present both accomplishments and concerns to their associates. These meetings are principally working panels convened to solve problems for the benefit of the Government. The decrease in the 1986 current estimate is consistent with 1985 experience. The increase in 1987 will permit the same level of travel as in 1986.

C. Management and Operations Travel.....	451	439	439	450

Management and Operations travel is required for the direction and coordination of general management matters. It includes travel by managers in such areas as personnel, financial management, and procurement activities and travel of the Center's top management to NASA Headquarters and other NASA Centers. This category of travel includes local travel, passenger vehicle rental and non-NASA travel. Local travel includes personal travel in and around the official station of the employee and includes tolls, parking fees and taxis. Passenger vehicle rental includes lease of commerical pasenger vehicles. The current "fixed price" four-year commerical vehicle rental contract that MSFC has signed with a contractor ends in July 1986 and must be renegotiated. Non-NASA travel includes transportation of persons, per diem, and other incidental expenses for all non-NASA employees, such as unpaid members of research advisory committees and pre-employment interviews for NASA SES positions. The 1987 budget estimate is due to anticipated increases in travel costs.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION.....	**43,536**	**45,722**	**44,344**	**45,999**
Summary of Fund Requirements				
A. Facilities Services.....	20,362	22,480	21,080	22,159
B. Technical Services.....	8,761	9,532	9,554	9,445
C. Management and Operations.....	14,413	13,710	13,710	14,395
Total, Operation of Installation.....	43,536	45,722	44,344	45,999

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Center's institutional activities. These are divided into three major functional areas: Facilities Services, the cost of maintaining and repairing institutional facilties and equipment, and the cost of custodial services and utilities; Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, medical, supply, and related services.

The decrease reflected in the 1986 current estimate from the budget estimate is due primarily to the delay and deferral of activities, and a rephasing of support contractor funding plans. The increase in 1987 includes rate increases for energy, support contracts, and the full year funding of support contracts.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. FACILITIES SERVICES	20,362	22,480	21,080	22,159

The Marshall Space Flight Center (MSFC) occupies 1,841 acres under a Department of the Army non-revocable lease in a complex of science and engineering laboratories and special development and test facilities. The complex encompasses 3.8 million gross square feet of building space on Redstone Arsenal. This physical plant houses an average daily on-Center population of approximately 4,800 personnel.

Summary of Fund Requirements

1. Maintenance and Related Services	6,486	6,988	6,219	6,815
a. Facilities	5,762	6,074	5,477	6,028
b. Equipment	724	914	742	787
2. Custodial Services	4,480	4,492	4,602	4,325
3. Utility Services	9,396	11,000	10,259	11,019
Total, Facilities Services	20,362	2'2,480	21,080	22,159

Explanation of Fund Requirements

1. Maintenance and Related Services	6,486	6,988	6,219	6,815

This activity involves maintenance and operation of a total of 202 facilities (building, structures, and trailers). The 1986 current estimate reflects a decrease due to the rephasing of support service contract obligation plans and the deferral and delay of repair and alteration projects and replacement equipment. The increase from 1986 to 1987 reflects the escalation of support service contractor wages, and the full year funding of such contracts.

2. Custodial Services	4,480	4,492	4,602	4,325

Custodial services include janitorial services, security services, fire protection, trash removal, sanitary landfill operations, and related supplies and materials. Janitorial service is provided to about 3 million square feet of facility space and trash removal for approximtely 115 separate locations. Security

and fire protection services include 24-hour coverage of MSFC property, law enforcement, and motor vehicle registration and control. The increase from the 1986 budget to the 1986 current estimate is due to a greater rise in price levels than anticipated. The decrease from the 1986 current estimate to the 1987 estimate is due to anticipated decreases in Redstone Arsenal Support Activity (RASA) rates for fire protection and sanitary landfill, partially offset by anticipated price increases.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		'(Thousands of Dollars)		
3. Utility Services.....	9,396	11,000	10,259	11,019

This function provides for the cost of electricity, steam, natural gas, water, and sewage disposal service provided by Redstone Arsenal Support Activity on a reimbursable basis. It also provides for the propane and burner fuel to generate steam for heating and cooling. The decrease from the 1986 budget estimate to the 1986 current estimate reflects the 1985 rate experience. The increase in 1987 is primarily due to anticipated rate increases in RASA provided utilities.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
B. TECHNICAL SERVICES	8,761	9,532	9,554	9,445
Summarv of Fund Reauirements				
1. Automatic Data Processing	5,694	6,290	6,211	6,178
a. Equipment	1,220	1,601	1,085	1,025
b. Operations	4,474	4,689	5,126	5,153
2. Scientific and Technical Information	1,282	1,366	1,459	1,498
a. Library	1,097	1,168	1,356	1,396
b. Education and information	185	198	103	102
3. Shop Support Services	1,785	1,876	1,884	1,769
Total, Technical Services	8,761	9,532	9,554	9,445
Exolanation of Fund Reauirements				
1. Automatic Data Processing	5,694	6,290	6,211	6,178

Funds provide for centralized systems analysis, programming, operations, and related computational services to meet the management and administrative computing requirements. This category also includes maintenance of ADP equipment such as central site computers and associated equipment. Equipment maintained includes IBM 4341, FR-80 microfiche system, systems software support, and a key-to-disc which collects, controls, organizes, and edits raw data for input into the IMB 4341.

This function also provides for the development and utilization of computer techniques and systems programming of all! digital computers and associated equipment. Also included is associated auxilliary support equipment such as film processors, Xerox microfiche printers, Xerox forms copiers, punch card accounting machines, and Univac 4020 terminals. This activity includes the operations of two large magnetic tape libraries; receipt, control, and distribution of program and data processing products; and testing and cleaning of magnetic tapes.

The decrease from the 1986 budget estimate to the 1986 current estimate and to the 1987 budget estimate reflects FY 1985 experience in planned purchase of equipment.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Scientific and Technical Information.....	1,282	1,366	1,459	1,498

This activity provides for the cost sharing operation of the Redstone Scientific Information Center (RSIC) library on Redstone Arsenal and other scientific and technical information services. Scientific information and library services are provided to MSFC employees and associated NASA contractor personnel through RSIC operations. The RSIC contains a central collection of books and journals, periodicals, documents on microfilm, and technical papers. Operation of the RSIC by the Army is under direction of a joint MSFC/Army Redstone scientific information board, with shared costs. These funds also provide for the preparation of reproducible pages for publication of NASA technical manuscripts and related documents and MSFC's share of the operation of the MSFC Visitor Information Center located at the Alabama Space and Rocket Center. The increase from the 1986 budget estimate to the 1986 current estimate is due to increased costs at the RSIC. The 1987 increase is the result of anticipated RSIC costs.

3. Shop and Support Service	1,785	1,876	1,884	1.769

These funds provide the Center with support in the areas of graphics, photographic services, and related supplies, materials, and equipment. The 1987 decrease is the result of the completion of several activities in 1986.

C. MANAGEMENT AND OPERATIONS.....	14,413	13,710	13,710	14,395
Summary of Fund Requirements				
1. Administrative Communications.....	4,051	4,030	3,867	3,534
2. Printing and Reproduction	866	500	757	802
3. Transportation	3,340	3,585	3,332	3,772
4. Installation Common Services.....	6,156	5,595	5,754	6,287
Total, Management and Operations....	14,413	13,710	13,710	14,395

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		

Explanation of Fund Requirements

1. Administrative Communications.....	4,051	4,030	3,867	3,534

Communications support for MSFC consists of local telephone service, long distance telephone service and various kinds of other non-telephone communications. The MSFC central exchange provides local telephone service. Long distance telephone service is provided by the GSA. Included are such items as long distance commercial tolls and the autodin network which is used for ordering supplies and materials. In addition, these funds provide for the use of Weeden Mountain radio transmission facilities, support of the emergency warning system, and operations of MSFC's fire surveillance system. The decrease in the 1986 current and the 1987 estimate reflects 1985 experience and continuation of efforts to economize in this area.

2. Printing and Reproduction.....	866	500	757	802

A portion of MSFC's printing and reproduction requirements are met by a contractor operated on-site reproduction plant. MSFC purchases reproduction services from the Government Pringing Office (GPO), the Army, and private firms. Off-site printing is an overflow requirement that cannot be handled within the on-site workload or capability. The increase from the 1986 budget to the 1986 current estimate reflects higher escalation than previously anticipated based on the 1985 actuals. The 1987 increase is escalation.

3. Transportation.....	3,340	3,585	3,332	3,772

Transportation includes operation and maintenance of vehicles and aircraft, transportation of related supplies and materials, and purchases of transportation equipment. Included is the maintenance of general purpose vehicles, material handling equipment, special purpose trailers and vehicles, equipment such as cranes, tractors, generators and welders; and intermediate and major inspections. Freight charges for shipment of materials and equipment by both surface and air transportation are also included. The decrease from the 1986 budget estimate to the 1986 current estimate reflects less than anticipated increases in fuel rates. The increase in 1987 is due to anticipated support service contractor wage rate escalation.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
4. Installation Common Services.....	6,156	5,595	5,754	6,287

This activity provides administrative support to Center management and staff activities, medical services, and various other installation support services.

Center management and staff functions include patent counsel services, tort claims, and equal opportunity activities. Medical services provide occupational medicine and environmental health services for the maintenance and improvement of employee health at MSFC, with emphasis on prevention, diagnosis, treatment, and care of illnesses and injuries.

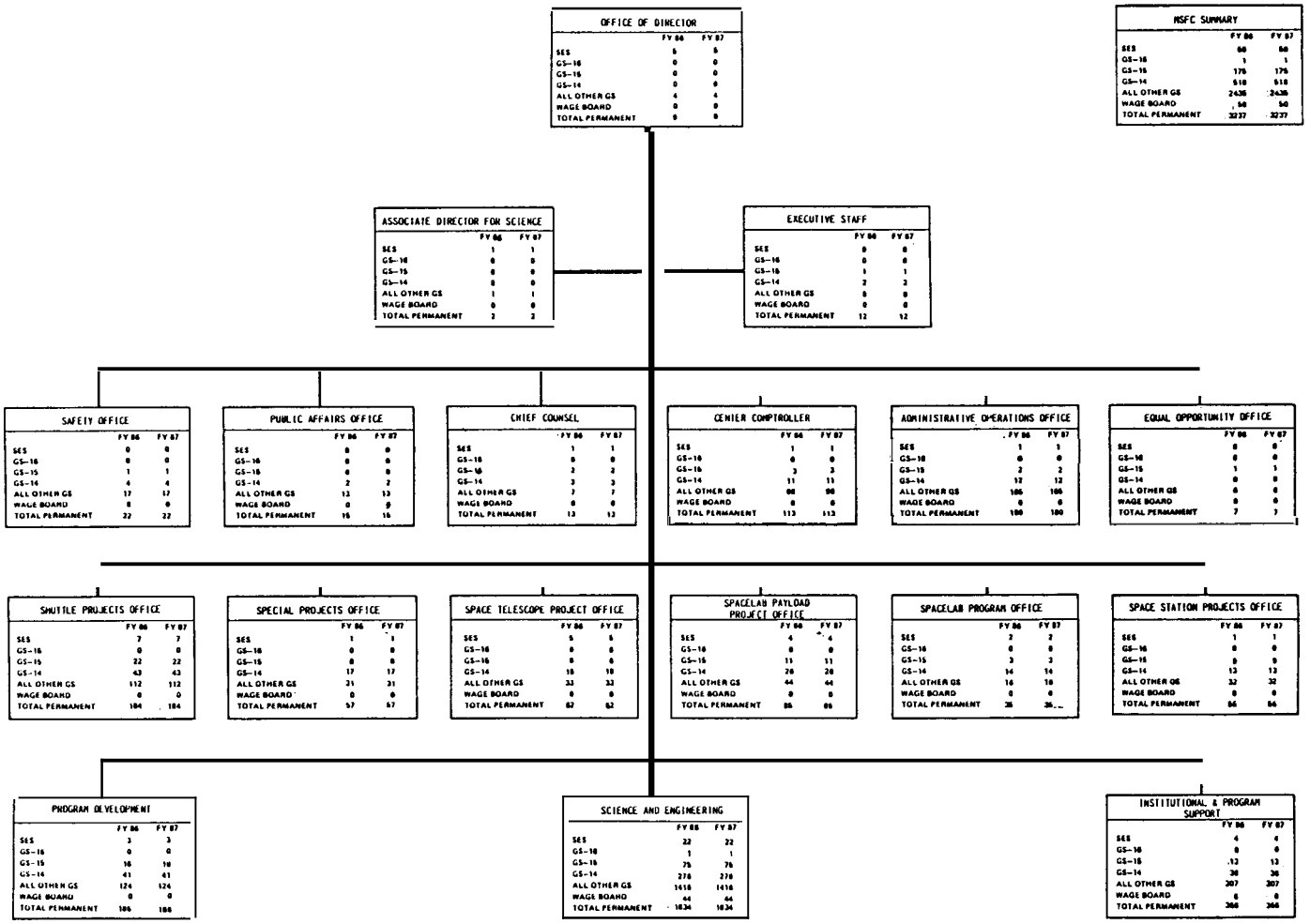
Installation support services include maintenance and repair of office equipment, equipment rental, acquisition of supplies and materials and other miscellaneous services such as: (1) receiving supplies, materials, and equipment; (2) distributing supplies, materials, equipment, and program-critical hardware; (3) preparing supplies, materials, and equipment for shipment, and (4) warehousing of raw materials.

Also provided are such services as the disposal of toxic waste, inspection of hazardous cargo prior to entry to Redstone Arsenal; receipt, storage, and issuance services for hazardous substances such as explosives, pyrotechnics and solid rocket motors; minor services such as laundry, furniture repair, toxic disposal, postage, and acquisition of supplies and materials.

The increase in the 1986 current estimate from the 1986 budget estimate is a result of expected support service contractor wage rate increases. The 1987 increase reflects anticipated increased price levels for supplies, materials, equipment, and contractor wage rate increases.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GEORGE C. MARSHALL SPACE FLIGHT CENTER



NATIONAL SPACE
TECHNOLOGY
LABORATORIES

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

NATIONAL SPACE TECHNOLOGY LABORATORIES

DESCRIPTION

The National Space Technology Laboratories is located in southwest Mississippi, approximately 50 miles northeast of New Orleans, Louisiana. Total land area is 138,807 acres of which 13,480 acres make up the actual installation owned by NASA. The remaining 125,327 acres are held as a buffer zone. In the buffer zone, 7,162 acres are owned by NASA and 118,165 acres are under restrictive easements. The installation has deep water access via the Pearl River and the Intercostal Waterway. Capital investment for the National Space Technology Laboratories, as of September 30, 1985, was $325,054,000.

CENTER ROLES AND MISSIONS

The National Space Technology Laboratories (NSTL), formerly the Mississippi Test Facility (MTF), is NASA's prime static test facility for large liquid propellant rocket engines and propulsion systems. The redesignation by NASA of MTF to the NSTL in June 1974 recognized the emerging role of the installation in space and environmental technology laboratories.

NSTL is presently engaged in development and acceptance testing of the Space Shuttle Main Engines and Main Propulsion System development testing. NSTL also conducts applied research and development in the fields of remote sensing, environmental sciences, and other selected applications programs. NSTL manages the installation and, through interagency agreements, provides support and maintains full utilization of all facilities by NASA and co-located elements of other executive agencies. These agencies are engaged in compatible research, development, and operational activities. They include the Department of Defense, the Department of Interior, the Department of Commerce, the Environmental Protection Agency, the Department of Transportation, the State of Mississippi, and the State of Louisiana. The principal roles are:

Space Shuttle: - NSTL provides, maintains and manages the facilities and the related capabilities required for the continued development and acceptance testing of the Space Shuttle Main Engines, and the development testing of the Shuttle's Main Propulsion Test Article which consists of a cluster of three main engines, an external tank and an orbiter aft-fuselage structure.

Space Applications: - Conducts fundamental and applied research, develops advanced airborne sensors and data/information systems, and conducts test and evaluation activities of remote sensing technology in the areas of renewable and non-renewable resources.

Support to Tenant Agencies: - Provides technical and institutional support to resident agencies.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
I. Personnel and Related Costs	5,013	5,104	5,142	5,193
II. Travel	190	200	200	210
III. Operation of Installation	5,466	6,052	5,565	6,050
A. Facilities Services	(2,713)	(3,473)	(2,920)	(3,266)
B. Technical Services	(846)	(674)	(656)	(714)
C. Management and Operations	(1,907)	(1,905)	(1,989)	(2,070)
Total, fund requirements	10,669	11,356	10,907	11,453

DISTRIBUTION OF PERMANENT CIVIL SERVICE WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
Space Transportation System	5	7	5	5
Space Transportation Capability Development	5	7	5	5
Space Science and Applications	41	34	44	44
Space Applications	41	34	44	44
Commercial Use of Space	1	2	1	1
Subtotal, Direct Workyears	46	43	48	48
Center Management and Operations Support Positions	67	63	69	69
Total, Permanent Workyears	114	106	119	119
Other Than Full-Time	16	18	15	15
Total, Workyears	130	124	134	134

PROGRAM DESCRIPTION

	Permanent Civil Service Workyears
SPACE TRANSPORTATION CAPABILITY DEVELOPMENT	5

In 1987, the National Space Technology Laboratories will continue to provide, maintain, and manage the facilities and the related capabilities required for development and acceptance testing of the Space Shuttle Main Engines.

SPACE APPLICATIONS	44

In 1987, the NSTL's Earth Resources Laboratory's program will continue to:

-- Conduct research investigations in the application of remotely sensed data using existing aircraft and satellite programs as a basic source of remotely sensed data in conjunction with surface data to develop techniques and procedures for practical applications.

-- Conduct applied research investigations for the application of new sensor data to priority information requirements of national concern in the areas of agricultural productivity, geological explorations, and land resources management including studies for aligning appropriate sensor technology with applicable disciplinary requirements.

-- Promote the effective transfer of applications technology as well as to reduce systems costs, and improve compatibility with other information sources and products.

-- Conduct research and development applications in non-remote sensing applications primarily in such areas as environmental system development and closed ecosystems development.

COMMERCIAL USE OF SPACE	1

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and Cncourage increased investment and participation in high technology space-based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use and access to space.

Center Management and Operations Support is defined as that support or services being provided to all NSTL organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved are:

Director and Staff - The Installation Director, Deputy Director, and immediate staff, e.g., Legal, Equal Opportunity, and Public Affairs.

Management Support - Those who provide information and management services supporting all levels of Center management, both program and functional. Specific functions include resources and financial management, program control, contracting and procurement, property management, personnel management, and management systems and analysis.

Operations Support - Those who manage or provide for the operation and maintenance of institutional facilities, buildings, systems and equipment, including those who manage or provide technical services such as automatic data processing, reliability and quality assurance, medical care, and photographic support.

RESOURCE REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**5,013**	**5,104**	**5,142**	**5,193**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Permanent positions	4,161	4,230	4,255	4,328
b. Other than full-time permanent positions	256	289	250	245
c. Overtime and other compensation	15	17	14	14
Subtotal, Compensation	4,432	4,536	4,519	4,587
2. Benefits	503	483	527	521
Subtotal, Compensation and Benefits	4,935	5,019	5,046	5,108
B. Supporting Costs				
1. Transfer of personnel	51	60	65	50
2. Personnel training	27	25	31	35
Subtotal, Supporting Costs	78	85	96	85
Total, Personnel and Related Costs	5,013	5,104	5,142	5,193

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits	4,935	5,019	5,046	5,108
1. Compensation	4,432	4,536	4,519	4,587
a. Permanent positions	4,161	4,230	4,255	4,328

The increases in the 1986 current estimate and the 1987 budget estimate are due to normal career development.

Basis of Cost for Permanent Positions

In 1987, the cost of permanent positions will be $4,328,000, an increase of $73,000 over 1986. The increase results from the following:

Cost of permanent positions in 1986		4,255
Cost increase in 1987		91
Within grade and career advances:		
Full year effect of 1986 actions	69	
Partial year effect of 1987 actions	22	
Cost decreases in 1987		-18
Turnover savings and abolished positions:		
Partial year effect of 1987 actions	-18	
cost of permanent positions in 1987		4,328

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent positions				
1. cost	256	289	250	245
2. Workyears	16	19	15	15

The distribution of 1987 workyears is as follows:

Distribution of Other than Full-Time Permanent Workvears

Program	Workyears
Developmental programs	4
Summer employment programs	---
Youth opportunity programs (Non-Ceiling)	---
Other temporary programs	11
Total	15

The decrease from the 1986 budget estimate to the 1986 current estimate is a decrease in the number of other than full time permanent employees. The 1987 decrease is the full year effect of the 1986 OTFTP personnel.

c. Overtime and other compensation	15	17	14	14

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Benefits	503	483	527	521
The following are the amounts of contribution by category:				
Civil Service Retirement Fund	297	300	306	305
Employee Life Insurance	10	11	11	11
Employee Health Insurance	119	114	121	116
FICA	22	9	38	39
Medicare	48	49	49	50
Annuitant & Other Benefits	7	---	2	---
Total	503	483	527	521

The increase from the 1986 budget estimate to the 1986 current estimate is the result of an increase in the number of permanent workyears. The 1987 estimate reflects the 1986 level of effort.

B. Supporting Costs	78	85	96	85
1. Transfer of personnel	51	60	65	50

The estimates for 1986 and 1987 are based on projected hiring plans.

2. Personnel training.	27	25	31	35

The personnel training program continues to develop the skills and knowledge of NSTL employees in order to more efficiently support NSTL roles and missions, primarily through "Upward Mobility" training for women and minorities and Equal Employment Opportunity Seminars. Increases in the 1986 current estimate and the 1987 budget estimate will be used to provide additional funding for NASA employee training to help maintain the current skill level.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**190**	**200**	**200**	**210**
Summary of Fund Requirements				
A. Program Travel	92	105	97	108
B. Scientific and Technical Development Travel	4	5	4	4
C. Management and Operations Travel	94	90	99	98
Total, Travel	190	200	200	210
Explanation of Fund Requirements				
A. Program Travel	92	105	97	108

Program travel requirements are directly related to the accomplishment of the Laboratories' mission, and will primarily be in support of Space Science and Applications Programs. Program travel accounted for about 45 percent of total travel in 1985. The decrease from the 1986 budget estimate to the 1986 current estimate reflects the 1985 experience. The increase from 1986 to 1987 includes expected increases in transportation costs.

B. Scientific and Technical Development Travel	4	5	4	4

Scientific and technical development travel will permit employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows personnel to retain technical competency and gain awareness of technological advances outside NSTL as well as to present both accomplishments and problems to associates. Many of the meetings are working panels convened to solve certain problems for the benefit of the Government.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel.....	94	90	99	98

Management and operations travel is used for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management, and procurement activities as well as travel of the Laboratories' top management to NASA Headquarters and other NASA Centers. The increase from the 1986 budget estimate to the 1986 current estimate reflects expected transportation cost increases.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION.....	**5,466**	**6,052**	**5,565**	**6,050**
Summarv of Fund Reauirements				
A. Facilities Services.....	2,713	3,473	2,920	3,266
B. Technical Services.....	846	674	656	714
C. Management and Operations.	1,907	1,905	1,989	2,070
Total, Operation of Installation.....	5,466	6,052	5,565	6,050

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Center's institutional activities. These are divided into three major functional areas: Facilities Services, the cost of maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities; Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, and related services.

Funding deltas from the 1986 budget estimate to the 1986 current estimate are due to a reestimate of utility use requirements. The 1987 increase reflects the anticipated rate increases in support service contracts, utilities, and other goods and services required at NSTL.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. FACILITIES SERVICES	2,713	3,473	2,920	3,266

The NSTL covers 138,807 acres of grounds, and a complex of facilities which are comprised of laboratories, offices, and rocket engine test facilities. The complex encompasses some 1,172,098 gross square feet of building space. This physical plant supports an average daily on-site population of 3,023. Many of the test facilities are utilized on schedules involving more than one shift operation and operations during off-peak hours.

Summary of Fund Requirements

1. Rental of Real Property	18	18	18	20
2. Maintenance and Related Services	582	480	569	584
a. Facility	574	440	529	554
b. Equipment	8	40	40	30
2. Custodial Services	325	344	330	343
3. Utility Services	1,788	2,631	2,003	2,319
Total, Facilities Services	2,713	3,473	2,920	3,266

1. Rental of Real Property	18	18	18	20

Provides for lease of hanger space for earth resources aircraft.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		'(Thousands of Dollars)		
2. Maintenance and Related Services.....	582	480	569	584

This activity provides for the modifications and alterations of facilities and movements of personnel and equipment of the Earth Resources Laboratory (ERL) and equipment purchases for the ERL contracts. Also provided is the modification and alteration of facilities in support of B-1 test stand operations and maintenance. The 1986 current estimate is based on 1985 actuals and at current requirements. The 1987 increase reflects anticipated cost levels.

3. Custodial Services.....	325	344	330	343

Provides for NASA's share of security guard services, janitorial services and fire protection services by the NSTL institutional support services contractor. The decrease in the 1986 budget estimate to the FY 1986 current estimate reflects lower support service contract wage rates than previously estimated.

4. Utility Services.....	1,788	2,631	2,003	2,319

Provides for the purchase of the two utility commodities: electricity from the Mississippi Power Company and natural gas from the United Gas Pipe Line Company. Natural gas is the primary heating fuel used at NSTL. Also provided is NASA's share of the operation of the utility distribution and control systems, water wells, and sewage systems. The decrease from the 1986 budget estimate to the 1986 current estimate is the result of lower than anticipated utility rates. The increase in the 1987 budget estimate reflects expected rates for utilities, and anticipated support service contract wage rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. TECHNICAL SERVICES	846	674	656	714
Summary of Fund Requirements				
1. Automatic Data Processing	5	5	5	6
a. Engineering	-	-	-	-
b. Operation	5	5	5	6
2. Scientific and Technical Information	129	142	142	152
a. Library	4	4	4	4
b. Education and information	125	138	138	148
3. Shop and Support Services	712	527	509	556
Total, Technical Services	846	674	656	714
Explanation of Fund Requirements				
1. Automatic Data Processing	5	5	5	6

Provides supplies and materials in support of the Center's ADP requirements.

2. Scientific and Technical Information	129	142	142	152

Provides books, periodicals, and other technical reports for the Center, and NASA's share of upgrading and operating the NSTL Visitor Information Center (VIC). The 1987 estimate includes current requirements at expected cost levels.

3. Shop and Support Services	712	527	509	556

Provides for NASA's share of such technical services as safety, photography and graphics. Provides for the purchase of O&M equipment and updated equipment to support the technical services at NSTL. The 1986 current estimate reflects support service contractor inflation rates lower than anticipated. The increase in the 1987 reflects expected cost escalation.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. MANAGEMENT AND OPERATIONS.....	1,907	1,905	1,989	2,070
Summary of Fund Requirements				
1. Administrative Coimunications.....	914	861	993	1,033
2. Printing and Reproduction	36	43	42	44
3. Transportation	843	881	839	873
4. Installation Common Services.....	114	120	115	120
Total, Management and Operations	1,907	1,905	1,989	2,070

Explanation of Fund Reauirements

1. Administrative Communications.....	914	861	993	1,033

Provides for NASA's share of the local telephone service, Federal Telecommunications System (FTS), long distance and operation and maintenance of the on-site communications equipment and switchboard. The increase from the 1985 budget estimate to the current estimate reflects cost escalation. The increase from the 1986 current estimate to the 1987 budget estimate reflects expected cost escalation.

2. Printing and Reproduction	36	43	42	44

Provides for printing and reproduction services in support of the Earth Resources Laboratory and the local house organ.' The increase from the 1986 current estimate to the 1987 budget estimate reflects expected cost escalation.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Transportation..	843	881	839	873

This estimate includes local transportation for the NSTL staff and the support contractors, as well as freight costs, government bills of landing, air freight, other general shipments and related transportation costs. The decrease in the 1986 budget estimate to the 1986 current estimate is due to rephasing of the support contract funding. The increase from the 1986 current estimate to the 1987 budget estimate reflects anticipated cost increases in vehicle rentals.

4. Installation Common Services.....	114	120	115	120

Provides supplies, materials and equipment for the Center. The decrease from the 1986 budget estimate to the 1986 current estimate is due to rephasing of support service contractor obligation plans. The increase from the 1986 current estimate to the 1987 budget estimate reflects expected cost escalation for the same level of service.

ORGANIZATION CHART

FY1987 CONGRESSIONAL BUDGET
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NATIONAL SPACE TECHNOLOGY LABORATORIES

NSTL SUMMARY STAFFING

	FY86	FY87
SES	3	
GM-15	9	9 1
GM-14	8	8
All other GS/GM	102	102
TOTAL PERMANENT	122	122

OFFICE OF THE DIRECTOR

	FY86	FY87
SES	2	2
GM-14	1	1
All other GS/GM	5	5
TOTAL PERMANENT	8	8

CHIEF COUNSEL

	FY86	FY87
GM-15	1	1
GM-14	1	1
All other GS/GM	2	2
TOTAL PERMANENT	4	4

EXECUTIVE STAFF

FY86 FY87

COMPTROLLER

GM-15	1	1
GM-14	0	0
All other GSIGM	19	19
TOTAL PERMANENT	20	20

PROCUREMENT & CONTRACTS OFFICE

	FY86	FY87
GM-15	1	1
GM-14	0	0
All other GSIGM	13	13
TOTAL PERMANENT	14	14

FACILITIES ENGINEERING OFFICE

	FY86	FY87
GM-15	1	1
GM-14	1	1
All other GS/GM	12	12
TOTAL PERMANENT	14	14

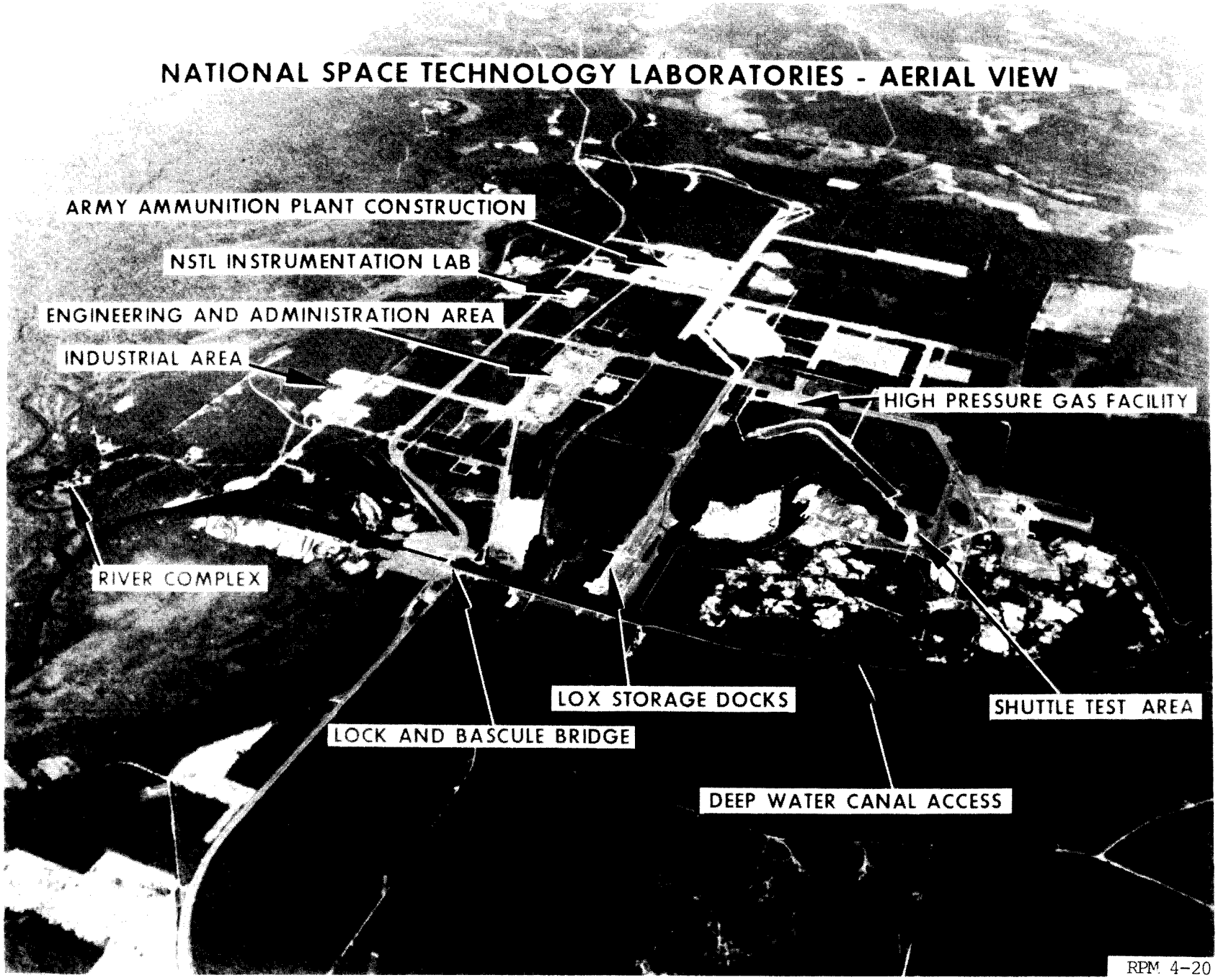
INSTALLATIONS OPERATIONS OFFICE

	FY86	FY87
GM-15	1	1
GM-14	2	2
All other GS/GM	16	16
TOTAL PERMANENT	19	19

EARTH RESOURCES LABORATORY

	FY86	FY87
SES	1	1
GM-15	4	4
GM-14	3	3
All other GSIGM	30	30
TOTAL PERMANENT	38	38

NATIONAL SPACE TECHNOLOGY LABORATORIES - AERIAL VIEW



RPM 4-20

GODDARD
SPACE FLIGHT
CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

GODDARD SPACE FLIGHT CENTER

DESCRIPTION

The Goddard Space Flight Center (GSFC), located 15 miles northeast of Washington, D.C., at Greenbelt, Maryland, is situated on a 552-acre main site. Three additional nearby plots of 554 acres comprise the remote site area and contain the Goddard Antenna Test Range, the Goddard Optical Facility, the Propulsion Research Facility, the Laser Facility, the Magnetic Fields Component Test Facility, the Attitude Control Test Facility, and the Network Training and Test Facility. The Center also utilizes an additional 6,176 acres at the Wallops facility located on the Atlantic Coast of Virginia's eastern shore. The Wallops facility consists of 1,833 acres on the main base, 3,095 acres on Wallops Island launching site, 108 acres on the mainland tracking site, and 1,140 acres of marshland. The total capital investment for the Goddard Space Flight Center, including tracking stations, work in progress, contractor-held facilities at various locations, and the Wallops facility, as of September 30, 1985, was approximately $821,565,000.

The majority of the Goddard Center's personnel are located at Greenbelt, Maryland. Other personnel are located at the Wallops facility in Virginia, the Goddard Institute for Space Studies in New York City, and at various world-wide sites, managing the operation of satellite tracking and communications network stations.

CENTER ROLES AND MISSIONS

The GSFC, established in 1959 as the first major United States installation devoted to the investigation and exploration of space, conducts a wide-ranging program in earth and space sciences. The GSFC has developed many diverse capabilities: the management of complex projects; the development of wholly integrated spacecraft, ranging from systems engineering to development, integration, and testing;. the development and operation of satellite tracking networks, and data acquisition and analysis; scientific research to include both theoretical studies and the development of many significant scientific experiments flown on satellites; and the operation of a research airport, located at Wallops, in support of NASA's aeronautics research programs. The principal and supporting roles are:

PRINCIPAL:

Earth Orbital Spacecraft Development, On-Orbit Servicing and Fliqht Operations - includes spacecraft propulsion and supporting technology such as low cost structural evaluation and reliability demonstration, advanced guidance systems and space power systems. Major emphasis is on automated, standard spacecraft systems, free-flyers, experiment development and integration, on-orbit free-flyer and payload servicing, Space Station Platforms, and the planning and conducting of associated flight operations.

Tracking and Data Acquisition Systems and Support Operations - plans, develops, implements and operates tracking facilities and provides for the related data processing, communications, and mission control; plans and conducts support of Earth orbital spacecraft, aeronautical research and sounding rockets; and network planning and implementation support for the Shuttle. This includes the implementation of the Tracking and Data Relay Satellite System (TDRSS).

Launch Range and Research Airport Management and Operations - plans and operates the Wallops launch range, associated aircraft, and a research airport in support of NASA aerospace programs as well as other Government agencies, such as the Department of Defense, and the academic and international community. Launch support and related services are provided for various sounding rockets and the expendable Scout launch vehicles launched at the Wallops facility.

Expendable Launch Vehicles - Goddard is the management center for the Delta launch vehicle.

Space Science and Applications - develops the bases for science and technology disciplines, develops and calibrates spaceborne sensors, and ground data processing and analysis systems, conducts scientific research and theoretical modeling studies, and implements science and applications experiments in astronomy, solar physics, high energy astrophysics, solar terrestrial studies, and atmospheric, oceanic and land processes.

Sounding Rocket Development, Procurement and Operations - develops and procures sounding rockets and carries out all phases of operations from mission/flight planning to landing and recovery, including supporting systems (i.e., guidance, telemetry and attitude control, power, payload housing, separation systems, and recovery).

Balloon Program - manages and provides technical oversight and direction to the balloon activities conducted for NASA and other agencies.

Spacelab Payload Development - develops, analytically integrates and processes data for Spacelab payloads in astrophysics, solar terrestrial physics, astronomy, and applications.

Special Payloads - manages and develops low cost reusable carrier systems which accommodate a variety of payloads to be flown on Shuttle missions. Three basic carrier systems are currently on-line to support Spartan, Get-Away Specials (GAS), and Hitchhiker payloads. These payloads, when ready, will be integrated and tested with the carrier and then flown with compatible Shuttle missions. These activities involve development and operation of diverse mechanical, power, electrical, aerodynamic, propulsion, control, thermal and combined systems. In addition, center personnel coordinate with an international array of experimenters (including private citizens, and representatives from high schools, universities, industry and other Government agencies) to accommodate their investigations with the carrier and Shuttle systems.

SUPPORTING:

Planetary Science - develops and applies techniques for the investigation and analysis of planetary atmospheres.

Aerospace Fliqht Test Support - plans and conducts launches of scientific payloads and aeronautical tests and other research, development and related activities as requested by elements of NASA, the Department of Defense, other Government agencies, and the worldwide scientific community.

SUMMARY OF RESOURCES REQUIREMENTS

FUNDING PLAN BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. Personnel and Related Costs	154,834	160,724	160,859	162,915
II. Travel	4,458	4,314	4,600	4,900
III. Operation of Installation	37,565	41,590	38,471	46,523
A. Facilities Services	(19,850)	(24,192)	(21,368)	(24,760)
B. Technical Services	(5,058)	(5,999)	(6,009)	(9,694)
C. Management Operations	(12,657)	(11,399)	(11,094)	(12,069)
Total, fund requirements	196,857.	206,628	203,930	214,338

DISTRIBUTION OF CIVIL SERVICE WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	2. 230	2. 223	2. 307	2. 328
Space Station	122	113	175	200
Space Transportation Capability Development	26	13	14	14
Space Science and Applications	1.957	1.949	2, 006	2, 000
Physics and Astronomy	1.134	1.150	1.160	1.105
Life Sciences	1	1	1	1
Planetary Exploration	80	77	76	75
Space Applications	742	722	768	819
Commercial Programs	11	14	9	9
Technology Utilization	10	10	8	8
Commercial Use of Space	1	4	1	1
Aeronautics and Space Technology	88	105	77	78
Aeronautical Research and Technology	10	13	9	9
Space Research and Technology	78	92	68	69
Space Tracking and Data Advanced Systems	26	28	27	27
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS	656	687	633	613
Space Transportation Operations	69	85	71	61
Space and Ground Networks. Communication and Data Systems	587	602	562	552
Subtotal. Direct Workyears	2. 886	2. 910	2. 940	2. 941
CENTER MANAGEMENT AND OPERATIONS SUPPORT	673	659	636	635
Subtotal Permanent Workyears	3. 559	3. 569	3. 576	3. 576
Other than full-time permanent	108	100	99	99
Total. permanent workyears	3. 667	3. 669	3.675	3. 675

	Permanent Civil Service Workyears
SPACE STATION	200

Space Station activities involve the evaluation of proposals and initial studies for definition of user science requirements, automated free-flying platforms, laboratory module outfitting and provisions to service, maintain and repair space platforms and free-flying spacecraft. In addition, systems engineering and integration efforts will be performed in direct support of the Johnson Space Center. Discipline studies in thermal and data systems requirements will be conducted. Working groups of scientists will be activated to involve potential users in Space Station requirements definition.

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT	14

GSFC is developing the Hitchhiker, a reusable carrier system which will provide increased flight opportunities with reduced leadtime, maximizing Shuttle load factors and minimizing spaceflight costs.

PHYSICS AND ASTRONOMY	1,105

Astrophysics activities at GSFC are pursued to accomplish laboratory and flight scientific research to increase human knowledge of the Earth's space environment, the stars, the Sun, and other objects in space; and provide advanced technical development of experiments and spacecraft components for future astrophysics missions. GSFC manages activities in the pursuit of scientific progress in all of the following areas of astrophysics: gamma ray astronomy, X-ray astronomy, ultraviolet and optical astronomy, infrared and radio astronomy, particle astrophysics, solar physics, interplanetary physics, planetary magnetospheres, and astrochemistry.

During 1986, the Hubble Space Telescope will be launched. HST will provide a space observatory and dedicated ground system to extend the sensitivity, resolving power, and spectral range of astronomical observatories significantly beyond those achievable from ground-based observations. Development activities will continue on the Gamma Ray Observatory mission, the Cosmic Background Explorer, various Shuttle/Spacelab Payloads and integrated rocket experiments; and the analysis of data from several major Physics and Astronomy missions including the High Energy Astronomy Observatories, the Dynamics Explorer, the repaired Solar Maximum Mission and the Active Magnetospheric Particle Tracer Explorer.

The International Ultraviolet Explorer spacecraft, with its unique satellite control and data management systems, will continue to afford guest observers the opportunity to point the satellite in real-time from the ground, make quick observations, and receive data in visual formats.

During 1986 and 1987, GSFC will be responsible for the continued development of a U.S. supplied focal plane, high resolution imaging instrument to be flown on the German Roentgen Satellite which is scheduled for launch in 1987 on the Space Shuttle. The Roentgen Satellite, another NASA international cooperative project with the Federal Republic of Germany, will perform the first all sky survey of X-ray sources and will point to and study specific X-ray sources for extended periods of time.

Goddard will provide the management and support of the NASA domestic and international sounding rocket programs. The project extends from conception through launch and analysis of the data obtained in the following areas: galactic astronomy, high energy astrophysics, solar physics, plasma physics, upper atmospheric and interdisciplinary research, and the space applications of materials processing science. During 1986 and 1987, Goddard will continue development of sounding rocket class payloads for flight on the Space Shuttle. This is a cost-effective approach which allows instruments to be flown for much longer periods of time than available with sounding rockets.

Goddard will continue to manage the scientific balloon program providing for launch and tracking support, flight hardware, and technical support including new systems development. Goddard has responsibility for operation of the National Scientific Balloon Facility at Palestine, Texas, and provides management and technical oversight.

	Permanent Civil Service Workyears
LIFE SCIENCES	1

The Goddard Life Sciences activities involve the utilization of remote sensing satellites to increase our understanding of global biological characteristics and processes.

PLANETARY EXPL~RATION	75

The GSFC activity within Planetary Exploration emphasizes the physics of interplanetary space environments. To this end, GSFC will maintain a strong and viable research group, with participation in instrument development and mission generations and data analysis activity.

SPACE APPLICATIONS	819

The 1986 and 1987 program activities will span GSFC's broad roles and missions mandate, including activities in the discipline areas of land, oceans, and atmospheric sciences. GSFC is engaged in three major types of activities in these areas: research and technology, flight projects, and data analysis.

The research and technology effort is directed toward solving major problems in the disciplines mentioned and involves conceptual instrument design and testing, mission payload studies, and conceptual flight missions. This is accomplished through the design and construction of mathematical models to study:

1. The global circulation of the Earth's atmosphere for better weather and climate predictions;

2. The geopotential fields (gravity and magnetic) of the Earth to provide a better understanding of the structure and evolution of the Earth;

3. The processes of the oceans such as surface winds, waves, temperature, currents, and circulation to support the ongoing weather and climate studies and the ocean research program;

4. The physical characteristics of the Earth's vegetation cover, water resources, and land use which can be remotely sensed; and

5. The interaction between the Earth's atmosphere, hydrosphere, and cryosphere.

Some examples of instrumentation activities which GSFC is supporting include instrumentation for measuring temperature and pressure profiles in the atmosphere which are essential parameters for weather and climate models; user active and passive microwave systems for measuring sea surface temperatures and winds, and measurement of soil moisture essential for water resources modeling and agricultural yield predictions; new instruments for ocean color measurements; and high precision laser electronic ranging systems in support of the Earth and ocean dynamics activities.

At GSFC flight project responsibilities in 1986 and 1987 include:

1. Operational weather satellite missions for the National Oceanic and Atmospheric Administration (NOAA), including launch of NOAA-G, GOES-G, and GOES-H in 1986;

2. Continued operations of the Nimbus satellites to provide remotely sensed resources data and environmental observations to a worldwide applications research community;

3. The data from the Landsat-4 and 5 will continue to be analyzed to evaluate the benefits of a new generation of land observation instruments;

4. Earth Radiation Budget Experiment data will be collected for the study of geographical and seasonal variations of the Earth's radiation budget:

5. Conducting correlation measurements from balloons, sounding rockets, aircraft, and ground installations; and

6. Development activities will be continued on the Upper Atmospheric Research Satellite instrument and the spacecraft, leading to a launch in the fall of 1989.

Earth Science activities involve the formulation, analysis, and distribution of data received from satellites for which GSFC has management responsibility. Such demonstrations involve the use of data from the Nimbus-7 spacecraft for the solution of problems concerning pollution, ocean resources and dynamics, and weather and climate. Similar activities will be conducted by using the data from Landsat-4; this information will be of use to investigators in the disciplines of agriculture, forestry, geology, land use, cartography, hydrology, ecology, and oceanography. Solar Terrestrial research efforts will include analysis of data collected from operating satellites such as the Dynamics Explorer, the Interplanetary Monitoring Platform and the International Sun-Earth Explorers, which are providing opportunities to study the dynamic interactions of the solar wind and the Earth's magnetosphere from various points in space. On September 11, 1985, ICE accomplished a successful rendezvous with Comet Giacobini-Zinner. ICE is the first spacecraft in history to fly through the tail of a Comet.

	Permanent Civil Service Workyears
TECHNOLOGY UTILIZATION	8

Technology Utilization activities are directed toward the application of space technology to public and private sector needs. Foremost among the technology applications projects in 1986 and 1987 are the cerebrospinal fluid control system, the closed loop system for hypertension, and applications of the programmable implantable medication system. Other activities include: (1) new technology identification, evaluation, and publication; (2) dissemination methods and techniques; and (3) public sector technology applications projects.

COMMERCIAL USE OF SPACE	1

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology space-based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use and access to space.

AERONAUTICAL RESEARCH AND TECHNOLOGY	9

In 1986 and 1987, the Wallops airport will be used to conduct research tests of various aircraft in their terminal area operating environment. Flight studies will be made of new approach and landing procedures utilizing the latest in guidance equipment and techniques, pilot information displays, terminal area navigation, and tests of other systems leading to all weather automatic landing of aircraft.

One runway is being used to study aircraft hydroplaning, water ingestion and tire design on wet or slush-covered surfaces. The data acquired from this research testing will ultimately assist in the development of safer, more flexible transportation systems. Wallops will continue to support aircraft noise and safety research for general aviation.

	Permanent Civil Service Workyears
SPACE RESEARCH AND TECHNOLOGY	69

The Space Research and Technology Program activities provide results appropriate to space missions. Past efforts have produced many worthwhile advances in space system capability, reliability, and effectiveness. During 1986 and 1987, program areas of continuing emphasis will include sensor technology, data base systems computer system science, power and thermal systems, and spacecraft systems. New initiatives are planned in automation and robotics, laser communications, and space flight experiments.

TRACKING AND DATA ADVANCED SYSTEMS	27

Goddard's activity in this area involves the investigation and development of advanced tracking and data acquisition systems techniques. The primary objectives are to: (1) obtain new and improved tracking and data capabilities that will meet the needs of approved new missions; and (2) improve the cost effectiveness and reliability needed for overall support of space flight missions.

SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS

SPACE TRANSPORTATION OPERATIONS	61

Space Shuttle activities at GSFC include planning and implementing the equipment systems, communications data, voice circuits, and operational procedures required for support of the Shuttle program.

Goddard manages and coordinates the Agency's Get-Away-Special Program. Center personnel coordinate with an international array of experimenters (including private citizens, high school and university students, and industry) who have procured, through Agency established procedures, payload space on the Shuttle. Tasks include ensuring that experiments meet flight and safety specifications and securing the experiments into containers for Space Shuttle flight. Individual experimenters are responsible for the performance of their instruments/experiments.

Activities also include the management of a flight support system which is the electromechanical interface between the orbiter and Multimission Modular Spacecraft and other spacecraft with compatible interface parameters. It will be used for ascent, retrieval, repair, and descent phases of Space Shuttle flights carrying Multimission Modular Spacecraft and other compatible spacecraft.

Goddard is the management center for the Delta expendable launch vehicle which is capable of accurately putting a wide variety of spacecraft into a broad spectrum of orbits, ranging from equatorial to polar inclinations. The Delta has been used for a wide range of reimbursable missions for other Government agencies, domestic commercial users, and international users, currently with 44 consecutive successful launches. The Delta vehicle has served the Agency for nearly three decades and will be phased out in 1987 as a Government-managed expendable vehicle program. A Scout launch capability is maintained by the Wallops facility.

	Permanent Civil Service Workyears
SPACE AND GROUND NETWORKS, COMMUNICATION AND DATA SYSTEMS.....	552

The Space Tracking and Data Systems program at GSFC involves five main areas: operation of the Space Tracking and Data Network; mission control, data processing, and orbit/attitude computation support for flight projects; the TDRSS; the NASA Communications (NASCOM) Network; and aeronautics and sounding rocket support.

The Space Tracking and Data Network is operated in direct support of NASA's Earth orbiting scientific and applications satellites and Shuttle/Spacelab programs. In addition, the Network provides on a reimbursable basis services to satellites that are operated by other United States Government Agencies, such as the Department of Defense and the National Oceanic and Atmospheric Administration, by foreign Governments, and by commercial companies. Appropriate segments of the Network deliver critical coverage for the launch of spacecraft that are on deep space missions by providing support during portions of the early flight path not visible to NASA'S Network (DSN).

The NASA Communications Network (NASCOM) provides all operational communications required by NASA. Facilities of this network link the stations of the Space Tracking and Data Network, the TDRSS, the DSN, and other tracking and data acquisition support elements with control centers, and the data processing and computation center, thereby making it possible for all participants to operate as a network.

GSFC provides tracking, data acquisition, communication, and control in support of the aeronautics and sounding rockets program. This 'includes support of balloons, sounding rockets, reentry vehicles and satellites launched from Wallops Island and other offsite range locations.

The Tracking and Data Relay Satellite System will become operational during 1986 with three operational satellites in geosynchronous orbit and the White Sands Ground Terminal providing telemetry, tracking, and command support. The system employs both S- and Ku-band frequencies and will greatly increase coverage

capabilities available to Earth orbiting spacecraft. The network will provide the operational interface between the project users and the TDRSS. With the demonstration of a successful TDRSS, a number of Spaceflight Tracking and Data Network ground stations will be closed. Two of the current stations will be maintained to provide for Shuttle launch and planetary support.

During 1986 and 1987, the GSFC Tracking Network will provide tracking for the Space Transportation System launched payloads.

Ground station support will also be continued for a number of operating satellites such as the International Sun Earth Explorers, International Ultraviolet Explorer, Solar Maximum Mission, and Nimbus. Some examples of this support include: mission control, orbit/attitude computing, and sensor data processing.

During 1986 and 1987, emphasis will continue to be placed on the operation of the Spacelab, Image, and Telemetry Data Processing Facilities. In 1986, software development activities relative to the Hubble Space Telescope Data Capture Facility will be completed.

Design and development of a generic data capture facility began in 1985. This system, when implemented, will minimize the repetitive development costs currently encountered in the support of different scientific missions. These activities will be continued in 1986 and conclude in 1987.

The first release of consolidated orbit computation software was completed in 1985 with subsequent releases scheduled for completion in 1986 and 1987. This software will provide the capability to perform realtime and non-realtime orbit determination as well as orbit computation product generation and tracking data evaluation with a single software system on a single processor.

In the area of mission control, work will continue in 1986 on the Multisatellite Operations Control Center to allow for the automation of systems in order to minimize manpower requirements for mission support. Likewise, work will proceed in the Hubble Space Telescope Operations Control Center to ready that facility for observer activities beginning in 1986.

In order to support the appropriate use of the most advanced technologies in these data systems, prototypes will be developed to provide lower cost and higher performance data handling components; to incorporate routine operations decisions in expert systems to reduce manpower costs; and to provide automated tools for software engineering and systems development management. An interactive systems prototyping environment will be assembled to allow simulation of critical man-machine operations interfaces early in the development cycle to reduce the need for expensive design changes later in the cycle. An integrated, distributed data base system will be implemented to improve the flow of management and technical information.

	Permanent Civil Service Workyears
CENTER MANAGEMENT AND OPERATIONS SUPPORT.....	*635*

Center Management and Operations Support is defined as support or services being provided to all GFSC organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved are:

Director and Staff - The Center Director, Deputy Director and the immediate staff, staff organizations, e.g., Comptroller, Chief Counsel, Equal Opportunity, and Public Affairs.

Management Support - Those who provide information and control services supporting all levels of Center management, both program and functional. Specific functions include resources and financial management, contracting and procurement, property management, personnel management, and management systems and analysis.

Operations Support - Those who provide for the operation and maintenance of institutional facilities, buildings, systems and equipment, including those who manage or provide technical services such as automated data processing, health and safety, and medical care.

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)-		
I. PERSONNEL AND RELATED COSTS	**154.834**	**160.724**	**160.859**	**162.915**
	Summary of Fund Requirements			
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	134.201	139.364	139.279	140.552
b. Other than full-time permanent	1.925	1.866	2.000	2.000
c. Overtime and other compensation	2.078	2.254	2.302	2.332
Subtotal. Compensation	138.204	143.484	143.581	144.884
2. Benefits	14.623	15.224	15.083	15.552
Subtotal, Compensation and Benefits	152.827	158.708	158.664	160.436
B. Supporting Costs				
1. Transfer of personnel	443	378	570	694
2. Personnel training	1.564	1.638	1.625	1.785
Subtotal. Supporting Costs	2.007	2.016	2.195	2.479
Total. Personnel and Related Costs	154.834	160.724	160.859	162.915

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
A. Compensation and Benefits.....	152,827	158,708	158,664	160,436
1. Compensation	138,204	143,484	143,581	144,884
a. Permanent workyears..	134,201	139,364	139,279	140,552

The increase in compensation from the 1986 budget estimate to the 1986 current estimate is due to an increase in FTE allocation. The increases in Compensation and Benefits from the 1986 current estimate to the 1987 budget estimate are due to the adjustments described below.

Basis of Cost for Permanent Workyears

In 1987, the cost of permanent workyears will be $140,552. The increase from 1986 is calculated as follows:

Cost of full-time permanent workyears in 1986.....		139,279
Cost increases in 1987.....		4,161
Within-grade and career advances:		
Full year cost of 1986 actions.....	1,610	
Part year cost of 1987 actions.....	1,785	
Decrease in reimbursements received.....	766	
Cost Decreases in 1987.....		-2,888
Turnover savings and abolished positions:		
Full year effect of 1986 actions.....	-1,462	
Partial year effect of 1987 actions.....	-1,426	
Cost of full-time permanent workyears in 1987.....		140,552

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent workyears				
1. cost	1,925	1,866	2,000	2,000
2. Workyears	129	136	130	130

The distribution of 1987 workyears is as follows:

Distribution of Other than Full-Time Permanent Workvears

Program	Workyears
Developmental programs	58
Other temporary	41
Youth opportunity programs	31
Total	130

The level of support remains constant for these programs.

c. Overtime and other compensation	2,078	2,254	2,302	2,332

The increases from the 1986 budget estimate to the 1986 current estimate and from the current estimate to the 1987 budget estimate reflect a centerwide emphasis on awards for performance and productivity accomplishments.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
The following are the amounts of contribution by category:				
Civil Service Retirement Fund	8,678	9,302	8,942	9,225
Employee Life Insurance	285	384	304	314
Employee Health Insurance	3,450	3,484	3,566	3,679
Workmen's Compensation	276	300	300	325
FICA	383	70	396	409
Medicare	1,542	1,664	1,575	1,600
Other	9	20	---	---
Total	14,623	15,224	15,083	15,552

Adjustments to Civil Service Retirement and FICA from the 1986 budget estimate to the 1986 current estimate are due to changes in Civil Service retirement law as applied to newly hired employees. The increase in benefits from the 1986 current estimate to the 1987 budget estimate is concomitant with salary adjustments for permanent workyears.

B. Support Costs	2,007	2,016	2,195	2,479
1. Transfer of personnel	443	378	570	694

The category includes the reimbursement of employees for movement of household goods to the employee's new duty station, transfer between tracking stations, and other relocation expenses. The increase from the 1986 budget estimate to the 1986 current estimate reflects the costs associated with a new contract for services to assist employees in permanent change of station moves. The 1987 estimate reflects the planned level of transfers at the anticipated cost levels.

2. Personnel Training	1,564	1,638	1,625	1,785

The personnel training costs are based on current training programs and the need to reorient employees' skills into areas compatible with the needs of the current space program and GSFC's role in the program. The 1987 estimate is based on the projected cost for the current level of requirements.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**4,458**	**4,314**	**4,600**	**4,900**
Summary of Fund Requirements				
A. Program Travel	3,793	3,830	3,914	4,184
B. Scientific and Technical Development Travel	302	262	320	346
C. Management and Operations Travel	363	222	366	370
Total, Travel	4,458	4,314	4,600	4,900
Explanation of Fund Requirements				
A. Program Travel	3,793	3,830	3,914	4,184

Program travel is essential to the accomplishment of the Center's mission, particularly with regard to the Space Science and Applications, Aeronautics and Space Technology, Tracking and Data Acquisition, Space Transportation System and Space Station programs. In these areas, efforts will be devoted to performing applications research, developing complex satellites and launch systems, managing data processing systems, and creating scientific instruments for further research. The increase from the 1986 budget estimate to the 1986 current estimate reflects an increase for Space Station expenditures. The increase in the 1987 estimate reflects approximately the same level of travel at higher anticipated travel costs and an increase for Space Station expenditures.

B. Scientific and Technical Development Travel	302	262	320	346

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. This participation allows personnel to benefit from exposure to technological advances outside GSFC, as well as to present both accomplishments and problems to associates. Many of the meetings are working panels convened to solve certain problems for the benefit of the government. The increase from the 1986 budget estimate to the 1986 current estimate is based on the same level of requirements as 1985 actuals at 1986 rates. The increase in the 1987 budget estimate from the 1986 current estimate reflects rate increases for the current level of requirements.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Summary of Fund Requirements				
C. Management and Operations Travel.....	363	222	366	370

Management and operations travel is used for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management, and procurement activities, travel of the Center top management to other NASA Centers and local travel in and around the Washington metropolitan area and to and from Wallops. The increase from the 1986 budget estimate to the 1986 current estimate reflects a revised number of trips for facilities engineering support at remote GSFC facilities, development of productivity initiatives, and recruiting. The 1987 budget estimate reflects rate increases for the current level of effort.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION	37,565	41,590	38,471	46,523

Summary of Fund Requirements

A. Facilities Services	19,850	24,192	21,368	24,760
B. Technical Services	5,058	5,999	6,009	9,694
C. Management and Operations	12,657	11,399	11,094	12,069
Total, Operation of Installation	37,565	41,590	38,471	46,523

Explanation of Fund Requirements

Operation of installation provides a broad range of services, supplies, and equipment in support of the center's institutional activities. These are divided into three major functional areas: (1) Facilities Services, the cost of renting real property, maintaining and repairing institutional facilities and equipment, the cost of custodial services and utilities; (2) Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs; and (3) Management and Operations, the cost of administrative communications, transportation, medical, supply, and related services.

The decrease from the 1986 budget estimate to the 1986 current estimate is primarily due to lower than anticipated utility rates, support service contractor wage rates, a rephasing of support contractor obligation rates, and the delay and deferral of other activities. The 1987 budget estimate provides for projected increases in support contractor rates, supplies, materials, equipment and utility rates, the replacement of a critically needed administrative computer, and full year funding for support service contracts.

A. Facilities Services	19,850	24,192	21,368	24,760

The Greenbelt facility is located on a 552-acre main site, and on a 554-acre remote site area with a complex of laboratory and office-type buildings as well as test facilities. This complex encompasses 2.5

million gross square feet of building space including 34 buildings. This physical plant supports an average daily on-center population of about 6,000. Many of the test facilities are used on schedules involving more than one shift, often during off-peak hours.

The Wallops facility includes 6,175 acres and a complex of facilities which mainly consists of a research airport and launch operations facilities. This complex encompasses 1.1 million gross square feet of building space including three major buildings. Also included are three major technical facilities. This physical plant supports an average daily on-site population of approximately 1,000.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Summary of Fund Requirements				
1. Rental of Real Property	680	695	615	694
2. Maintenance and Related Services	4,835	6,780	5,403	6,541
3. Custodial Services	4,343	4,773	4,348	4,763
4. Utility Services	9,992	11,944	11,002	12,762
Total, Facilities Services	19,850	24,192	21,368	24,760

Explanation of Fund Requirements

1. Rental of Real Property	680	695	615	694

Provides space for personnel at tracking stations and the Goddard Institute for Space Studies in New York. The decrease from the 1986 budget estimate to the 1986 current estimate reflects 1985 experience in rental payments to the General Services Administration, as well as closing the Chile tracking station. The increase in the 1987 budget estimate reflects GSA rates.

2. Maintenance and Related Services	4,835	6,780	5,403	6,541

This activity includes general building maintenance such as painting, inspection and mechanical and electrical maintenance. It provides for ground maintenance and also includes supplies and facilities

equipment such as building materials, electrical and electronics materials, general maintenance and operating materials.

The decrease from the 1986 budget estimate to the 1986 current estimate reflects 1985 experience. The increase from 1986 to 1387 reflects anticipated support service contractor wage rate growth and expected increases in 1987 price levels for supplies, materials, equipment and other contractual effort.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Custodial Services.....	4,343	4,773	4,348	4,763

The estimate provides for janitorial, plant security, fire fighting and ambulance services. These services include washing and relamping of light fixtures, office cleaning, minor laundry services, trash removal, badging of all on-site personnel and visitors, vehicle identification, and fire fighting. The decrease from the 1986 budget estimate to the 1986 current estimate reflects 1985 experience and the rephasing of support service contract funding. The increase in the 1987 budget estimate is due to anticipated rate changes in support service contracts, the provision of adequate security and fire protection, and the full year funding of support service contracts.

4. Utility Services.....	9,992	11,944	11,002	12,762

The estimate provides for maintenance of the utility plant and distribution systems as well as the purchase of utility services, and supplies, materials and equipment required for the maintenance of these systems. At the Greenbelt facility, electricity is purchased from the Potomac Electric and Power Company, natural gas from the Washington Gas Light Company, and fuel oil from a local supplier. Water and sewage service is provided by the Washington Suburban Sanitary Commission. The purchased utilities at Wallops are electricity and fuel oil. The decrease from the 1986 budget estimate to the 1986 current estimate and the increase from the 1986 current estimate to the 1987 budget estimate reflects the anticipated utility rate increases and the consumption projections from 1985 experience.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. Technical Services	5,058	5,999	6,009	9,694
Summary of Fund Requirements				
1. Automatic Data Processing	4,228	5,065	5,138	8,788
a. Equipment	800	1,306	1,115	4,373
b. Operations	3,428	3,759	4,023	4,415
2. Scientific and Technical Information	595	676	676	646
a. Library	31	44	45	47
b. Education and Information	564	632	631	599
3. Shop Support Services	235	258	195	260
Total, Technical Services	5,058	5,999	6,009	9,694
Explanation of Fund Requirements				
1. Automatic Data Processing	4,228	5,065	5,138	8,788

This funding provides for the hardware, system software, maintenance, and programming and operations support necessary to supply management with accurate and timely information. The systems supported include institutional management, finance and accounting, procurement and personnel management. The increase in the 1986 current estimate from the 1986 budget estimate provides additional contract support to upgrade the accounting system and a revised estimate of wage rates. The 1987 budget estimate includes the replacement of a critically needed administrative computer which will be capable of handling current and future demands for online systems and real-time information, as well as support contracts at anticipated wage rate levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Scientific and Technical Information.....	595	676	676	646

These funds provide for a public affairs educational and information program, and support to the center in the provision of various scientific and technical information services. This estimate also provides for exhibit management and refurbishment, demonstration models, workshops and symposia, and education and information materials. The center is making a concerted effort to vitalize its outreach to the community. In 1985, funds supplied equipment for the briefing room which has been used for press briefings during shuttle launches and for briefings and discussions with local educators. The briefing room will be utilized to a greater extent during and following the Hubble Space Telescope mission. In 1986 and 1987, the center plans to renovate the exhibits in the Greenbelt visitors center to provide a comprehensive and participative view of the space program at GSFC.

3. Shop Support Services.....	235	258	195	260

Support is given in the areas of safety, fire protection system maintenance and related supplies and equipment. Engineering and fabrication support for facility planning and alteration and safety, reliability, and quality assurance requirements and other technical services are included in this category. The decrease from the 1986 budget estimate to the 1986 current estimate reflects the deferral of purchases of audio visual and fire warning system equipment until 1987.

C. Management and Operations.....	12,657	11,399	11,094	12,069
Summary of Fund Requirements				
1. Administrative Communications.....	4,845	4,815	5,198	4,627
2. Printing and Reproduction.....	5	70	61	69
3. Transportation.....	1,326	2,628	1,303	1,633
4. Installation Common Services.....	6,481	3,886	4,532	5,740
Total, Management and Operations.....	12,657	11,399	11,094	12,069

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			

Explanation of Fund Requirements

1. Administrative Communications.....	4,845	4,815	5,198	4,627

These funds support local telephone service, long distance service and other administrative communications. Cost increase from the 1986 budget estimate to the 1986 current estimate is due to a projected increase in Federal Telecommunications System (FTS) charges. In 1986, the center is installing its own interconnect phone system from which we anticipate annual cost savings beginning in 1987 due to reduced charges for leased lines and system maintenance.

2. Printing and Reproduction.....	5	70	61	69

This category covers the costs associated with the maintenance of administrative copiers across the center. The projected decrease from the 1986 budget estimate to the 1986 current estimate reflects anticipated cost for centerwide maintenance service agreements. The increase in the 1987 budget estimate is for anticipated rate increases in the maintenance agreements.

3. Transportation.....	1,326	2,628	1,303	1,633

This funding provides for the operation and maintenance of an administrative aircraft, purchase of replacement vehicles, the maintenance and repair of the installation's vehicle fleet, fuel and supplies associated with the operations of the vehicles, and special vehicle rental. The decrease from the 1986 budget estimate reflects the reclassification of contract workyears associated with logistics to the installation common services subfunction. The increase in the 1987 budget estimate reflects anticipated support contractor wage rates and price levels for other goods and services in addition to the overhaul of the engine of a King Air administrative aircraft.

4. Installation Common Services.....	6,481	3,886	4,532	5,740

This activity supports center management and staff activities, provides medical services, and covers various installation support services. Funding provides for costs of: patent searches and applications; materials, equipment maintenance (microfilm, special typewriters, etc.) for staff offices; operation of the GSFC on-site health unit and medical services for the Goddard Institute for Space Studies employees in New York; and emergency care on-site, annual physical exams for Goddard employees, fitness programs, immunizations and counseling. Annual physical exams are provided for approximately 3,600 employees at the center. The necessary supplies, materials, and equipment for operation of the health unit are included.

This category also provides funding for packing and crating; rigging equipment for shipment; storage and warehousing; and moving and hauling. The change from the 1986 budget estimate to the 1986 current estimate reflects the reclassification of contract workyears associated with the logistics subfunction from the transportation subfunction and the rephasing of support service contract obligations plans. The increase from the 1986 current estimate to the 1987 budget estimate reflects anticipated support service contractor wage rates, expected 1987 price levels for supplies, materials, equipment and other contractual effort, and the full year funding of support service contracts.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

DIRECTOR

DEPUTY DIRECTOR

	86	87
SES	C	C
EXCEPTED	0	0
GS 16	0	0
GS 15	1	1
GS I4	0	0
OTHER GS	5	5
WAGE GRAOE	0	0
TOTAL	12	12

NASA OFFICE OF INSPECTOR GENERAL GSFC FIELD OFFICE

TOTAL

	86	87
SES	53	53
EXCEPTED	2	2
GS 16	1	1
GS 15	331	331
GS 14	538	538
OTHER GS	2573	2573
WAGE GRADE	130	130
TOTAL	[illegible]	[illegible]

COMPTROLLER

	86	87
SES	1	1
EXCEPTEO	0	0
GS 16	0	0
GS 15	3	3
GS 14	6	6
OTHER GS	W	W
WAGEGIAOE	0	0
TOTAL	104	104

DIRECTOR OF FLIGHT ASSURANCE

	86	87
SES	1	1
EXCEPTED	0	0
GS IC	0	0
GS 15	IS	15
GS 14	22	22
OTHER GS	JJ	77
WAGE GRADE	0	0
TOTAL	115	115

CHIEF COUNSEL

	86	87
SES	1	1
EXCEPTED	0	0
GS 16	0	0
GS 15	2	2
GS 14	2	2
OTHER GS	4	4
WAGE GRADE	0	0
TOTAL	9	9

EQUAL OPPORTUNITY PROGRAMS OFFICE

	86	87
SES	0	0
EXCEPTEO	0	0
GS 16	e	0
GS 15	e	0
GS 14	I	1
OTHER GS	4	4
WAGE GRAOE	0	0
TOTAL	5	5

OFFICE OF PUBLIC AFFAIRS

	86	87
SES	0	0
EXCEPTED	0	0
GS 16	0	0
GS 15	1	1
GS 14	3	3
OTHER GS	11	11
WAGEGIAOE	0	1
TOTAL	IS	15

DIRECTOR OF MANAGEMENT OPERATIONS

	86	87
SES	5	5
EXCEPTED	0	0
GS IC	0	0
GS 15	16	16
GS 14	35	35
OTHER GS	489	489
WAGE GRADE	130	130
TOTAL	675	615

DIRECTOR OF FLIGHT PROJECTS

	86	87
SES	10	10
EXCEPTED	0	0
GS 16	0	0
GS 15	81	81
GS 14	81	81
OTHER GS	135	135
WAGE GRADE	0	0
TOTAL	307	307

DIRECTOR OF MISSIONS OPERATIONS DATA SYSTEMS

	86	87
SES	4	4
EXCEPTEO	0	0
GS IC	0	0
GS I5	46	46
GS I4	91	91
OTHER GS	474	474
WAGE GRADE	0	0
TOTAL	615	615

DIRECTOR Of SPACE SCIENCE & ATH

	86	87
SES	14	14
EXCEPTED	2	2
GS 16	1	1
GS I5	102	102
GS 14	136	135
OTHER GS	508	
WAGEGIAOE	0	0
TOTAL	782	782

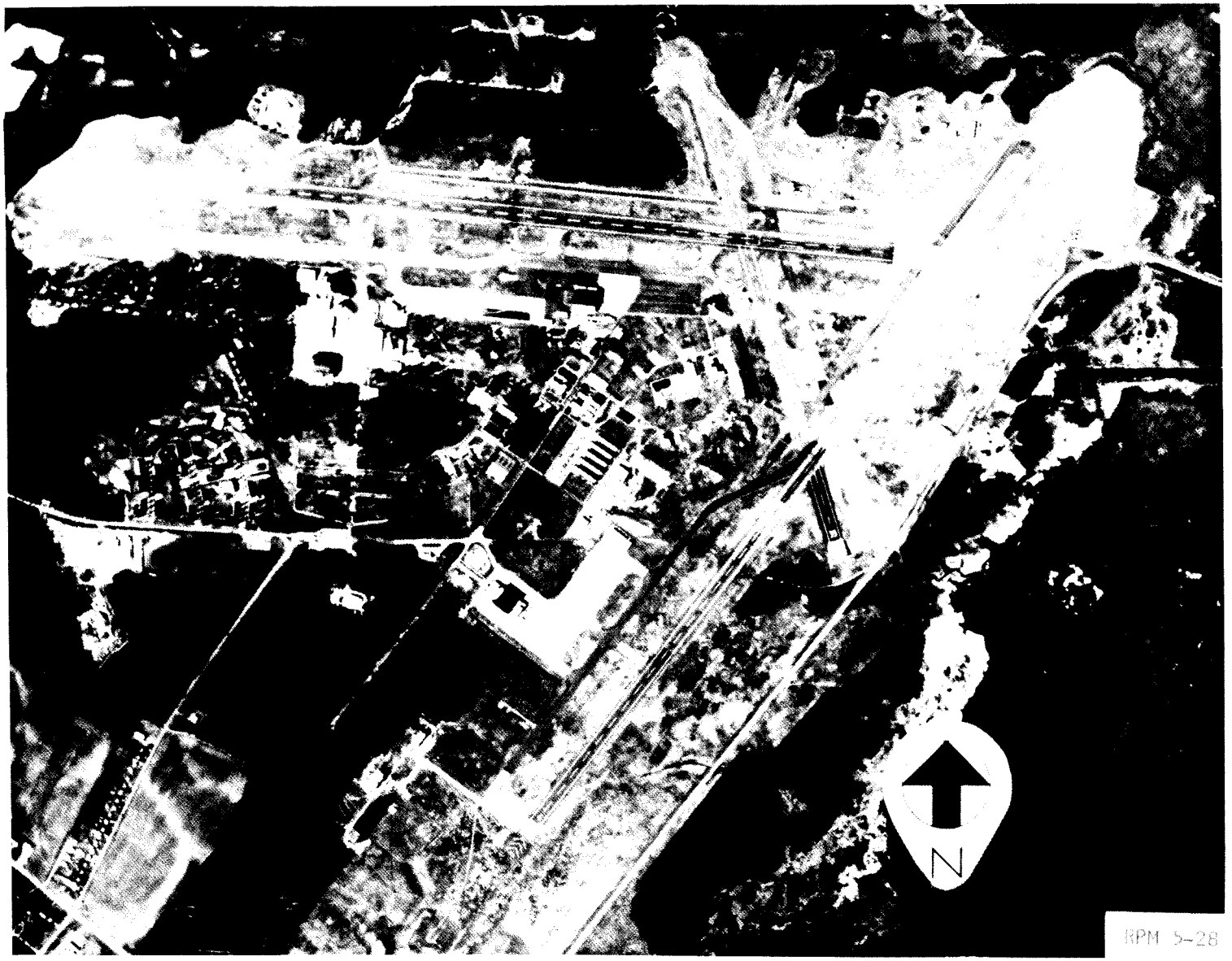
DIRECTOR OF ENGINEERING

	86	87
SES	1	1
EXCEPTEO	0	0
GS IC	0	0
GS 15	53	53
GS I4	131	131
OTHER GS	III	671
WAGEGIAOE	0	8
TOTAL	782	782

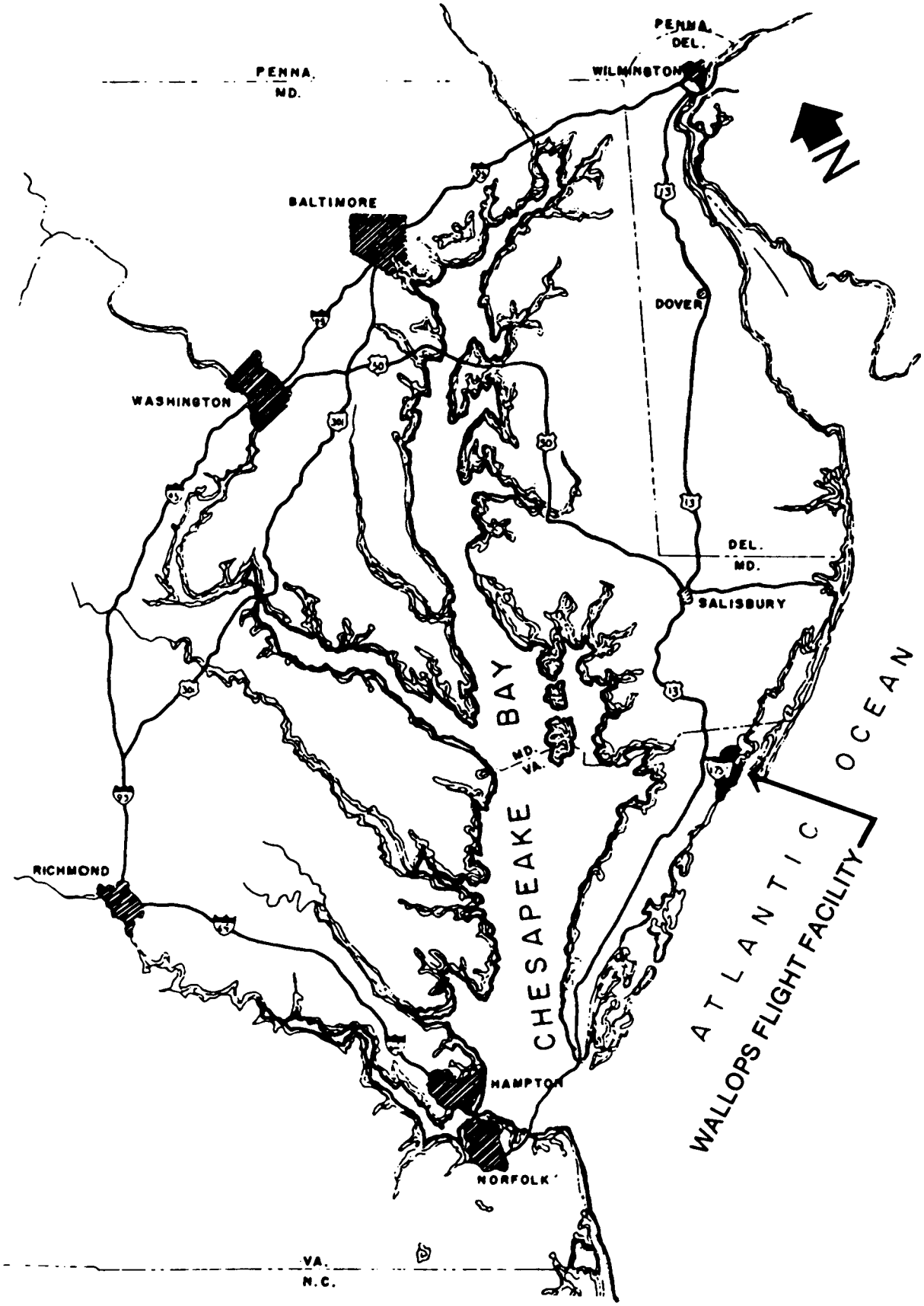
DIRECTOR OF SUBORBITAL PROJECTS AND OPERATIONS

	86	87
SES	4	4
EXCEPTED	0	0
GS 16	0	0
GS 15	11	11
GS 14	31	31
OTHER GS	201	201
WAGE GRADE	0	0
TOTAL	247	247

GODDARD SPACE FLIGHT CENTER/WALLOPS
FISCAL YEAR 1987 ESTIMATES
AERIAL VIEW



GODDARD SPACE FLIGHT CENTER/WALLOPS
FISCALYEAR 1987 ESTIMATES
AREA MAP



AMES
RESEARCH CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

AMES RESEARCH CENTER

DESCRIPTION

Established in 1940, Ames Research Center (ARC) operates at two locations. The Ames Moffett location is on 423.5 acres at the southern end of San Francisco Bay on land contiguous to the U.S. Naval Air Station, Moffett Field, California. Certain facilities, such as the utilities and airfield runways, are used jointly by NASA and the Department of the Navy. Also housed at this location is the U.S. Army Aviation Research and Technology Activity. The capital investment at Ames Moffett, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1985, was $730,293,000.

The Ames Dryden Flight Research Facility (DFRF) is 65 air miles northeast of Los Angeles. Ames Dryden is located at the north end of Edwards Air Force Base on 521 acres of land under a permit from the Air Force. The total capital investment at DFRF, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1985, was $125,158,000.

CENTER ROLES AND MISSIONS

The programs at Ames involve research and development in the fields of aeronautics, life sciences, space sciences and applications, and space technology, as well as use for national needs of the new science and technology growing from the aerospace program. Specifically, the Center's major program responsibilities are concentrated in: theoretical and experimental fluid mechanics and aerodynamics, rotorcraft technology, powered-lift technology, high performance aircraft technology, flight simulation, flight research, computational fluid dynamics, fluid and thermal physics, space sciences, airborne. sciences and applications, controls and guidance, human factors, space biology and medicine, and ground and flight projects in support of aeronautics and space technology. In addition to these major program responsibilities, the Center provides major support for military programs. The principal and supporting roles are:

PRINCIPAL

Fundamental Aerodynamics - advance the general state of the art, both theoretical and experimental.

Rotorcraft Technology - advance the tools of helicopter performance analysis and design, and develop a technology base for improving efficiency, safety, performance and environmental acceptability.

Low-Speed Vehicle Systems - conduct research in the short and vertical takeoff and landing area with emphasis on advanced rotorcraft technology and systems.

Computational Fluid Dynamics - advance the state of the art through the definition of new systems, both hardware and software, and apply these advances to aeronautical and other related areas.

Aeronautical Flight Research - conduct flight research using aircraft as test facilities and conduct flight research programs of advanced aerospace vehicle concepts.

Flight Test Techniques - investigate and develop new flight test techniques to improve the capability of conducting flight research.

Flight Instrumentation Development - direct the development of new methods and equipment for flight measurements.

Guidance and Control - conduct theoretical investigation, simulation and flight research evaluation of new and innovative concepts in rotorcraft and power-lift aircraft flight control to validate design methods and verify system performance in the flight environment.

Human-Vehicle Interactions - advance the state-of-the-art through the study of man-machine and other human factor interactions and considerations involved in aircraft operations.

High-speed Aircraft - conduct flight research on advanced military configurations and demonstrate the potential for improved aircraft performance through the integration of aircraft systems.

Aircraft Automation - develop a technology base for automated aircraft by conducting research in the integration of artificial intelligence, controls and human factors.

Short Takeoff and Vertical Landing (STOVL) Technology - develop a technology base for military STOVL systems in support of Department of Defense missions.

Materials and Structures - conduct tests to increase the understanding of structural responses to aerodynamic heating, with particular emphasis on high temperature space or hypersonic vehicle structures.

Flight Simulation - improve the state of the art to permit more effective use of simulators in aircraft design and validation-of-flight simulation; provide support to NASA and other government agencies' development and flight programs.

Military and FAA Aeronautics - provide facilities and technical support to military and civil aviation in areas consistent with other Ames aeronautics roles and unique capabilities.

Transatmospheric Research and Technology - combine aeronautics and space disciplines to provide the technology for a future class of vehicles capable of flight to orbit and/or hypersonic cruise.

Airborne Research and Applications - conduct airborne research and applications experiments by operating instrumented jet aircraft.

Information Sciences - advance the nation's automation capabilities by focusing research efforts on the technology development for support of space station, planetary, astrophysical and aeronautical missions, and commercial use of space.

Fluid and Thermal Physics - develop thermal analysis methods and thermal protection systems required for aerospace planes and orbital transfer vehicles, including probe development for the Galileo mission.

Planetary Mission Operations and Data Analysis - conduct mission operations and data analysis support for the Pioneer series of missions.

Physics and Astronomy - conduct research in infrared astronomy, atmospheric physics, and astrophysics *to* contribute to basic understanding of the planet Earth.

Life Sciences:

Life Support Systems - develop advanced technology for spacecraft life support systems and protective systems.

Life Sciences Spaceflight Experiments - develop, manage and operate spaceflight experiments in the life sciences, particularly those involving non-human species, and provide information applicable to solving space medicine problems.

Space Biology - utilize the unique environment of space to expand our understanding of basic biological phenomena.

Biomedical Research - understand and ameliorate biomedical problems experienced by man during and following spaceflight.

Life in the Universe - provide understanding of the origin, evolution, nature and distribution of life in the universe and understand its interaction with the terrestrial environment.

SUPPORTING

Space Transportation System - provide prime and contingency landing support to the Space Transportation System.

Advanced Turboprop - Conduct research and technology efforts including wind tunnel and flight tests to support NASA's efforts in advanced turboprop technology.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)		
I.	Personnel and Related Costs.....	93,439	93,756	94,564	96,698
11.	Travel.....	2,513	2,720	2,717	2,983
III.	Operation of Installation	24,338	31,516	27,417	34,232
	A. Facilities Services	(11,796)	(18,757)	(15,861)	(21,820)
	B. Technical Services	(3,944)	(4,924)	(3,721)	(4,186)
	C. Management and Operations	(8,598)	(7,835)	(7,835)	(8,226)
	Total, fund requirements	120,290	127,992	124,698	133,913

Distribution of Permanent Civil Service Workyears

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	**1.459**	**1.444**	**1.458**	**1.458**
Space Station	12	14	11	11
Space Science and Applications	340	333	336	336
Physics and astronomy	107	111	105	105
Life sciences	132	127	133	133
Planetary exploration	54	47	47	47
Space applications	47	48	51	51
Commercial Programs	4	5	4	4
Technology Utilization	2	3	2	2
Commercial Use of Space	2	2	2	2
Aeronautics and Space Technology	1.103	1.092	1.107	1.107
Aeronautical Research and Technology	953	958	953	919
Transatmospheric Research and Technology	--	--	--	50
Space Research and Technology	150	134	154	138
SPACE FLIGHT. CONTROL AND DATA COMMUNICATIONS	**75**	**75**	**71**	**71**
Space Transportation Operations	40	40	36	36
Space and Ground Network Communications and Data Systems	35	35	35	35
Subtotal. direct workyears	1.534	1.519	1,529	1.529
CENTER MANAGEMENT AND OPERATIONS	**510**	**482**	**500**	**500**
Total. permanent workyears	2. 044	2. 001	2. 029	2. 029
Other than full-time	128	113	115	115
Total. workyears	2. 172	2. 114	2. 144	2. 144

PROGRAM DESCRIPTION

RESEARCH AND DEVELOPMENT	Permanent Civil Service Workyears
SPACE STATION	11

Space Station efforts will consist of definition and integration studies and advanced technology development activities with special emphasis on plant and animal life sciences experiments and equipment, human factors design criteria, and information sciences and support functions.

PHYSICS AND ASTRONOMY	105

In 1987, the civil service personnel will provide support for the airborne astronomy program, which includes a C-141 aircraft, the Kuiper Airborne Observatory, and a Lear Jet aircraft, which are operated by Ames as flying astronomical observatories with the bulk of the observing accomplished by various university research teams. These facilities are supported through in-house research in astronomy and astrophysics and with in-house capability to operate research aircraft. The Center controls a variety of other operational aircraft, including two U-2C's, an ER-2, and a C-130, some of which serve as unique national and international facilities for research in astronomy, geophysics, meteorology, and Earth resources; others acquire data for remote sensing projects and provide a mechanism for integration of spaceborne, airborne, and ground-based data acquisition and processing systems. Support for the astronomy program is also provided by a sophisticated laboratory effort in spectroscopy and dust physics.

Infrared astronomy observation from space platforms avoids obscuration caused by the Earth's atmosphere. Ames has the responsibility for definition and development of instruments to accomplish these observations, which have included such developments as the telescope portion of the Infrared Astronomical Satellite, launched in early 1983; definition of the Space Infrared Telescope Facility and definition studies of instruments to be used on potential free flyers in space.

Ames has an active program of laboratory, theoretical and computational studies to develop the basic astrophysical modeling concepts, to obtain the necessary physical data, to interpret the infrared astronomical observations, and to support the development of improved scientific instrument concepts for use on aircraft and spacecraft. This program's objectives are to investigate the nature and evolution of solar systems; and to inyestigate galactic and extragalactic objects through the unique insights to be gained by infrared observations of these astrophysical systems.

	Permanent Civil Service Workyears
LIFE SCIENCES	133

In 1987, the civil service personnel will continue to be involved in research, hardware development, and program management related to meeting program milestones in the areas of understanding the effects of space flight on humans and other life forms, managing non-human biological experiments in space, and understanding the origin, evolution, and distribution of life and life-related chemicals on Earth and elsewhere in the universe.

Biomedical research will be conducted to investigate the effects of space flight on humans. Specifically, causes and potential countermeasures for neurophysiological, musculo-skeletal, and cardiovascular changes observed during and immediately following space flight will continue to be studied. Ground-based space flight simulations and actual flight experiments with humans and animals will continue to be performed to provide a basis for understanding why and how biological systems are affected by space flight.

Spacelab Life Sciences - 1 (SLS-1), NASA's first dedicated life sciences mission, will be launched in early 1987. During this mission Ames will test a small mass measuring device, a rodent cage and the General Purpose Work Station which will permit the handling of tissues and fluids in zero gravity. Ames will also participate in the International Microgravity Laboratory - 1 (IML-1), a mission which will contain four Ames-developed experiments, one plant study and three to be housed in the ESA-built Biorack. In addition to the actual launches, Ames will continue the development and integration of experiments for the SLS-2 and the Spacelab-J missions scheduled for 1988.

Research into the origin and distribution of life and life-related molecules will also be continued through analyses of biochemical pathways in living systems, and analyses of chemical abundances in Precambrian deposits by the use of an ultrasensitive stable isotope measuring system and studies of the interactions of known polypeptides and DNA segments. Research efforts in the origin and distribution of biogenic elements will increase. Cometary particles collected by U-2 aircraft will be analyzed for carbon abundance, phase, and molecular identification.

The Ecosystems Science and Technology Program will continue to enhance the understanding of the biological aspects of global conditions and biogeochemical processes on Earth. Progress will be achieved through investigations in remote sensing science and advanced sensor technology; disciplinary research in areas of plant stress, hydrologic cycles, and forest biomass determinations. Interdisciplinary research will include biogeochemical cycles and ecosystem disturbances. These latter two research areas involve not only remote sensing, but theoretical and experimental work within the disciplines of (1) biology, (2) biochemistry, (3) atmospheric science, (4) geochemistry, and (5) spectroscopy.

Permanent Civil
Service Workyears

PLANETARY EXPLORATION 47

A continuing series of project management activities, backed by the scientific expertise of principal investigators from Ames, other NASA Centers and the university community, will be continued in 1987 to accomplish the ongoing programs in planetary exploration. An in-house supporting research and technology program serves both to maintain the Center's scientific and technological expertise and to provide the stimulus and definition for new planetary research.

In 1987, the civil service personnel will continue to provide project management and scientific support for Pioneers 6 through 9, a series or spacecraft exploring the physics of the interplanetary medium and providing ongoing data on the plasma in which the Earth is immersed; Pioneers 10 and 11, two spacecraft that made close approaches to the planet Jupiter to study the planet and its magnetic field; Pioneer Venus Orbiter which is still taking data at Venus and which will examine Halley's Comet in the UV during perihelion passage; and the Galileo Probe which will investigate the atmosphere of Jupiter and its environment.

Ames researchers are playing a key role in these missions. Ames scientists are responsible, as principal investigators, for measuring the characteristics of the solar wind in the interplanetary space and near Jupiter and Saturn; measuring the atmospheric structures on Mars, Venus and Jupiter; measuring atmospheric radiation balance and cloud characteristics on Venus and Jupiter; studying Mars for possible life-bearing soils and compounds; and investigating planetary ring systems as observed by spacecraft and other techniques. Ames researchers are also responsible for synthesizing atmospheric models of these planets that can be used to explain their current state and evolution and be applied in comparative studies to understand features of the Earth's climate.

Ames maintains an active program of laboratory, computational, and theoretical studies to develop basic atmospheric modeling concepts, obtain the necessary physical data to interpret the spacecraft observations, and develop improved scientific measurements and instrument concepts for use on spacecraft. This program concentrates on planetary atmospheres and has been particularly active in combining radiative transfer concepts with aerosol physics to obtain comprehensive planetary cloud and dust models.

SPACE APPLICATIONS..... 51

A highly diversified group of scientists, engineers, and technicians are required in 1987 to support programs in Earth and environmental observations including space, atmospheric, and stratospheric programs;

to provide skilled personnel in support of the Agency's applications satellite programs; to interpret and process both spaceborne and airborne remotely sensed data; and to interact with and disseminate data and associated processing techniques to the user community.

The Ames atmospheric research program is an integrated activity that blends the expertise of the Center personnel and university scientists, in the development of computer models for the atmosphere and in the measurement of atmospheric constituents and properties from aircraft platforms. Computer modeling of the atmosphere is being performed to understand the atmosphere and predict the effects of various pollutants, such as aircraft emissions and fluorocarbons, and of natural events such as the solar cycle, solar storms and volcanic eruptions. These modeling efforts make effective use of the unique computational resources at the Center. A similar program which focuses on the climatic effects of aerosol and cloud particles in the Earth's atmosphere through models of aerosols and their radiative effects and through measurements of aerosol and cloud properties from aircraft is also underway at Ames.

Ames space applications responsibility is also fulfilled by conducting a continuing program of applied research and development to enhance the use of remote and in-situ sensing technology for Earth resources applications and defining, developing, and evaluating potential future satellite sensors, data acquisition and processing techniques, and associated communications technology.

	Permanent Civil Service Workvears
TECHNOLOGY UTILIZATION	2

The technoglogy utilization program serves to transfer knowledge developed through the NASA programs into industry for effective use in the marketplace.

COMMERCIAL USE OF SPACE	2

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage increased industry investment and participation in high technology space-based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use of and access to space.

	Permanent Civil Service Workyears
AERONAUTICAL RESEARCH AND TECHNOLOGY	919

In 1987, the Ames program in aeronautics will be characterized in terms of three elements: generic research and technology, vehicle specific technology (e.g., rotorcraft) and aeronautical support to other government agencies and to industry. These three elements form a coherent and interdependent program to meet the objectives of rotorcraft, powered-lift and high-performance aircraft by improving operational performance and terminal-area safety and efficiency and by reducing aircraft noise and vibrations.

Generic Research and Technology:

The generic research and technology program is principally focused in the disciplines of fluid and thermal physics, propulsion, structures, flight dynamics, guidance and control, and human factors. The program provides the fundamental disciplinary advances, both theoretical and experimental, that extend the state of the art. Substantial progress is anticipated in Ames' ability to compute the theoretical behavior of flows about aerodynamic components and full configurations and to measure experimental aircraft configuration parameters. Continued efforts will be directed toward providing advances in computational capability supporting aeronautical research. Numerical aerodynamic simulation will focus on augmenting the Nation's program in computational fluid dynamics and other areas of computational physics by developing an advanced capability that will provide modern and efficient access for users nationwide for application to computational aerodynamics, computational chemistry, and other complex analytical problems. Also, fundamental aerodynamic research will be continued using large- and small-scale research facilities and flight research vehicles to develop design methodologies for designing advanced aircraft. Flight research will continue for the development of aircraft systems integration technology including flight, propulsion, and aerodynamic controls. In controls and guidance, advanced control technology will focus on: developing the methodology to design highly coupled, highly non-linear control systems; developing reliable flight-critical control systems for advanced aircraft; evaluating and improving digital flight control system prediction tools, techniques, methodology and criteria; applying optimal control theory in conjunction with dynamic modeling of aircraft and ground-based guidance aids to provide new insights into the definition of air traffic control system interfaces; and conducting flight research on digital fly-by-wire concepts to continue to support the development of advanced flight systems technology. In 1987, the human factors program will include continuation of basic research in workload and performance measurements, fundamentals of visual perception, development of helicopter and high-performance aircraft display and control integration to reduce pilot workload, study of advanced flight display formats for improving information presentation to aircrew, and more complete understanding of human fatigue and circadian desynchronosis effects on aircraft pilots. In addition, the applications of the results of these generic activities to space flight crews and hardware will be examined.

Vehicle Specific Technology:

The vehicle specific technology is focused on rotorcraft, powered-lift and high-performance aircraft. The vehicle technology emphasis at Ames relates to, and depends on, the basic capabilities and the aeronautical research disciplines described previously. The 1987 research program will include small-scale and large-scale wind tunnel testing and ground-based simulation, and flight research. Powered-lift aircraft performance is highly dependent on high-lift technology (both propulsive and aerodynamic lift) and advanced guidance and control systems, both of which are part of the ongoing program at Ames. High-performance aircraft research requirements include the areas of high angle-of-attack performance and control, sophisticated flight and aerodynamic controls, structural, aerodynamic, flight control and propulsive system interactions, and superaugmented aircraft. In rotorcraft aerodynamics, research will be conducted to improve the understanding of rotor aerodynamics, rotor/fuselage interaction. In guidance, work will be pursued to improve all-weather rotorcraft capability for terminal area operations. In the controls area, flying qualities design criteria will be developed to improve control system concepts for better performance and mission capabilities for rotorcraft. In addition, efforts will be continued to investigate the requirements for flying night, all-weather, nap-of-the-earth missions with a single pilot. Research to provide major improvements in aircraft automation will be conducted through the use of artificial intelligence. In 1987, technology for next-generation rotorcraft will pursue further understanding relative to high-speed rotorcraft concepts and will continue preparation for flight research on the X-wing.

Other Aeronautical Support:

Ames has traditionally received requests from other agencies and industry, as well as from other NASA centers, for test support of their aircraft and systems development programs. Typically, Ames provides 8,000 to 9,000 hours per year of wind tunnel occupancy time in support of both commercial and military aircraft development, as well as support for large NASA projects such as the Space Shuttle. The Research and Technology Directorate of the U.S. Army Aviation Research and Development activity, and the Aero Flight Dynamics Directorate, both under Aviation Systems Command (AUSCOM) are located at Ames. The Aero Flight Dynamics Directorate, the primary investigator of Army rotorcraft flight dynamics and controls, is also located at Ames, working both on independent research and development projects and with a staff integrated into the NASA organization on projects of joint interest. Extensive use is made of Ames aeronautical research facilities in these efforts.

There are also a large number of joint programs with the Air Force Systems Command, the Naval Air Systems Command, and the Defense Advanced Research Projects Agency (DARPA). Examples of these joint efforts include: (1) V/STOL and STOVL fighter studies, JVX support, LHX support and an AV-8B flight test program with the Navy; (2) participation in the joint NASA/DARPA X-29A forward swept wing demonstration programs; (3) continued participation in the joint NASA/USAF Advanced Fighter Technology Integration (AFTI) F-111 program for research and development of a mission adaptive wing that will obtain smooth in-flight contour changes to the wing aerodynamic shape to achieve improved aerodynamic efficiency; (4) continued

participation in the joint NASA/USAF AFTI/F-16 program using a digital flight control system for conventional and nonconventional control without degrading overall performance; (5) continued participation with the Navy in a program to extend oblique wing technology to transonic and supersonic speeds; and (6) work on digital flight control system verification and validation with the FAA. Advanced structural, aerodynamic, propulsion, and control concepts will be investigated. In conjunction with the DARPA, a large-scale flight investigation of the X-wing rotor system will be conducted, utilizing the rotor systems research aircraft. The focus will be in exploring the start-stop phase of flight for the high-speed X-wing concept.

	Permanent Civil Service Workyears
TRANSATMOSPHERIC RESEARCH AND TECHNOLOGY	50

The activities at ARC are in two major areas. The first emphasizes the special capabilities and expertise in hypersonic and computational facilities at Ames Moffett for the conduct of extremely high Mach number tests and analysis of both wind tunnel and flight data. The strength of the computational methods using the Class VI and numerical aerodynamic simulation computers, combined with the advanced materials activities, provides unique capabilities to design and tailor lightweight, high-temperature structures applicable to advanced hypersonic cruise and aerospace vehicle concepts. The second area emphasizes the special capabilities at Ames Dryden to evolve the testing, instrumentation, data acquisition systems, and range capabilities necessary for future potential flight testing of a hypersonic/transatmospheric research vehicle over the required range of speed, altitude and envelope conditions.

SPACE RESEARCH AND TECHNOLOGY	138

In 1987, civil service personnel will provide a space research and technology program which encompasses both basic research and project support. The basic research focuses on entry technology and materials research, with a germinal effort in artificial intelligence. The project work supports space shuttle, the orbiter experiments program, the infrared astronomy program, the Galileo probe, and advanced work related to technology definition of a space station.

The entry technology research will provide aerothermodynamic data required for the design, development, and verification of planetary entry vehicles; aero-assisted orbital transfer vehicles (AOTV), and computational fluid dynamic codes to predict space vehicle flow fields and performance. Work is proceeding to apply laser physics and nonintrusive laser techniques to the development of flow diagnostic tools that will be used to probe gas dynamic flows that will in turn be used to define and verify turbulence models. Research efforts in the materials area will provide advanced thermal protection systems concepts and materials for heat shields to protect Earth and planetary entry vehicles (probes) and AOTV's; develop

computational chemistry codes to calculate basic properties of matter; and expand the understanding of surface environment interactions (corrosion). Research is also being conducted in the advanced electronics and materials areas to determine atomic structure and properties of absorbed surface layers and to advance the state of the art of computing wave functions for molecules and atomic clusters. Research in artificial intelligence will address spaceborne symbolic processing, information extraction, and software tools for development of knowledge-based systems.

In 1987, the Space Shuttle program will be used along with ground-based facilities to study a variety of aerodynamic and thermodynamic problems. The Galileo project will be supported with heat shield design and performance data, heat shield shape change effects on aerodynamics, and subsonic probe stability. Ground-based facilities will also simulate AOTV heating environments and debris-impact on space station components. In the area of orbiting astronomical instruments, work will continue to develop infrared detectors, define systems for precision pointing and control of telescopes, and advance the technology required to cool detectors to very low temperatures. Ames is supporting space shuttle orbiter experiments to study advanced materials and evaluate possible cost and weight reduction for the thermal protection system for shuttle and advanced space transportation systems.

Ames work will be directed primarily toward developing and conducting selected space shuttle experiments and performing disciplinary research in the high-temperature space structures technology area.

The shuttle experiments include: continuation of simulation studies to assist in analysis and solution of various problems that exist in certain flight profile areas between entry and landing and evaluation of the performance of the shuttle entry air data system; studies to evaluate adequacy and provide a basis for improving shuttle handling qualities criteria; and application of modified maximum likelihood parameter estimation methods for determination of digital flight control systems, stability and control, performance, and structural and atmospheric turbulence characteristics in the shuttle reentry environment.

High-temperature space structures disciplinary research will involve analyses and laboratory tests of medium-sized specimens to evaluate predictive techniques for thermal structures. Also, airloads data will be obtained from calibrated strain gauges on the orbiter and compared with wind tunnel and theoretical predictions to evaluate flight measurement techniques and analytical methods.

The infrared astronomy program is technologically supported in three primary areas: infrared detector research, cryogenics, and optics. This technology research is developing techniques for measuring infrared sensitivity and bandwidth to provide much-enhanced data for scientific research. Specific work consists of developing detector arrays and electronics, lightweight mirrors and optics, structures, and cryogenic systems including replenishable systems.

Permanent Civil
Service Workyears

SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS

SPACE TRANSPORTATION OPERATIONS..... 36

Dryden Flight Research Facility is the secondary recovery site for the Space Shuttle Program and the primary recovery site for selected missions. DFRF also must be in a recovery mode for every launch in case the Space Shuttle must abort on the first orbit. Upon landing, DFRF provides orbiter convoy operations support, support in deservicing the orbiter, in mating the orbiter to the Shuttle Carrier Aircraft for transporting the orbiter to Kennedy Space Center. DFRF is also responsible for maintaining the Space Shuttle servicing facilities located at Ames Dryden.

SPACE AND GROUND NETWORK COMMUNICATIONS AND DATA SYSTEMS..... 35

In 1987, DFRF will maintain and operate the NASA Western Aeronautical Test Range, which provides direct operational support for a wide variety of aeronautical and aerospace programs. During real-time mission support operations, the various functional elements such as radar, tracking and data processing, communications, airborne video acquisition, and telemetry data processing all function in an intergrated manner in the range Mission Control Centers to provide real-time control, monitoring, processing and command uplink capabilities. Post-mission processing is also supplied as support to programs short of the analysis or second generation data processing function.

CENTER MANAGEMENT AND OPERATIONS SUPPORT..... 500

Center Management and Operations Support is support or services that are provided to all Ames organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved are as follows:

Director and Staff - The Center Director, Deputy Director, Associate Director, and the immediate staff, e.g., Chief Counsel, Patent Counsel, Equal Opportunity, Public Affairs, Resources Management, and under the auspices of the Chief Engineer, Health, Safety, Security and Energy Management.

Management Support - The part of the Ames civil service workforce which provides information and control services supporting all levels of Center management, both program and functional. Specific functions include financial management, contracting and procurement, property management, and personnel management.

Operations Support - The part of the Ames civil service workforce which provides for the operation and maintenance of institutional facilities, buildings, systems, and equipment, and which provides technical services such as administrative automatic data processing, library and information services.

RESOURCE REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	***93,439***	***93,756***	***94,564***	***96,698***
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent workyears	77,448	78,281	78,002	78,950
b. Other than full-time permanent	2,704	2,662	2,693	2,693
c. Reimbursable detailees	391	378	671	899
d. Overtime and other compensation	1,588	1,534	1,637	1,637
Subtotal, Compensation	82,131	82,855	83,003	84,179
2. Benefits	9,770	9,816	9,978	10,399
Subtotal, Compensation and Benefits	91,901	92,671	92,981	94,578
B. Supporting Costs				
1. Transfer of personnel	430	166	457	477
2. Personnel training	1,108	919	1,126	1,643
Subtotal, Supporting Costs	1,538	1,085	1,583	2,120
Total, Personnel and Related Costs	93,439	93,756	94,564	96,698

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits.....	1,901	92,671	92,981	94,578
1. Compensation	82,131	82,855	83,003	84.179
a. Full-time permanent workyears..	77,448	78,281	78,002	78,950

The decrease from the 1986 budget estimate to the 1986 current estimate is due to a revised allocation of FTE's.

Basis of Cost for Permanent Workyears

In 1987, the cost of permanent workyears will be $78,950,000. The increase from 1986 is calculated as follows:

Cost of full-time permanent workyears in 1986.....		78,002
Cost Increases in 1987.....		2,020
Within grade and career advances:		
Full year cost of 1986 actions.....	875	
Partial year cost of 1987 actions.....	1,145	
Cost Decreases in 1987.....		-1,072
Turnover savings and abolished positions:		
Full year cost of 1986 actions.....	-405	
Part year cost of 1987 actions.....	-667	
Cost of full-time permanent workyears in 1987.....		78,950

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent				
1. cost	2,704	2,662	2,693	2,693
2. Workyears	161	161	163	163

The distribution of 1987 workyears is as follows:

Distribution of Other Than Full-time Permanent Workyears

Program	Workyears
Development programs	60
Summer employment program	11
Youth opportunity programs	48
Other temporary	44
Total	163

The current estimate for 1986 reflects an increase from the 1986 budget estimate due to an increase in norkyears.

c. Reimbursable detailees	391	378	671	899

The military personnel detailed to Ames on a reimbursable basis are individuals experienced in aeronautics, rotorcraft technology, veterinary medicine, and related fields. The increase in the 1986 current estimate and the 1987 budget estimate are due to including military retirement costs in detailee reimbursements.

d. Overtime and other compensation	1,588	1,534	1,637	1,637

Overtime and other compensation includes overtime, holiday pay, incentive awards, Sunday premium pay, and night work differential. The use of overtime and other compensation is primarily for off-peak operation of major facilities such as the Unitary Plan Wind Tunnel System, and the 6-by-6 foot Supersonic Wind Tunnel, and preparation for test flights and Space Shuttle operations. The increase from the 1986 budget estimate to the 1986 current estimate is due to additional overtime requirements for the 40-by-80-by-120 Foot Wind Tunnel Project and five shuttle landings at Dryden.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. ~enefits	9,770	9,816	9,978	10,399
The following are the amounts of contributions by category:				
Civil Service Retirement Fund	5,510	5,243	5,283	5,068
Employee Life Insurance	186	214	194	200
Employee Health Insurance	2,165	2,317	2,252	2,327
Workmen's Compensation	624	623	624	765
FICA	407	508	715	1,109
Medicare	878	911	910	930
Total	9,770	9,816	9,978	10,399

The increase from the 1986 budget estimate to the 1986 current estimate reflects increased costs associated with FICA for new employees. The 1987 budget increase reflects an increase in FICA and Workmen's Compensation estimates based on Department of Labor billings.

3. Supportinq Costs	1,538	1,085	1,583	2,120
1. Transfer of personnel	430	166	457	477

The increase from the 1986 budget estimate to the 1986 current estimate reflects a change in the GSA policy regarding payment for PCS moves and household goods. The 1987 budget estimate reflects expected increased cost rates.

2. Personnel training	1,108	919	1,126	1,643

The increase from the 1986 budget estimate to the 1986 current estimate reflects 1985 experience. The increase from the 1986 current estimate to the 1987 budget estimate is due to increased training for new technical employees at anticipated tuition cost levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	**2,513**	**2,720**	**2,717**	**2,983**
Summary of Fund Requirements				
A. Program Travel	1,521	1,816	1,830	2,058
B. Scientific and Technical Development Travel	486	450	433	448
C. Management and Operations Travel	506	454	454	477
Total, Travel	2,513	2,720	2,717	2,983
Explanation of Fund Requirements				
A. Program Travel	1,521	1,816	1,830	2,058

Program travel is required for the accomplishment of the Center's missions and accounts for 69 percent of travel costs in 1987. Travel for program purposes is required for the continuing efforts in space research, aeronautical research and technology, flight simulation, fluid mechanics, airborne research and applications, space life sciences, flight test techniques, flight measurements, guidance and flight control, and flight measurement development activities. The increase from the 1986 budget estimate to the 1986 current estimate is due to life sciences flight experiments. The latter is in support of Spacelab flights on the shuttle. The 1987 estimate primarily provides for anticipated rate increases.

B. Scientific and Technical Development Travel	486	450	433	448

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the scientific and aerospace community. This participation allows them to benefit from exposure to technological advances outside Ames as well as to present both accomplishments and problems to their associates. Many such meetings are working panels convened to solve certain problems for the benefit of the Government. The decrease from the 1986 budget estimate to the 1986 current estimate reflects a lower number of trips. The 1987 estimate reflects approximately the same level of activity as in 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Management and Operations Travel	506	454	454	477

Management and operations travel provides for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management and procurement; travel of the Center's top management to NASA Headquarters, other NASA Centers, and contractor plants; and local transportation. The 1987 estimate reflects the 1986 level of travel at anticipated rate levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION	**24,338**	**31,516**	**27,417**	**34,232**

Summary of Fund Requirements

A. Facilities Services	11,796	18,757	15,861	21,820
B. Technical Services	3,944	4,924	3,721	4,186
C. Management and Operations	8,598	7,835	7,835	8,226
Total, Operation of Installation	24,338	31,516	27,417	34,232

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the center's institutional activities. These are divided into three major functional areas: Facilities Services, the cost of maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities; Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, medical, supply, and related services.

The reduction from the 1986 budget estimate to the 1986 current estimate is primarily due to delay and deferral of activities, and lower than anticipated electricity and support contractor wage rates. The 1987 estimate provides for expected rate increases in support contractor wages and anticipated utility wage commensurate with planned program activities.

A. FACILITIES SERVICES	11,796	18,757	15,861	21,820

Ames includes 11 major technical facilities. This physical plant supports an average daily population of 2,500 to 2,900 personnel. Many of the facilities are utilitzed on schedules involving more than one shift and frequently during off-peak hours. The physical plant at Dryden houses an average daily on-site population of 900 to 1,200 personnel. Many of the test facilities are also utilized on schedules involving more than one shift, which frequently operate during off-peak hours.

Summary of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
1. Rental of Real Property	48	47	43	47
2. Maintenance and Related Services	3,681	4,032	3,065	3,408
a. Facilities	3,634	3,983	3,023	3,361
b. Equipment	47	49	42	47
3. Custodial Services	3,367	4,301	3,976	4,365
4. Utility Services	4,700	10,377	8,777	14,000
Total, Facilities Services	11,796	18,757	15,861	21,820

Explanation of Fund Reauirements

1. Rental of Real Property	48	47	43	47

At Dryden, this item provides for the rental of trailers to provide office, shop, laboratory, and storage space in support of the Space Shuttle program. The decrease from the 1986 budget estimate to the 1986 current estimate is due to purchase rather than rental of some of the trailers which support the Space Shuttle program. The 1987 estimate provides for the same rental space as 1986.

2. Maintenance and Related Services	3,681	4,032	3,065	3,408

At Ames, maintenance and repair includes the maintenance of grounds and emergency repairs of heating, ventilating, and lighting equipment in the institutional buildings and offices. Maintenance of grounds includes maintenance of approximately 30 acres of improved planted areas and associated pest control; maintenance of approximately 45 acres of unimproved areas such as substations, aircraft taxiways, drainage ditches, large fields and roadway shoulders within these areas; and vacuum sweeping approximately 42 acres of streets, parking lots, and aircraft ramp, taxiway and V/STOL areas. At Dryden, this activity involves all facilities, including those used for Shuttle. The reduction from the 1986 budget estimate to the 1986

current estimate reflects delay and deferral of planned maintenance activities and lower than anticipated contractor wage rates. The increase from 1986 to 1987 reflects anticipated support contractor wage rate increases and expected price levels for supplies, materials, equipment and other contractual effort.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Custodial Services	3,367	4,301	3,976	4,365

Janitorial and building cleaning services are associated with approximately two and three quarters million square feet of various types of space located in 226 buildings and structures, and over 90 trailers which provide temporary office and shop space. Security services are for buildings and property, including aircraft and computer facilities, and "round-the-clock" staffing of an emergency duty office which monitors fire, security, and safety alarms, and coordinates fire, security, and safety areas in emergency situations. Other services included are pest control services, refuse collection, laundry and custodial supplies.

This activity involves support contractor efforts which provide janitorial and security services, fire protection and other miscellaneous custodial services and supplies. The decrease from the 1986 budget estimate to the 1986 current estimate is the result of decreases in support contractor wage rates and delay and deferral of activities to reflect budget reductions. The increase in 1987 is due to expected changes in prices for goods and services purchased.

4. Utility Services	4,700	10,377	8,777	14,000

The major utility service is electricity with lesser requirements for natural gas, fuel oil, water and sewage services.

At Ames, electricity is provided by the U.S. Bureau of Reclamation's Central Valley Project, marketed by the Western Area Power Administration (WAPA) of the Department of Energy, and the Pacific Gas and Electric Company (PG&E); natural gas is provided by PG&E; water by the U.S. Naval Air Station at Moffett Field; and sewage service by the City of Mountain View.

Approximately 80 percent of the electric power at Ames Moffett is consumed in the operation of high power demand research facilities, such as the Unitary Plan wind tunnel system, the 14-foot transonic wind

tunnel, and the operation of simulators and smaller wind tunnels. Approximately 55 percent of the natural gas is used in research facilities; the other part is used for heating and ventilation of institutional buildings. Ames, Moffett Field, accounts for 95 percent of the overall utility energy usage and 91 percent of total utility costs.

At Dryden utility services are purchased through Air Force contracts with regional utility companies with costs based on Air Force projected rates. The largest amount is for electricity with lesser amounts for natural gas, fuel oil, water and sewage services.

The increase between 1985 and 1986 current estimate is primarily caused by increased WAPA rates, the effect of which is less than anticipated in the 1986 budget estimate. The increase between the 1986 current estimate and the 1987 budget estimate is due to an increase in electricity consumption and rates. Rate increases are those published by WAPA, scheduled to become effective in FY 1986 and 1987, respectively.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. TECHNICAL SERVICES	3,944	4,924	3,721	4,186
Summary of Fund Requirements				
1. Automatic Data Processing	2,843	3,872	2,677	3,054
a. Equipment	419	1,210	180	200
b. Operations	2,424	2,662	2,497	2,854
2. Scientific and Technical Information	540	580	530	572
a. Library	89	59	64	70
b. Education and Information	451	521	466	502
3. Shop and Support Services	561	472	514	560
Total, Technical Services	3,944	4,924	3,721	4,186

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
1. Automatic Data Processing.	2,843	3,872	2,677	3,054

This category includes the central administrative ADP facility equipment and operating costs. The decrease from the 1986 budget estimate to the 1986 current estimate is due to delays imposed on the Center's office automation plan. The 1987 increase provides for minor, but critically needed, changes in the administrative mainframe, as well as anticipated support contractor rate increases.

2. Scientific and Technical Information.....	540	580	530	572

This category provides for the purchase of books, supplies, and materials for the operation of the Dryden library. Also included in this category is a support contract to perform public information services, media development, and education programs. The 1986 current estimate reflects a reduction in Shuttle public affairs requirements and decreased library costs from the 1986 budget estimate. The 1987 estimate reflects the same level as 1986 at anticipated 1987 cost rates.

3. Shop and Support Services.....	561	472	514	560

This category includes administrative shop, photo and graphics, and audiovisual services primarily supporting the public affairs activity. The increase in the 1986 current estimate and 1987 budget estimate provides for the same level of services as the 1985 actual at anticipated cost rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
C. MANAGEMENT AND OPERATIONS	8,598	7,835	7,835	8,226
Summary of Fund Requirements				
1. Administrative Communications	3,048	2,444	2,905	3,047
2. Printing and Reproduction	187	332	163	172
3. Transportation	946	898	878	924
4. Installation Common Services	4,417	4,161	3,889	4,083
Total, Management and Operations	8,598	7,835	7,835	8,226
Explanation of Fund Requirements				
1. Administrative Communications	3,048	2,444	2,905	3,047

Communications services are provided by the General Services Administration (GSA) for the Federal Telecommunications Service, and the Pacific Telephone and Telegraph Company and the General Telephone and Telegraph Company for local services at Ames and Dryden, respectively. Other communications consist of teletype equipment and services provided by Western Union. Also included are the lease of switchboard equipment and the support contract for telephone operators. The increase from the *1986* budget estimate to the *1986* current estimate is due to increases in local communication costs. The *1987* estimate reflects the same level of service plus anticipated rate increases.

2. Printing and Reproduction	187	332	163	172

The estimate for administrative printing includes the operating costs of the printing and reproduction facility as well as supplies, materials, equipment acquisitions and outside procurements. All common processes of duplication, including photostating, blueprinting and microfilming are included. The decrease from the *1986* budget estimate to the *1986* current estimate reflects a reduction in the level of printing activity. The increase in the *1987* budget estimate provides for level services at anticipated rate increases.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Transportation	946	898	878	924

The estimates include motor pool operation costs including GSA vehicle rentals, freight costs, Government bills of lading, air freight and other general shipments. The reduction in the 1986 current estimate from the 1986 budget estimate is due to a decrease in support contractor rates. The 1987 budget estimate provides for the same level of service as 1986 plus anticipated rate increases.

4. Installation Common Services	4,417	4,161	3,889	4,083

These services include support to center management and staff activities, medical services, and installation support activities. For example, this category includes those supplies, materials and services in support of Center management, general and patent legal services, personnel, procurement, and financial management services. Medical services include the staffing of the health units, laboratory service fees, clinic supplies, and maintenance of clinic equipment. Installation support services provide contractor support for supply and property management, mail, pickup and delivery services, and postage. The decrease from the 1986 budget estimate to the 1986 current estimate is due to a reestimate of support contractor wage rates. The 1987 budget estimate provides approximately the same level of effort as in 1986.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AMES RESEARCH CENTER

ORGANIZATION AND STAFFING CHART

STAFFING SUMMARY

	86	87
SES	36	36
GS/GM-16	1	1
GS/GM-15	130	130
GS/GM-14	283	283
OTHER GS/GM	1221	1221
WAGE GRADE	348	348
TOTAL	2029	2029

DIRECTOR AND STAFF

	86	87
SES	3	3
GS/GM-16	0	0
GS/GM-15	9	9
GS/GM-14	10	10
OTHER GS/GM	54	54
WAGE GRADE	0	0
TOTAL	76	76

DIRECTOR OF ADMINISTRATION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	6	6
WAGE GRADE	0	0
TOTAL	8	8

UNIVERSITY AFFAIRS OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	0	0
OTHER GS/GM	2	2
WAGE GRADE	0	0
TOTAL	2	2

LOGISTICS MANAGEMENT DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	19	19
WAGE GRADE	6	6
TOTAL	26	26

FINANCIAL MANAGEMENT DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	1	1
OTHER GS/GM	53	53
WAGE GRADE	0	0
TOTAL	55	55

PERSONNEL DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	39	39
WAGE GRADE	0	0
TOTAL	42	42

[illegible] DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	4	4
OTHER GS/GM	72	72
WAGE GRADE	0	0
TOTAL	77	77

TECHNICAL SERVICES DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	25	25
WAGE GRADE	2	2
TOTAL	28	28

DIRECTOR OF ENGINEERING AND TECHNICAL SERVICES

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	1	1
WAGE GRADE	0	0
TOTAL	4	4

FACILITIES PLANNING OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	4	4

INFORMATION AND COMM. SYSTEMS DIVISON

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	3	3
OTHER GS/GM	38	38
WAGE GRADE	0	0
TOTAL	43	43

SYSTEMS ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	6	6
GS/GM-14	13	13
OTHER GS/GM	113	113
WAGE GRADE	0	0
TOTAL	133	133

TECHNICAL SERVICES DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	1	1
OTHER GS/GM	23	23
WAGE GRADE	134	134
TOTAL	159	159

DIRECTOR OF AEROSPACE SYSTEMS

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	4	4
WAGE GRADE	0	0
TOTAL	7	7

ADVANCED PLANS AND PROGRAMS OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	4	4
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	8	8

FULL-SCALE AERODYNAMICS RESEARCH DIVISON

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	10	10
OTHER GS/GM	44	44
WAGE GRADE	19	19
TOTAL	79	79

ROTORCRAFT AND POWERED-LIFT FLIGHT PROJECT DIV.

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	9	9
OTHER GS/GM	33	33
WAGE GRADE	0	0
TOTAL	48	48

AEROSPACE HUMAN FACTORS RESEARCH DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	10	10
OTHER GS/GM	20	20
WAGE GRADE	0	0
TOTAL	34	34

FLIGHT SYSTEMS AND SIMULATION RESEARCH DIV.

	86	87
SES	1	1
GS/GM-16	1	1
GS/GM-15	16	16
GS/GM-14	24	24
OTHER GS/GM	67	67
WAGE GRADE	1	1
TOTAL	110	110

DIRECTOR OF FLIGHT OPERATIONS AND RESEARCH

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	1	1
OTHER GS/GM	6	6
WAGE GRADE	0	0
TOTAL	10	10

CHIEF ENGINEER'S OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	0	0
OTHER GS/GM	0	0
WAGE GRADE	0	0
TOTAL	1	1

SHUTTLE PROJECT OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	0	0
WAGE GRADE	0	0
TOTAL	1	1

DRYDEN RESEARCH AIRCRAFT OPERATIONS DIVISION

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	6	6
OTHER GS/GM	70	70
WAGE GRADE	105	105
TOTAL	186	186

SCIENCE AND APPLICATIONS AIRCRAFT DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	7	7
OTHER GS/GM	17	17
WAGE GRADE	0	0
TOTAL	28	28

DRYDEN AERONAUTICAL PROJECT OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	12	12
OTHER GS/GM	7	7
WAGE GRADE	0	0
TOTAL	21	21

AMES RESEARCH AIRCRAFT OPERATIONS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	7	7
GS/GM-14	4	4
OTHER GS/GM	30	30
WAGE GRADE	44	44
TOTAL	86	86

RESEARCH ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	7	7
GS/GM-14	25	25
OTHER GS/GM	110	110
WAGE GRADE	0	0
TOTAL	143	143

DIRECTOR OF AEROPHYSICS

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	8	8

INFORMATION SCIENCES OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	6	6
OTHER GS/GM	12	12
WAGE GRADE	0	0
TOTAL	20	20

NUMERICAL AERODYNAMIC SIMULATION PROJECT OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	8	8
OTHER GS/GM	38	38
WAGE GRADE	0	0
TOTAL	48	48

AERODYNAMICS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	16	16
OTHER GS/GM	55	55
WAGE GRADE	20	20
TOTAL	97	97

COMPUTER SYSTEMS AND RESEARCH DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	3	3
OTHER GS/GM	35	35
WAGE GRADE	0	0
TOTAL	41	41

FLUID DYNAMICS DIVISION

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	6	6
GS/GM-14	22	22
OTHER GS/GM	45	45
WAGE GRADE	0	0
TOTAL	75	75

THERMOSCIENCES DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	9	9
GS/GM-14	18	18
OTHER GS/GM	34	34
WAGE GRADE	17	17
TOTAL	76	76

DIRECTOR OF SPACE RESEARCH

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	8	8
WAGE GRADE	0	0
TOTAL	13	13

GALILEO PROBE PROJECT OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	5	5
OTHER GS/GM	8	8
WAGE GRADE	0	0
TOTAL	15	15

LIFE SCIENCE FLIGHT EXPER. PROJECT OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	9	9
OTHER GS/GM	15	15
WAGE GRADE	0	0
TOTAL	25	25

LIFE SCIENCE DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	24	24
OTHER GS/GM	43	43
WAGE GRADE	0	0
TOTAL	70	70

SPACE SCIENCE DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	28	28
GS/GM-14	20	20
OTHER GS/GM	56	56
WAGE GRADE	0	0
TOTAL	103	103

CARDIOVASCULAR RESEARCH OFFICE

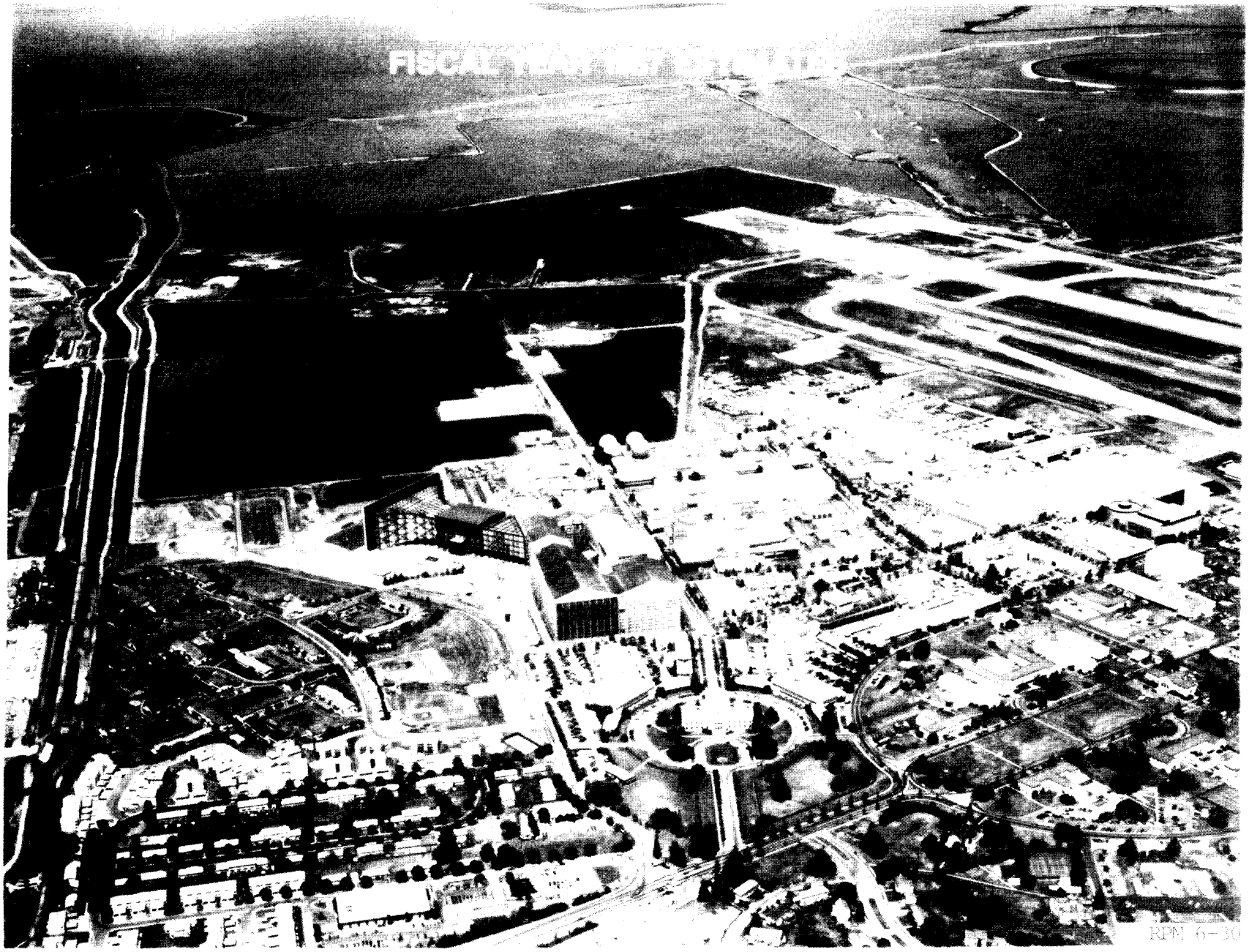
	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	2	2
OTHER GS/GM	2	2
WAGE GRADE	0	0
TOTAL	5	5

PROJECT CONTROL DEVELOPMENT OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	4	4

SIRTF STUDY OFFICE

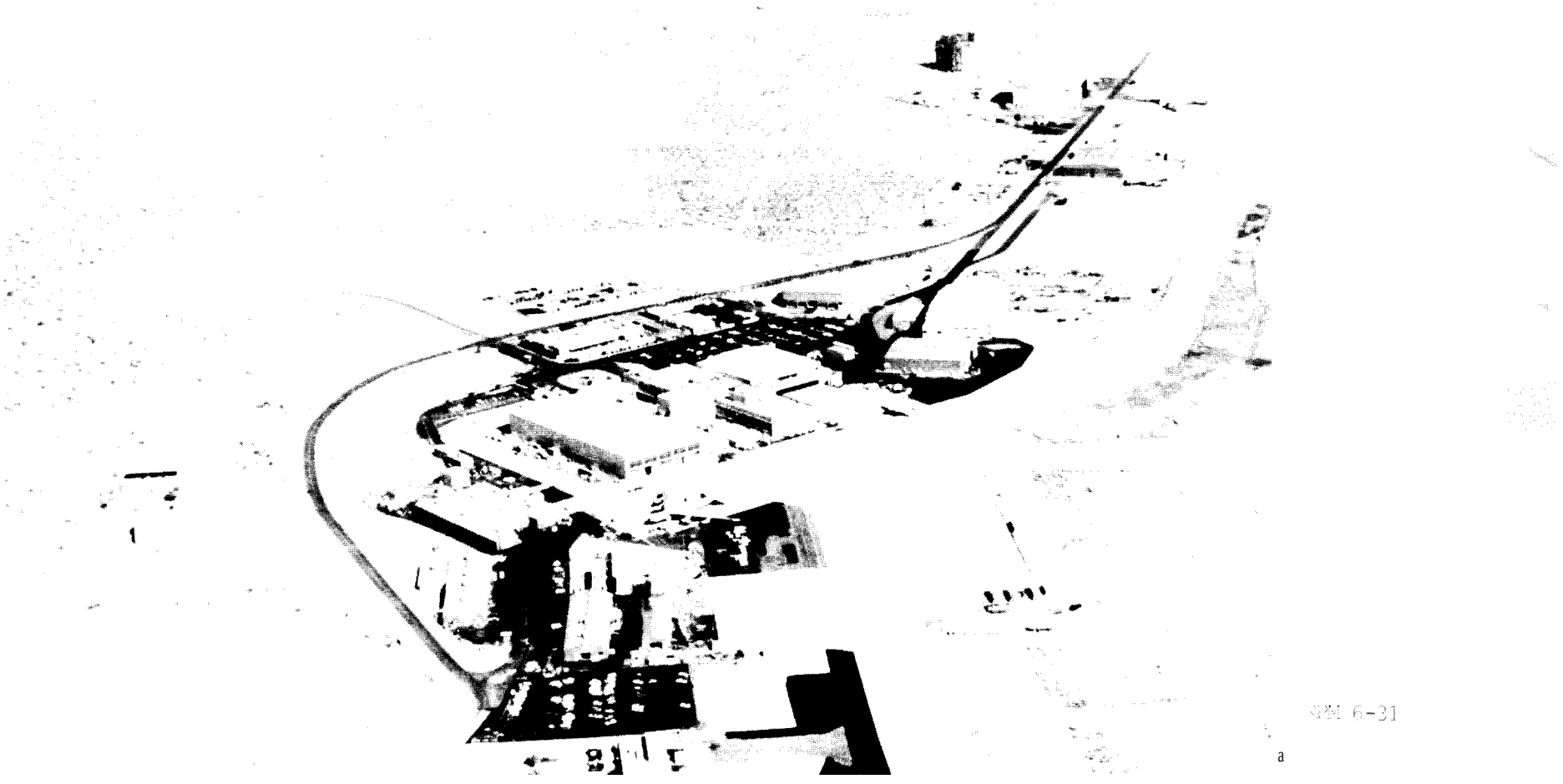
	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	4	4
OTHER GS/GM	5	5
WAGE GRADE	0	0
TOTAL	10	10


FISCAL YEAR
RPM 6-30

Arnes Research Center

Dryden Flight Research Facility

FISCAL YEAR 1987 ESTIMATES



LANGLEY
RESEARCH CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATE

LANGLEY RESEARCH CENTER

DESCRIPTION

The Langley Research Center (LaRC), located at Hampton, Virginia, was established in 1917. It is situated between Norfolk and Williamsburg, Virginia, in the Tidewater area of Hampton Roads. The Center utilizes 807 acres of Government-owned land, divided into two areas by the runway facilities of Langley Air Force Base. Runways, some utilities, and certain other facilities are used jointly by NASA and the Air Force. In addition, there are 110 acres of NASA-owned land located in the city of Newport News, Virginia, and 3,276 acres under permit from the Department of Interior. The total capital investment of the Langley Research Center, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1985, was $765,250,000.

CENTER ROLES AND MISSIONS

Langley continues to play a leading role in the development of aeronautics and space technology. Technical excellence in specified research areas is attributed to the quality and capability of the civil service staff and to the availability of unique aeronautical facilities. The principal and supporting roles are:

PRINCIPAL

Transport Aircraft Technology - develop a technology base for improving transport aircraft as a cost effective, safe, and environmentally compatible transportation mode.

General Aviation and Commuter Aircraft Technology - develop and maintain an engineering technology base related to improving general aviation and commuter aircraft.

Transatmospheric Research and Technology - combine aeronautics and space disciplines to provide the technology for a future class of vehicles capable of flight to orbit and/or hypersonic cruise.

High-speed, Highly Maneuverable Aircraft Technology - conduct cutting edge discipline research applicable to military aircraft and missiles.

Fundamental Aerodynamics - advance the general state-of-the-art, both theoretical and experimental.

Acoustics and Noise Reduction - conduct research and develop a technology base related to reducing interior and exterior aircraft noise.

Aerospace Vehicle Structures and Materials - develop a technology base for potential advances.

Guidance and Control Technology - develop a technology base related to improving aircraft and spacecraft control and guidance systems.

Advanced Space Vehicle Configuration Technology - develop technology for advanced vehicle transportation systems, including orbit-on-demand vehicles, aeroassisted orbit transfer, transatmospheric vehicles, and maneuvering reentry vehicles.

Advanced Space Systems Technology - develop a technology base and systems analysis capability for large space antenna applications and space station system trade studies.

Sensor and Data Acquisition Technology - develop a technology base for sensors and data acquisition devices.

Technology Experiments in Space - define and develop space technology experiments in support of LaRC roles including materials, structures, control and dynamics of large space structures, large space antenna systems, remote sensoring atmospheric sciences, and advanced transportation systems.

Atmospheric Sciences Technology - develop improved techniques for atmospheric sensing. Includes research, experiment development/management, data analysis, and investigator management and specialized ground/aircraft investigations. This also includes development of Shuttle payloads related to atmospheric sensing.

Upper Atmospheric Research - provide mission analysis, sensor development, data interpretation, and utilization for remote sensing; contributing to model development.

Hypersonic Propulsion Systems - contribute to the technology base of airbreathing propulsion systems by advancing the state-of-the-art of hypersonic propulsion.

SUPPORTING

Rotorcraft Technology - contribute to the development of the technology base with emphasis on structures, aeroelasticity, acoustics, noise, and avionics components.

Planetary Entry Technology - provide planetary and entry aerothermodynamics experimental and analytical data.

Computational Fluid Dynamics - contribute to the software technology base.

Launch Vehicle Procurement - develop and procure for science/applications missions, including Scout launch vehicle.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands	of Dollars)	
I.	Personnel and Related Costs	116,525	119,762	117,556	118,595
II.	Travel	2,735	3,175	2,935	3,220
III.	Operation of Installation	27,862	31,279	29,538	33,218
	A. Facilities Services	(15,968)	(18,092)	(17,112)	(18,057)
	B. Technical Services	(3,304)	(5,197)	(4,436)	(6,771)
	C. Management and Operations	(8,590)	(7,990)	(7,990)	(8,390)
	Total, Fund Requirements	147,122	154,216	150,029	155,033

Distribution of Civil Service Workyears

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
RESEARCH AND DEVELOPMENT	2. 070	2. 144	2. 145	2. 147
Space Station	66	50	55	55
Space Transportation Capability Development	15	10	2	2
Space Science and Applications	232	188	187	192
Physics and Astronomy	7	---	6	1
Life Sciences	7	6	6	6
Space Applications	218	182	175	185
Commercial Programs	10	12	10	9
Technology Utilization	9	8	8	7
Commercial Use of Space	1	4	2	2
Aeronautics and Space Technology	1.748	1.884	1.892	1.890
Aeronautical Research and Technology	1.304	1.355	1.375	1.332
Transatmosperhic Research and Technology	---	---	---	70
Space Research and Technology	443	529	516	487
Space Flight, Control and Data Communications	38	25	24	22
Shuttle Production and Operations Capability	11	---	---	---
Space Transportation Operations	27	25	24	22
Subtotal, direct workyears	2. 108	2, 169	2, 169	2,169
Center Management Operations Support	716	639	643	643
Total. full-time workyears	2. 824	2, 808	2, 812	2. 812
Other than full-time	109	97	99	99
Total. workyears	2. 933	2. 905	2. 911	2. 911

PROGRAM DESCRIPTION

	Permanent Civil Service Workyears
RESEARCH AND DEVELOPMENT	
SPACE STATION	55

Space Station effort will consist of direct support to systems engineering activities, user accommodation and utilization efforts, and advanced technology development work. Additionally, LaRC will perform definition and integration studies and will define and analyze evolutionary options.

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT	2

The objective of this activity is to evaluate alternate crew safety strategies for near- and far-term space mission scenarios; to establish safety criteria and identify technology requirements to meet those criteria; and to perform design synthesization, analytical modeling, and systems analysis and evaluation tasks on competing space station technology concepts.

PHYSICS AND ASTRONOMY	1

The objective of the Heavy Nuclei Collection Project is to obtain data on heavy nuclei in space for use in studies of the nucleo synthesis in recent explosive processes in the Universe and for use in the fundamental nuclear physics and astrophysics studies.

LIFE SCIENCES	6

This research brings together an interdisciplinary program to investigate hypotheses concerning the role of wetland ecosystems in the global methane cycle and the concentration and flux of organic carbon. The radiation effects and protection program focuses on shielding and radiation physics through fundamental study of the interactions with and transport through materials of radiation, including galactic and solar cosmic rays and trapped radiation.

SPACE APPLICATIONS	185

The space applications program at Langley provides a national research capability for understanding the environment and for developing related atmospheric sensing systems and techniques. The Center's technical expertise is widely recognized in the areas of remote sensing of the Earth's atmospheric trace species and of theoretical and empirical atmospheric modeling. In the area of Upper Atmospheric Research, Langley civil

service personnel will continue to study the Earth's atmosphere in 1987 to assess any changes caused by man and determine whether or not there is any associated change in the chemical composition of the stratosphere that would change the transmission of solar ultra violet to the Earth's surface. Efforts will continue in defining and developing Shuttle and satellite experiments which will provide measurements of atmospheric constituents and other characteristics.

A significant improvement in the understanding of man's impact on the atmosphere and climate will be obtained from the combination of Langley developed statistical/theoretical models and the comprehensive global data set provided by spaceborne sensors such as Limb Infrared Monitor of the Stratosphere, Stratospheric Aerosol Measurements 11, Stratospheric Aerosol and Gas Experiments, Measurement of Air Pollution from Satellites, and Earth Radiation Budget Experiments. The Center's sensor development program encompasses the broadest possible range of advanced remote sensing techniques, including correlation gas filter radiometry and interferometry, laser heterodyne radiometry, lidar, and active and passive microwave techniques.

The Center is managing the Global Tropospheric Experiment which is a coordinated program of theoretical modeling, field measurements, data analysis, and technology development to contribute to the enhanced understanding of the chemical and dynamic processes of the global troposphere.

Studies of the Earth's radiation budget are fundamental to the understanding of climate phenomena. Langley has the responsibility for the sensor development, and data management for the Earth Radiation Budget Experiment, a prime element in NASA's support of the National Climate Program. Preliminary radiation budget studies, based on Nimbus data, are examining the relationship of radiation budget to such climatological parameters as cloudiness, snow and ice cover, and sea surface temperature. The Earth Radiation Budget Experiment satellite, equipped with the instruments which were the responsibility of Langley Research Center, was launched in October 1984; the instruments on NOAA 9 were launched in December 1984; and the last set of instruments is scheduled for launch in Spring 1986 on NOAA G; thus analysis of the data will be continued in 1987.

	Permanent Civil Service Workyears
TECHNOLOGY UTILIZATION	7

The general objective of the NASA technology utilization program is to enhance economic growth and contribute to the technological solution of public problems through the transfer of new technology, from aeronautical and space research and development efforts, to the nonaerospace segments of the economy.

In 1987, civil service personnel will provide support to define methods to expedite the application of new technology through the compression of the time required from generation of technology to its use in the economy; and encourage the use of aerospace technology in nonaerospace segments of the economy having problems amenable to technological solutions.

	Permanent Civil Service Workvears
COMMERCIAL USE OF SPACE	2

The objective of the Commercial Use of Space program is to increase private sector awareness of space opportunities and encourage industry investment and participation in high technology space based research and development. This effort will establish an organizational focal point to initiate a program specifically intended to foster commercial use and access to space.

AERONAUTICAL RESEARCH AND TECHNOLOGY	1,332

The aeronautical and research technology program at Langley is characterized by the dynamic interaction between a broad spectrum of technical disciplines, the application of discipline research to specific technology requirements, demonstrations of particular technology applications, and the in-depth examination of future technology requirements. The unique wind tunnel, computing facilities, and flight operations capability at Langley complement the expertise of the technical staff to produce a broad cohesive program in aeronautical research.

The aerodynamics activity at Langley encompasses extensive theoretical and experimental activities. Basic work in fluid and flight mechanics involves theoretical and experimental determination of aerodynamic flows and complex aircraft motions. The program utilizes the unique Langley capabilities made possible by the VPS-32 computer and recently-developed cryogenic wind tunnel testing capability provided in the national transonic facility which allows the full simulation of flight conditions.

Research areas include airfoil and wing design, flow-field analysis, configuration design processes, aircraft noise prediction, control analysis, aircraft drag reduction, propulsion system integration, flight dynamics, and fighter and missile aerodynamics. The VPS-32 computer will be used in the areas of far-field noise, three-dimensional (3-D) potential flow programs, and the solution of 2-D and 3-D Navier-Stokes equations. Wind tunnel and flight tests will be continued on general aviation aircraft configurations having the potential for practical stall immunity and means for spin avoidance. Basic research on the conception and development of methods for reducing turbulent skin-friction drag and the designs for both passive and active laminar flow airfoils will be pursued. A goal of the activities in the viscous drag reduction area is to validate the various concepts to the level required for aircraft manufacturers to

consider their use in future production aircraft. Application of advanced transonic theories to the design of improved 3-D wings will be continued and evaluated by wind tunnel tests. The development of design methodology for high-performance aircraft at high angles-of-attack in the areas of aerodynamics, controls, and handling qualities will be accelerated. Technology options for realization of practical hypersonic and transatmospheric flight are being studied.

Activities in acoustics and noise reduction include research on jet noise, propeller noise, interior noise, rotor blade noise, atmospheric propagation, structure-borne noise, and system noise prediction.

The materials and structures effort is directed at the development of new and improved structural materials, manufacturing processes, and design technology to improve the structural efficiency, reliability, and durability and to reduce design costs of airframes and components. This activity is directed toward research on advanced composite materials, advanced metallic materials, computer aided analysis and design technology, and development of analytical or semiempirical fatigue and life prediction methodology. Use of active and passive controls for minimization of aeroelastic response, reduced static stability, and minimization of gust and maneuver loads is being pursued in both theoretical and wind tunnel studies.

Emerging technological advances in computer systems are being exploited to significantly increase the utility and reduce the cost of engineering computations. The Langley research program in computer science is directed at software systems for distributed computer networks, methods for concurrent systems design, software engineering, fault tolerant software techniques for improved system reliability, and software development management. Investigations of advanced computer hardware applications will be continued with analysis of finite element structural computational costs.

Controls and guidance work at Langley includes research programs to advance technology development in aircraft guidance and navigation, aircraft control systems, cockpit systems and integration and interfacing techniques, and performance validation and verification methods for fully integrated, highly reliable flight control systems. Also, major efforts in aircraft flight management and operating procedures technology and active controls technology for conventional takeoff and landing aircraft are being conducted in this program area. The work includes requirement analyses, design studies, ground simulations, and experimental flight research. The Langley expertise in the controls and guidance area is being applied to various aircraft classes, intersystems communications networks for enhanced interfacing and integration of functions within an aircraft, flight path definitions, and advanced technology for pilot/system interfaces for both aircraft and spacecraft. Investigations will continue on the integration of aircraft with enhanced capabilities and the evolving air traffic control system to achieve benefits in capacity and efficiency while maintaining safety. Other efforts will include the definition of technology for enhanced functional integration to increase aircraft systems reliability and reduce operating cost, and the investigation of concepts and technology which will result in greatly improved aircraft displays and input/output capabilities. Other technology applications are found in research on advanced flight control systems, design procedures, handling and flying qualities criteria for advanced aircraft, and pilot modeling and assessment of pilot

performance and workload. Research efforts in developing and applying artificial intelligence technology to aircraft cockpits will be undertaken. The avionics integration research laboratory continues to be used for both NASA and industry research on fault tolerant systems. The impact of lightning on inducing errors in digital aircraft systems will continue to be assessed.

Langley has traditionally received requests from other agencies and industry for test support of their aircraft, missiles, and systems development programs. The Aerostructures Directorate of the U.S. Army Aviation Research and Technology Activity, and the Aviation Technology Directorate, both under Aviation Systems Command (AVSCOM) are located at Langley. These directorates, the primary investigators of Army rotorcraft structures and avionics, work on independent research and development projects and on projects of mutual interest with a staff integrated into the NASA organization. Extensive use is made of Langley facilities in these research activities. There are also a large number of joint programs with the Air Force Systems Command, the Naval Air Systems Command, other DOD components, and the Federal Aviation Administration.

	Permanent Civil Service Workyears
TRANSATMOSPHERIC RESEARCH AND TECHNOLOGY	70

The Transatmospheric Research and Technology activities at Langley include: development of fundamental processes and engineering feasibility of supersonic combustion of both ramjets and other advanced airbreathing propulsion systems; characterization of advanced materials for high temperature applications and the development of large hot reusable structures for aerospace vehicles; efforts in high-speed aerodynamics, configurations and advanced computational methods for a variety of vehicle applications; and the conduct of studies to define and understand the integration of advanced technologies into a future class of horizontal take-off and landing vehicles for operation to orbit and/or hypersonic cruise within the atmosphere.

SPACE RESEARCH AND TECHNOLOGY	487

The space research and technology program at Langley is characterized by levels of effort in several discipline areas and the application of expertise to current and future technology requirements. Longer range studies are directed at defining the technology requirements for future space systems and missions technology development for a permanently manned space station.

The objective in the materials area is to establish and demonstrate the required technology for application of advanced materials for a wide variety of space applications. Materials systems and applications include: high-temperature composites with long-life capability for use as structural materials in future space transportation systems; high-temperature metallic materials for thermal protection systems; and high-stiffness, low-weight, low-thermal expansion composites for large, long-life space structures.

Environmental effects on the mechanical and physical properties of materials are being studied utilizing specialized facilities and laboratories. These studies include dimensional stability and radiation stability of composites and thermal control coating. An integral part of the research activity is the definition of new experimental testing and research facility requirements which will assure that the reliability and durability of future space structures can be adequately predicted and assessed.

The goal of the activities in the area of structures is to provide validated analysis and design methodology, design concepts, and dynamics and control methodology required for efficient long-life space transportation and payload structures. High-temperature metallic heat shield concepts and actively cooled structural and propulsion concepts for advanced space transportation systems are being derived and evaluated using specialized laboratories and wind tunnels. Analysis, design, and loads determination methodology for deployable and erectable large space platforms, antennas, and booms are being studied as part of a multi-center, multi-disciplinary program for advanced technology. A technology program is being developed to demonstrate and validate the control of large flexible space structures through analysis and flight testing. An integrated structural-thermal analysis methodology is being developed and verified for spacecraft structures. Work will be initiated on integral controls software that will require application of advanced numerical techniques and computer hardware.

An extensive program in electronic component technology, automation/robotics technology, and information systems technology is conducted at Langley. Sensor research includes continuously tunable infrared laser techniques, and high-power/high-pressure tunable gas lasers for the measurement of low concentration atmospheric constituents and transport phenomena (e.g., winds). Research will continue on the extension of microwave radiometer technology to large space systems. Onboard data management system concept will be carried out in 1987. This work supports a broad objective of developing candidate architectures and associated systems technology for manned spacecraft onboard data management, with potential application to the space station. The demonstration of a wavelength division multiplexed fiber optic technology is underway at Langley. The objective of this research is to provide the component technology base for advanced local area networks used in the space station or other complex aerospace systems. The unique micro-G environment of space provides an opportunity to develop advanced materials processing concepts. Langley is investigating the potential of diffusion limited crystal growth as a technique to provide large uniform lead tin telluride crystals with potential application in infrared sensors. The evaluation of solid-state data storage technology for space station applications has been initiated. The overall objective is to identify candidate technologies, evaluate their potential, and perform research necessary to demonstrate viability in projected space station environment. Langley is evaluating advanced optical data processing techniques which take advantage of the parallelism of optics to perform complex mathematical operations such as matrix arithmetic at high speed for potential application to complex aerospace systems. Automation technology efforts will focus on conducting systems level research on remote satellite servicing concepts and application of artificial intelligence technology. Other space electronics technology efforts are focused on spacecraft attitude control, software development, verification and validation techniques, and special problems in large space structures pointing and figure control.

The objective of the Langley space vehicle and spacecraft technology program is to develop experimental and theoretical data bases to support: development of space transportation system (STS) vehicles for the 1990's and beyond, employing technologies advanced beyond those utilized for the space shuttle; the evolving STS program and solve operational problems as they surface; and reduction and interpretation of STS flight data. The objectives are being met through the development and application of experimental and theoretical techniques employing LaRC computers and wind tunnel facilities and through comparative analyses of the resulting data with flight data as available. Disciplines include aerodynamic/thermodynamic performance, configuration optimization, flight control system assessment, mission design, planetary entry trajectory analyses, and computational flow field techniques.

The space shuttle orbiter will be utilized as a research vehicle to extend the knowledge of aerodynamics, aerothermodynamics, and basic fluid mechanics into previously inaccessible flow regimes by acquiring flight measurements during routine shuttle operations. Experiments have been developed for space shuttle flights which will provide unique measurements for direct assessment of ground-based facility measurements and theoretical techniques. The space shuttle will also be utilized as a space platform from which to perform Langley-developed payload experiments extending basic research and technology development into the space environment when economically feasible or when the development can be achieved in space.

The Langley program in space energy conversion is focused on radiant energy conversion concepts which convert solar and laser radiation efficiently into electricity or other useful forms of energy. The objective of the energy conversion effort is to perform basic research on solar-pumped lasers for conversion of solar energy directly into electromagnetic radiation, laser power or work for potential power generation, transmission, storage, and control for future space missions.

	Permanent Civil Service Workyears
SPACE TRANSPORTATION OPERATIONS	22

The expendable launch vehicle program at Langley provides centralized procurement of the Scout launch vehicle. In 1987, civil service personnel will support a program which includes the procurement of launch vehicle hardware, launch services, engineering, and maintenance. Launches under this program will be conducted from sites located at the Western Space and Missile Center in California, Wallops Flight Facility in Virginia, and San Marco Equatorial Range, Kenya, .Africa.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	643

Center management and operations support provides services or support to all Langley organizations which cannot be identified exclusively to a single program or project. The civil service personnel involved are:

Director and Staff - The Center Director, Deputy Director, and immediate staff; **e.g.,** Chief Scientist, Equal Opportunity, and Public Affairs.

Management Support - Provide information and control services supporting all levels of Center management, both program and functional. Specific functions include resources and financial management, program control, contracting and procurement, property management, personnel management, and management systems and analysis.

Operations Support - Provide for the operation and maintenance of institutional facilities, buildings, systems, and equipment, including those who manage or provide technical services such as automatic data processing, reliability and quality assurance, medical care, and photographic support.

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**116,525**	**119,762**	**117,556**	**118,595**
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	100,033	104,061	101,036	101,826
b. Other than full-time permanent	1,795	1,693	1,725	1,725
c. Overtime and other compensation	1,158	987	1,283	1,283
Subtotal, Compensation	102,986	106,741	104,044	104,834
2. Benefits	12,549	12,225	12,372	12,491
Subtotal, Compensation and Benefits	115,535	118,966	116,416	117,325
B. Supporting Costs				
1. Transfer of Personnel	159	86	180	180
2. Personnel Training	831	710	960	1,090
Subtotal, Supporting Costs	990	796	1,140	1,270
Total, Personnel and Related Costs	116,525	119,762	117,556	118,595

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
A. Compensation and Benefits	115,535	118,966	116,416	117,325
1. Compensation	102,986	106,741	104,044	104,834
a. Full-time permanent	100,033	104,061	101,036	101,826

The decrease from the 1986 budget estimate to the 1986 current estimate reflects the current distribution between permanent and other FTEs.

Basis of Cost for Civil Service Workvears

In FY 1987, the cost of permanent workyears will be $101,826,000. The increase results from the following:

Cost of full-time permanent workyears in 1986		101,036
Cost increases in 1987		2,179
Within grade and career development advances:		
Full year effect of 1986 actions	957	
Partial year effect of 1987 actions	1,222	
Cost decreases in 1987		-1,389
Turnover savings:		
Full year effect of 1986 actions	-363	
Partial year effect of 1987 actions	-1,026	
Cost of full-time permanent workyears in 1987		101,826

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent				
1. Cost	1,795	1,693	1,725	1,725
2. Workyears	135	131	133	133

The distribution of 1987 workyears is as follows:

Distribution of Other Than Full-Time Permanent Workyears

Program	Workyears
Developmental programs	85
Youth Opportunity programs	34
Other temporary	14
Total	133

The increase in the 1986 current estimate reflects the level in the developmental programs and other temporaries.

c. Overtime and other compensation	1,158	987	1,283	1,283

The major cost in this area is overtime. Also included are holiday pay, incentive awards, and bonus awards. The use of overtime and other compensation is limited to emergency repairs and work that cannot be accomplished during normal duty hours. This includes the monitoring of on-site contracts being performed during off-duty hours and wind tunnel work required at night to take advantage of off-peak electrical rates. The increase from the 1986 budget estimate to the 1986 current estimate and continuing into 1987 reflects additional running of wind tunnels to compensate for accidents in the 16-foot and 7- by 10-foot tunnels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
2. Benefits	12,549	12,225	12,372	12,491
The following are the amounts of contribution by category:				
Civil Service Retirement Fund	7,063	6,856	7,156	7,228
Employee life insurance	249	266	252	255
Employee health insurance	3,000	2,967	3,013	3,044
Workmen's compensation	919	919	609	609
FICA	105	23	107	108
Medicare	1,209	1,174	1,220	1,232
Other Benefits	4	20	15	15
Total	12,549	12,225	12,372	12,491

The increase from the 1986 budget estimate to the 1986 current estimate is due to increase in civil service retirement, health insurance, and FICA offset by workmen's compensation. The 1987 estimate reflects the change in compensation estimates.

B. Supporting Cost	990	796	1,140	1,270
1. Transfer of personnel	159	86	180	180

Transfer of personnel includes actual expenses involved in the movement and temporary storage of an employee's household goods, subsistence and temporary expenses, real estate costs, and miscellaneous moving expenses. The increase from the 1986 budget estimate to the 1986 current estimate reflects a change in the GSA policy regarding payment for PCS moves and household goods.

2. Personnel training	831	710	960	1,090

The purpose of the training program is to continue the development and education of civil service employees to support Langley's roles and missions more efficiently. The 1986 current estimate and the 1987 budget estimate reflects increased training requirements for those responsible for developing, designing, implementing, and validating programs for large mainframe computers, office automation and the new Space Station initiative.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
II. TRAVEL	**2,735**	3,175	**2,935**	**3,220**
Summary of Fund Requirements				
A. Program Travel	1,881	2,392	2,163	2,417
B. Scientific and Technical Development Travel	608	583	583	607
C. Management and Operations Travel	246	200	189	196
Total, Travel	2,735	3,175	2,935	3,220
Explanation of Fund Requirements				
A. Program Travel	1,881	2,392	2,163	2,417

Program travel is directly related to the accomplishment of the Center's mission. Travel for program purposes reflects the continuing effort in space research, aircraft technology, flight simulation, fluid mechanics, airborne science and applications, space applications, Space Station, and Shuttle support. The decrease from the 1986 budget estimate to the 1986 current estimate reflects a realignment of program requirements. The 1987 estimate reflects essentially the same level of travel as 1986 but reflects anticipated air fare rate increases.

B. Scientific and Technical Development Travel	608	583	583	607

Scientific and technical development travel permits employees to participate in meetings and technical seminars with other representatives of the aerospace community. Participation allows staff to benefit from exposure to technological advances outside Langley, as well as to present both accomplishments and problems to their associates. Many of the meetings are working panels convened to solve certain problems for the benefit of the Government. The 1987 estimate reflects anticipated price levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. Management and Operations Travel.....	246	200	189	196

Management and operations travel is used for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management, and procurement activities; travel of the Center's top management to NASA Headquarters and other NASA Centers; peer group reviews; and local transportation. The decrease in the 1986 current estimate from the 1986 budget estimate reflects a constraint on travel in order to support programmatic requirements. The 1987 estimate reflects the same level of travel as in 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION	**27,862**	**31,279**	**29,538**	**33,218**

Summary of Fund Requirements

A. Facilities Services	15,968	18,092	17,112	18,057
B. Technical Services	3,304	5,197	4,436	6,771
C. Management and Operations	8,590	7,990	7,990	8,390
Total, Operation of Installation	27,862	31,279	29,538	33,218

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Center's institutional activities. These are divided into three major functional areas: Facilities Services, the cost of maintaining and repairing institutional facilities and equipment, and the cost of custodialservices and utilities; Technical Services, the cost of automatic data processing for management activities, and the cost of educational and informational programs and exhibits; and Management and Operations, the cost of administrative communications, reproduction, transportation, medical, and logistic services.

The decrease from the 1986 current estimate to the 1986 budget estimate is the result of reduced operational maintenance support, lower than anticipated utility rates and a rephasing of contractor obligation plans. The 1987 budget estimate provides for projected increases in support contractor rates, supplies, materials, equipment, and utility rates, and a full year funding of support service contracts.

A. FACILITIES SERVICES	15,968	18,092	17,112	18,057

The Langley complex encompasses 2,068,679 gross square feet of building and space. Included are 19 major technical facilities. This physical plant houses an average daily on-Center population of 4,100 to 4,400 personnel. Many of the test facilities are utilized on more than one shift or during off-peak hours.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Summary of Fund Requirements				
1. Rental of Real Property	---	7	7	7
2. Maintenance and Related Services	494	1,126	506	562
3. Custodial Services	3,918	3,429	3,349	3,563
4. Utility Services	11,556	13,530	13,250	13,925
Total, Facilities Services	15,968	18,092	17,112	18,057

Exolanation of Fund Reauirements

1. Rental of Real Property	---	7	7	7

The estimates shown here are the costs of leasing rights of way for access to model drop zone areas at Plum Tree Island.

2. Maintenance and Related Services	494	1,126	506	562

This estimate provides funds for maintenance and repair of administrative facilities, roads and utility lines, and grounds maintenance. The decrease from the 1986 budget estimate to the 1986 current estimate reflects delay and deferral of activities and a rephasing of support contractor funding plans. The increase in 1987 is due to anticipated support contractor wage increases and the full year funding of support contracts.

3. Custodial Services	3,918	3,429	3,349	3,563

This activity provides for janitorial and security services. Also included .are funds for fire protection services provided by the City of Hampton. The decrease from the 1986 budget estimate to the 1986 current estimate reflects a slight cost decrease in janitorial, security, and fire protection services. The 1987 estimate provides for the same level of effort at anticipated rate increases.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
4. Utility Services.....	11,556	13,530	13,250	13,925

Included in this item is the purchase of electric service from Virginia Power Company, fuel oil from a local supplier, and water and sewage charges. Also included are funds for heat and steam services from the Air Force for East Area facilities and the purchase of steam from Hampton for facilities located in the West Area of Langley and for operation of the City of Hampton, Air Force and NASA Cooperative Refuse Burner. The decrease from the 1986 budget estimate to the 1986 current estimate reflect less than anticipated increases in the cost of electricity coupled with a slight increase in Refuse Burner costs. The 1987 budget estimate reflects anticipated rate increases.

B. TECHNICAL SERVICES.....	3,304	5,197	4,436	6,771
Summary of Fund Requirements				
1. Automatic Data Processing	2,267	4,013	3,463	5,910
a. Equipment	969	715	763	1,792
b. Operations	1,298	3,298	2,700	4,118
2. Scientific and Technical Information	1,037	1,184	973	861
a. Library	250	261	260	275
b. Education and Information.....	787	923	713	586
Total, Technical Services.....	3,304	5,197	4,436	6,771
Explanation of Fund Requirements				
1. Automatic Data Processing	2,267	4,013	3,463	5,910

Funds for the Center's business computer complex which provides the accounting and management information data are provided in this function. Included are equipment lease, purchase and maintenance; paper and other expendable supplies; a contract for programming and operations; and several small

contracts. The decrease from the 1986 budget estimate to the 1986 current estimate is due to deferral of equipment purchases and a rephasing of support contractor funding plans. The 1987 estimate provides for expected support contractor rate increases, the full year funding of support contracts and a critically needed upgrade of the administrative computer central processing unit.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Scientific and Technical Information.....	1,037	1,184	973	861

This estimate provides support contractor assistance in the operation of the Technical Library and Visitor Information Center. Funding for all the Center's public affairs activities is included in these estimates. Also included is support for operation of the Visitor Information Center, coordination of tours and special events, construction and transportation of exhibits, and other miscellaneous educational and informational programs. The decrease in the 1986 current estimate and the 1987 budget estimate reflects deferral of the Visitor Center exhibit construction and reduced support for exhibits maintenance.

C. MANAGEMENT AND OPERATIONS.....	8,590	7,990	7,990	8,390
Summary of Fund Requirements				
1. Administrative Communications.....	2,525	2,441	2,441	2,566
2. Printing and 'Reproduction..	151	157	158	159
3. Transportation.....	2,201	2,262	2,008	2,244
4. Installation Common Services.....	3,713	3,130	3,383	3,421
Total, Management and Operations.....	8,590	7,990	7,990	8,390
Explanation of Fund Requirements				
1. Administrative Communications.....	2,525	2,441	2,441	2,566

Includes funds for local telephone and exchange costs; Federal Telecommunications Systems (FTS) services; and datafax and telegraph service. The budget estimate for 1987 reflects the same level of service as 1985 and 1986 at anticipated rate changes.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
2. Printing and Reproduction..	151	157	158	159

Provides supplies for reproduction services. The 1987 estimate reflects the same level of service as 1986.

3. Transportation	2,201	2,262	2,008	2,244

Includes the operation, maintenance, and purchase of motor vehicles; shipping, transportation and freight charges. Also included are charges for local transportation, pickup and delivery of freight, furniture, and other bulk objects, and operation and maintenance of the administrative aircraft. This effort also includes all of the aircraft fuel, equipment, and expendable supplies. The decrease in the 1986 current estimate from the 1986 budget estimate defers replacement of motor vehicles. The 1987 estimate provides for continuation of the 1986 level at anticipated price levels.

4. Installation Common Services	3,713	3,130	3,383	3,421

Provides for medical services, mail delivery, stock issue and warehousing, and other general administrative support. Also included are the rental and maintenance of office copy machines and equipment, minority programs, and other administrative services and supplies. The increase from the 1986 budget estimate to the 1986 current estimate reflects a reassessment of postage costs and employee assistance program. The 1987 estimate reflects the same level as 1986 adjusted for anticipated rate changes.

NATIONAL AERONAUTICS AM SPACE ADMINISTRATION

LANGLEY RESEARCH CENTER

ORGANIZATION AM STAFFING CHART

STAFFING SUMMARY

	86	87
SES	30	30
EX	0	0
GS/GM 15	173	173
GS/GM 14	347	347
OTHER GS/GM	2230	2230
WAGE GRADE	50	50
TOTAL	2830	2830

DIRECTOR AND STAFF

	86	87
SES	4	4
EX	0	0
GS/GM 15	1	1
GS/GM 14	5	5
OTHER GS/GM	19	19
TOTAL	29	29

OFFICE OF DIRECTOR FOR PROJECTS

	86	87
SES	1	1
GS/GM 15	3	3
GS/GM 14	1	1
OTHER GS/GM	2	2
TOTAL	7	7

AERONAUTICAL SYSTEMS OFFICE

	86	87
SES	1	1
GS/GM 15	4	4
GS/GM 14	7	7
OTHER GS/GM	5	5
TOTAL	17	17

SCOUT PROJECT OFFICE

	86	87
GS/GM 15	2	2
GS/GM 14	5	5
OTHER GS/GM	11	11
TOTAL	18	18

LDEF PROJECT OFFICE

	86	87
GS/GM 15	2	2
GS/GM 14	1	1
OTHER GS/GM	1	1
TOTAL	4	4

SPACE TECH FLIGHT EXPERIMENTS OFFICE

	86	87
GS/GM 15	1	1
GS/GM 14	1	1
OTHER GS/GM	1	1
TOTAL	3	3

ERBE/SAGE II PROJECT OFFICE

	86	87
GS/GM 15	1	1
OTHER GS/GM	2	2
TOTAL	3	3

SPACE FLIGHT EXPT. DEFINITION AND INTEGRATION OFFICE

	86	87
GS/GM 15	1	1
GS/GM 14	7	7
OTHER GS/GM	1	1
TOTAL	9	9

COFSPO

	86	87
GS/GM 15	1	1
GS/GM 14	2	2
OTHER GS/GM	5	5
TOTAL	8	8

OFFICE OF DIRECTOR FOR ELECTRONICS

	86	87
SES	1	1
GS/GM 14	1	1
OTHER GS/GM	2	2
TOTAL	4	4

ANALYSIS AND COMPUTATION DIVISION

	86	87
SES	1	1
GS/GM 15	3	3
GS/GM 14	14	14
OTHER GS/GM	85	85
TOTAL	103	103

INSTRUMENTATION RESEARCH DIVISION

	86	87
SES	1	1
GS/GM 15	5	5
GS/GM 14	16	16
OTHER GS/GM	112	112
TOTAL	134	134

FLIGHT ELECTRONICS DIVISION

	85	86
SES	1	1
GS/GM 15	3	3
GS/GM 14	12	12
OTHER GS/GM	73	73
TOTAL	89	89

OFFICE OF DIRECTOR FOR STRUCTURES

	85	86
SES	1	1
GS/GM 14	1	1
OTHER GS/GM	2	2
TOTAL	4	4

INTERDISCIPLINARY RESEARCH OFFICE

	86	87
GS/GM 15	2	2
GS/GM 14	2	2
OTHER GS/GM	4	4
TOTAL	8	8

ACOUSTICS & NOISE REDUCTION DIVISION

	86	87
SES	1	1
GS/GM 15	7	7
GS/GM 14	7	7
OTHER GS/GM	35	35
TOTAL	50	50

STRUCTURES ma DYNAMICS DIVISION

	86	87
SES	1	1
GS/GM 15	8	8
GS/GM 14	12	12
OTHER GS/GM	38	38
TOTAL	59	59

MATERIALS DIVISION

	86	87
SES	1	1
GS/GM 15	10	10
GS/GM 14	14	14
OTHER GS/GM	43	43
TOTAL	68	68

LOADS AND AERO-ELASTICITY DIVISION

	86	87
SES	1	1
GS/GM 15	8	8
GS/GM 14	12	12
OTHER GS/GM	49	49
TOTAL	70	70

OFFICE OF DIRECTOR FOR SPACE

	86	87
SES	1	1
GS/GM 15	0	0
OTHER GS/GM	3	3
TOTAL	4	4

LOW SPEED AERODYNAMICS DIVISION

	86	87
SES	1	1
GS/GM 15	12	12
GS/GM 14	11	11
OTHER GS/GM	71	71
WAGE GRADE	4	4
TOTAL	99	99

HIGH SPEED AERO-DYNAMICS DIVISION

	86	87
SES	0	0
GS/GM 15	14	14
GS/GM 14	17	17
OTHER GS/GM	63	63
TOTAL	94	94

TRANSONIC AERO-DYNAMICS DIVISION

	86	87
SES	1	1
GS/GM 15	11	11
GS/GM 14	17	17
OTHER GS/GM	80	80
TOTAL	109	109

ATMOSPHERIC SCIENCES DIVISION

	86	87
SES	1	1
GS/GM 15	16	16
GS/GM 14	30	30
OTHER GS/GM	50	50
TOTAL	97	97

SPACE SYSTEMS DIVISION

	86	87
SES	1	1
GS/GM 15	18	18
GS/GM 14	27	27
OTHER GS/GM	62	62
TOTAL	108	108

SPACE STATION OFFICE

	86	87
SES	2	2
GS/GM 15	5	5
GS/GM 14	8	8
OTHER GS/GM	9	9
TOTAL	24	24

OFFICE OF DIRECTOR FOR SYSTEMS ENGINEERING AND OPERATIONS

	86	87
SES	2	2
GS/GM 15	2	2
GS/GM 14	2	2
OTHER GS/GM	7	7
TOTAL	13	13

FABRICATION DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	3	3
OTHER GS/GM	290	290
WAGE GRADE	14	14
TOTAL	308	308

SYSTEMS ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM 15	7	7
GS/GM 14	15	15
OTHER GS/GM	105	105
TOTAL	128	128

FACILITIES ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM 15	5	5
GS/GM 14	21	21
OTHER GS/GM	130	130
TOTAL	157	157

OPERATIONS SUPPORT DIVISION

	86	87
SES	0	0
GS/GM 15	1	1
GS/GM 14	4	4
OTHER GS/GM	376	376
WAGE GRADE	30	30
TOTAL	411	411

SYSTEMS SAFETY, QUALITY & RELIABILITY OFFICE

	86	87
GS/GM 15	2	2
GS/GM 14	2	2
OTHER GS/GM	24	24
TOTAL	28	28

OFFICE OF DIRECTOR FOR MANAGEMENT OPERATIONS

	86	87
SES	1	1
GS/GM 15	6	6
GS/GM 14	2	2
OTHER GS/GM	7	7
TOTAL	16	16

FINANCIAL MANAGEMENT DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	2	2
OTHER GS/GM	44	44
TOTAL	47	47

BUSINESS DATA SYSTEMS DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	4	4
OTHER GS/GM	10	10
TOTAL	15	15

PERSONNEL DIVISION

	86	87
GS/GM 15	0	0
GS/GM 14	7	7
OTHER GS/GM	36	36
TOTAL	43	43

MANAGEMENT SUPPORT DIVISION

	86	87
SES	0	0
GS/GM 15	1	1
GS/GM 14	1	1
OTHER GS/GM	51	51
TOTAL	53	53

ACQUISITION DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	3	3
OTHER GS/GM	78	78
TOTAL	82	82

PROGRAMS AND RESOURCES DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	2	2
OTHER GS/GM	22	22
TOTAL	25	25

RESEARCH INFORMATION AND APPLICATIONS DIVISION

	86	87
GS/GM 15	1	1
GS/GM 14	4	4
OTHER GS/GM	68	68
WAGE GRADE	10	10
TOTAL	83	83

OFFICE OF DIRECTOR FOR FLIGHT SYSTEMS

	86	87
SES	1	1
GS/GM 15	2	2
GS/GM 14	4	4
OTHER GS/GM	14	14
TOTAL	21	21

FLIGHT MANAGEMENT DIVISION

	86	87
GS/GM 15	2	2
GS/GM 14	6	6
OTHER GS/GM	29	29
TOTAL	37	37

GUIDANCE AND CONTROL DIVISION

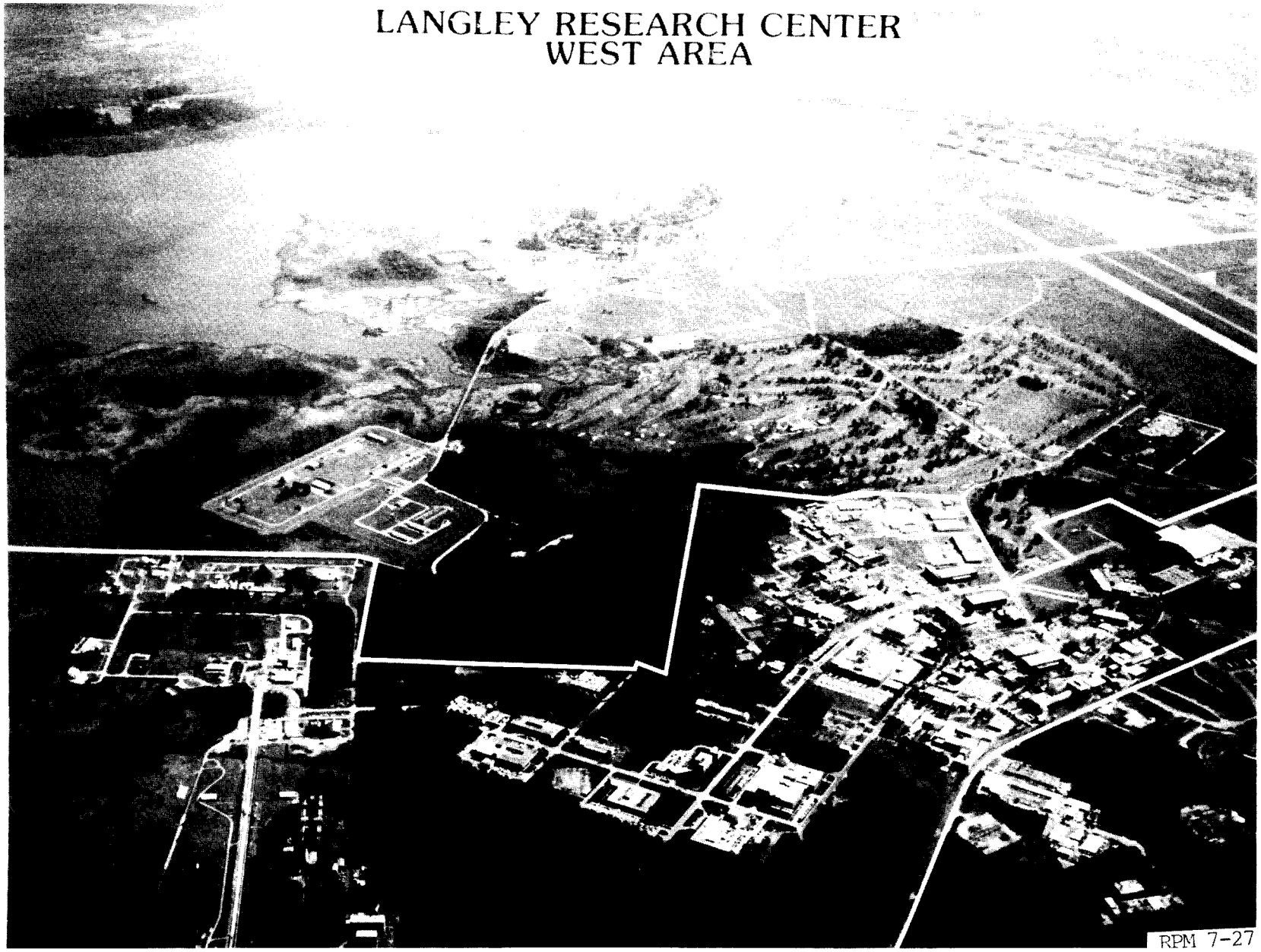
	86	87
SES	1	1
GS/GM 15	5	5
GS/GM 14	20	20
OTHER GS/GM	50	50
TOTAL	76	76

INFORMATION SYSTEMS DIVISION

	86	87
GS/GM 15	4	4
GS/GM 14	13	13
OTHER GS/GM	58	58
TOTAL	76	76

RPM 7-26

LANGLEY RESEARCH CENTER
WEST AREA



RPM 7-27

LEWIS
RESEARCH CENTER

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

LEWIS RESEARCH CENTER

DESCRIPTION

The Lewis Research Center (LeRC) occupies two sites in north central Ohio. The original site, established in 1941, adjacent to the Cleveland-Hopkins International Airport, includes 366 acres, 14 of which are leased from the City of Cleveland. There are over 170 buildings and structures, including wind tunnels, test chambers, laboratories and other research facilities at the Cleveland location.

The Plum Brook Station, established in 1956, is located south of Sandusky, Ohio, about 50 miles west of Cleveland, on land formerly occupied by the Plum Brook Ordnance works. There are 6452 acres owned by NASA and approximately 47 acres in easements. During 1975, consistent with future NASA research and technology needs, the principal facilities were placed in a standby mode except the use of selected facilities by Federal, state and local government agencies or their contractors.

The total capital investment of Lewis and Plum Brook Station, including fixed assets in progress and contractor-held facilities at various locations, as of September 30, 1985, was $523,814,000.

CENTER ROLES AND MISSIONS

Lewis was established as an aircraft engine research laboratory to develop superior aircraft propulsion systems. Since then, Lewis has developed and constructed many unique facilities for testing full-scale aircraft engines and engine components, chemical rocket engines, electric propulsion systems, space and terrestrial power generation systems, and space communication systems. The principal and supporting roles are:

PRINCIPAL

Aeronautics - develop and maintain a preeminent national capability in: fundamental aeropropulsion disciplines including internal computational fluid dynamics, internal unsteady aerodynamics and

aeroelasticity, hot section technology, aircraft icing phenomena; aeronautical propulsion and power transfer technologies including engine materials and structures, propulsion system integration, propellers, instrumentation and controls; and the associated research facilities and techniques.

Transatmospheric Research and Technology - combine aeronautics and space disciplines to provide the technology for a future class of vehicles capable of flight to orbit and/or hypersonic cruise.

Space Station - definition and development of the Space Station Power System.

Communications - develop the high-risk technology required to ensure continued U.S. preeminence in satellite communications and which will be applicable to a wide range of future communication system required by NASA, other government agencies and U.S. Industry.

Expendable Launch Vehicles - management and operation of the Atlas and Centaur launch vehicle systems for Government and commercial users.

Space Transportation System/High Energy Upper Stage - design, develop and manage the Shuttle Centaur Cryogenic Upper Stage for the Space Transportation System to support the launch of the Galileo, Ulysses, Venus Radar Mapper, and Air Force missions.

Space Propulsion Systems Technology - development and maintenance of the technology base for advanced primary and auxiliary space propulsion systems, including associated structures and materials technologies.

Space Energy Processes and Systems Technology - development and maintenance of the technology base for space power and energy conversion systems, including associated structures and materials.

In-Space Flight Experiments - develop and implement basic microgravity science experiments, especially in materials processing, and conduct flight experiments that contribute to technology developments for space power and propulsion systems.

SUPPORTING

Energy Processes and Systems Technology - management of research and technology projects for terrestrial energy generation and conservation systems.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)		
I.	Personnel and Related Costs.....	110,068	112,741	111,482	112,842
11.	Travel.....	2,626	2,726	2,622	2,897
111.	Operation of Installation.....	24,689	29,318	28,873	34,581
	A. Facilities Services..	(16,946)	(22,757)	(21,507)	(24,503)
	B. Technical Services..	(2,409)	(2,209)	(3,014)	(3,856)
	C. Management and Operations..	(5,334)	(4,352)	(4,352)	(6,222)
	Total, fund requirements	137,383	144,785	142,977	150,320

Distribution of Civil Service Workyears

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	2.023	2.001	2.068	2,078
Space Station	182	205	239	280
Space Transportation	164	130	156	143
Space Science and Applications	178	141	120	130
Space Applications	178	141	120	130
Commercial Programs	5	7	11	11
Technology Utilization	4	2	2	2
Commercial Use of Space	1	5	9	9
Aeronautics and Space Technology	1,494	1,518	1,542	1,514
Aeronautics	1,156	1,165	1,197	1,099
Transatmospheric Research and Technology	---	---	---	70
Space	338	353	345	345
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS	76	54	60	50
Space Transportation Operations	76	54	60	50
Subtotal, Direct Workyears	2,099	2,055	2.128	2.128
CENTER MANGEMENT AND OPERATIONS	548	527	527	527
Total, full-time workyears	2,647	2,582	2,655	2,655
Other than full-time workyears	77	110	39	39
Total, workyears	2,724	2,692	2,694	2,694

PROGRAM DESCRIPTION

RESEARCH AND DEVELOPMENT	Permanent Civil Service Workyears
SPACE STATION.....	280

Space Station effort consists of power system definition studies, advanced technology development and initial development efforts. Lewis manages an agency-wide advanced technology development program to define and develop power system technology options and also conducts a portion of the propulsion advanced development effort in support of the Marshall Space Flight Center.

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT.....	143

Design, development, production and operation of the Centaur G. and Centaur G-Prime cryogenic upper stages are managed by the Shuttle/Centaur Project Office at Lewis. In 1987, civil service personnel will continue to support the activities associated with fabrication and qualification of the Centaur G vehicles. Significant efforts will also include integration of the Centaur G into the Space Transportation System's Kennedy Space Center operation for the 1988 Venus Radar Mapper mission and various DOD missions. The first two Centaur G vehicles will be delivered to Kennedy Space Center in 1986.

SPACE APPLICATIONS...	130

The Space Applications activity at Lewis consists principally of space communications research. In 1986 Civil Service personnel will continue to support studies of various advanced satellite communications systems concepts directed at providing additional frequency bands and improved communications service. These studies are being focused on the needs of the public and private sectors, both nationally and internationally. Lewis will continue to develop technology with possible application to both ground and space segments of future advanced civil and military communications systems.

In 1987, Lewis will increase it's work in advanced design and development of scientific flight experiments in basic science and technology associated with materials combustion and fluid dynamics phenomenon in reduced gravity.

TECHNOLOGY UTILIZATION.	2

The 1987 technology utilization program at Lewis will continue to concentrate on the identification and evaluation of technology which can be transferred to the non-aerospace industry, and on active programs to communicate and transfer the technology.

	Permanent Civil Service Workyears
COMMERCIAL USE OF SPACE.....	9

The Commercial Use of Space program at Lewis will continue to assist industry in evaluating the commercial potential of space by providing the Lewis Research Center's ground-based facilities and microgravity aircraft, and technical expertise for evaluation and testing of ideas/concepts. Specific areas of microgravity research being pursued include processing of metals and alloys, glasses and ceramics, polymers, biological materials and semiconductor materials. Target industries are being identified and approached to determine whether the space environment can be utilized for profit-making purposes.

AERONAUTICAL RESERACH AND TECHNOLOGY.....	1,099

Lewis' major research and technology responsibility in aeronautics is propulsion. The primary goal is to establish aeropropulsion technology which contributes significantly to the continuing preeminence of the U.S. civil and military aircraft industry. The approach is to provide the technology base for developing advanced aeronautical propulsion systems which will lead to improvements in fuel efficiency, operating cost, reliability and durability, and which will operate with acceptable environmental impact. The Lewis aeropropulsion program includes key generic discipline research, focused interdisciplinary research, and efforts focused on specific propulsion systems/vehicle applications. The Propulsion Directorate of the U.S. Army Aviation Research and Technology Activity under the Aviation Systems Command is co-located with NASA Lewis and jointly conducts independent research and technology development projects and other activities of mutual interest.

The generic discipline research includes internal computational fluid mechanics (ICFM), materials, and computational structural mechanics. The objective of this research is to develop an understanding of the physical phenomena involved in these disciplines so that accurate analytical tools can be developed to predict and to improve propulsion system performance. The scope of the ICFM research includes computational methods, modeling and verification, and applications. The advanced materials research is focused on super-alloys, intermetallics, coatings, ceramics and composites for high temperature propulsion system applications. Computational structural mechanics involves the development and verification of advanced analytical methods for structural dynamics, fracture mechanics, and the development of life prediction methodology.

The focused interdisciplinary propulsion research includes icing, instrumentation and control technology, and hot section technology. Icing research brings together disciplines such as fluid mechanics and heat transfer to improve the analytical tools required for predicting icing effects, and to develop advanced ice protection systems. The goal of the icing research is to develop the technology base required to provide all-weather capability for civil and military aircraft. The focus of the instrumentation and controls technology is the development of nonintrusive research instrumentation and engine sensors/controls for the "smart" adaptive propulsion systems of the future. Hot section technology is aimed at providing improved durability and reliability of high temperature propulsion system components through the development of improved experimental and analytical tools.

In engine systems research, Lewis is developing focused propulsion technology for specific engines and propulsion systems. Research and technology in this area involves small engines (gas turbines and intermittent combustion engines), advanced turboprops (including a flight test planned for 1987), convertible engines, variable cycle engines, and new, innovative propulsion systems. Applications for this focused propulsion system research include subsonic transports, commuters, general aviation, rotorcraft, supersonic STOVL aircraft, and supersonic/hypersonic aircraft.

The Lewis aeropropulsion technology program is supported by advanced propulsion system studies and by propulsion facilities ranging from small research test rigs to large propulsion system altitude tanks and wind tunnels.

	Permanent Civil Service Workvears
TRANSATMOSPHERIC RESEARCH AND TECHNOLOGY.....	70

These activities at Lewis are directed toward understanding and defining a class of airbreathing propulsion systems, using hydrogen fuel, that are applicable to orbital accelerator and hypersonic cruise vehicles including the necessary advancements in variable geometry inlets and nozzles; characterizing a family of materials and cooling concepts compatible with extremely hot reusable engine and airframe structures; development of the computational methods necessary to analyze and define the flow in complex internal ducts and passages; and conducting the studies necessary to integrate these components into an efficient and capable propulsion system.

SPACE RESEARCH AND TECHNOLOGY.....	345

The major roles of Lewis in space research and technology are to advance the state of the art and maintain a technology base for power systems, advanced primary and auxiliary propulsion, and space communications. This includes associated materials technology, structural analysis and life prediction technology, power

management and distribution technology, and advanced development work in support of a space station, its evolutionary growth, satellites and other future space applications. In-space flight experiments are defined, developed and implemented in the context of the above technology areas and in the underlying basic sciences.

The Lewis primary propulsion programs emphasize the extension and advancement of the technologies of hydrogen- or hydrocarbon-fueled engines such as the space shuttle main engine toward long-life, reusable, serviceable systems for Earth-to-orbit applications. This concentrates on thrust chamber cooling and life, critical turbomachinery components, advanced structural analysis and life prediction and diagnostics.

Another thrust is to provide the technology for improving orbital transfer propulsion systems in the areas of performance, life and reusability. Emphasis is on combustion and heat transfer, long-life lightweight reusable components, and high expansion area nozzles. Arcjets are also being investigated.

The Lewis auxiliary propulsion programs are directed toward space station and satellite applications. Technologies for gaseous hydrogen-oxygen thrusters, resistojets capable of using various fuels, inert gas ion, and storable chemical engines are being explored.

Lewis does basic science and technology work and conducts in-space science and technology experiments in materials, combustion and fluid dynamics in reduced gravity. This activity is coordinated with the scientific community in universities, industry, and government. Critical space experiments in support of power and propulsion systems technology advances are also carried out.

Space power programs are directed toward evolutionary space station, satellite and other future space mission needs. This includes solar photovoltaic, solar dynamic, electrochemical energy conversion and storage, nuclear energy conversion, and power component and circuit development. The photovoltaic program seeks improvement in solar cell efficiency and life at reduced cost. In solar dynamics a higher efficiency alternative that reduces weight and area to high power levels is sought. Electrochemical research supports extended operating life and improved energy density for batteries and fuel cells. The nuclear energy conversion program is directed toward the development of advanced static and dynamic thermal energy conversion technologies and associated subsystems.

Power component and circuit technology for multihundred kilowatt power systems is being investigated. The interactions of the space plasma environment with power systems are also being studied.

The space communications program includes applied research and advanced development in microwave electron beam amplifiers, microwave solid-state devices, and antenna systems. The program consists of efforts to develop advanced concepts, techniques, and communications systems components which will enable growth in the utilization of the radio frequency spectrum to frequencies well beyond 100GHz.

The Lewis program in space materials and structures research and technology emphasizes the development of improved materials, advanced structural analysis and life prediction for advanced space power generation, propulsion and communications systems.

	Permanent Civil Service Workyears
SPACE FLIGHT. CONTROL AND DATA COMMUNICATIONS	
SPACE TRANSPORTATION OPERATIONS	50

This program is responsible for the delivery to specified orbit of all spacecraft launched by the Atlas/Centaur vehicle. The program includes the procurement of vehicle systems hardward, launch services, and engineering and management support, as well as development, maintenance and operation of ground support equipment. In 1986 civil service personnel working in the Atlas/Centaur launch vehicle program will support one FLTSATCOM program launches. Following the final FLTSATCOM launch in the third quarter of 1987, an orderly phaseout of the Atlas/Centaur project will be initiated.

CENTER MANAGEMENT AND OPERATIONS SUPPORT	527

Center Management and Operations Support is defined as support or services being provided to all Lewis organizations which cannot be directly identified to a benefiting program or project. The Civil Service personnel involved are:

Director and Staff - The Center Director, Deputy Director, and immediate staff, e.g., Technology Utilization, Equal Opportunity, Public Affairs, and Commercial Use of Space.

Management Support - Those who provide information and control services supporting all levels of Center program and functional management. Specific functions include resources planning and management, legal and patent counsel, contracting and procurement, personnel management, property management, financial management, and management information systems and analysis.

Operations Support - Those who provide for the operation and maintenance of institutional facilities, buildings, systems, and equipment, including those who manage or provide technical services such as general automatic data processing, reliability and quality assurance, medical care, and graphics support.

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	**110,068**	**112,741**	**111,482**	**112,842**
Summarv of Fund Reauirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	93,995	95,267	95,935	97,152
b. Other than full-time permanent	1,238	2,370	785	816
c. Overtime and other compensation	1,975	1,988	2,100	2,059
Subtotal, Compensation	97,208	99,625	98,820	100,027
2. Benefits	11,681	12,111	11,398	11,233
Subtotal, Compensation and Benefits	108,889	111,736	110.218	111,260
B. Supporting Costs				
1. Transfer of personnel	45	75	15	15
2. Personnel training	1,134	930	1,249	1,567
Subtotal, Supporting Costs	1,179	1,005	1,264	1,582
Total, Personnel and Related Costs	110,068	112,741	111,482	112,842

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. Compensation and Benefits.....	108,889	111,736	110,218	111,260
1. Compensation	97,208	99,625	98,820	100.027
a. Full-time permanent	93,995	95,267	95,935	97,152

The increase from the 1986 budget estimate to the 1986 current estimate reflects the current distribution between permanent and other FTEs.

Basis of Cost for Civil Service Workyears

In 1987, the cost of permanent workyears will be $97,152,000. The increase from the 1986 level results from the following:

Cost of full-time permanent workyears in 1986.....		95,935
Cost of increases in 1987.....		2,305
Within grade and career development advances:		
Full year effect of 1986 actions.....	1,020	
Partial year effect of 1987 actions.....	1,088	
Effect of 1986 decrease in offsetting reimbursements.....		197
Cost of decreases in 1987.....		-1,088
Turnover saving:		
Full year effect of 1986 actions.....	-961	
Partial year effect of 1967 actions.....	-127	
Cost of full-time permanent workyears in 1987.....		97,152

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent				
1. cost	1,238	2,370	785	816
2. Workyears	85	123	49	52

The distribution of 1987 workyears is as follows:

Distribution of Other Than Full-Time Permanent Workvears

Program	Workyears
Development programs	16
Youth opportunity programs	13
Other temporary	23
Total	52

The reduction from the 1986 budget estimate to the 1986 current estimate is due to a realignment between permanent and other FTEs. The increase in 1987 is the full year effect of that planned realignment.

c. Overtime and other compensation	1,975	1,988	2,100	2,059

The increase from the 1986 budget estimate to the 1986 current estimate reflects an overtime plan consistent with the facility use schedule. The decrease in 1987 reflects estimated requirements.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Benefits	11,681	12,111	11,398	11,233
The following are the amounts of contribution by category:				
Civil Service Retirement Fund	6,653	6,660	6,442	6,485
Employee life insurance	215	255	220	212
Employee health insurance	2,856	3,026	2,935	2,883
Workmen's compensation	590	587	587	469
FICA	212	304	100	100
Medicare	1,137	1,259	1,095	1,076
Other benefits	18	20	19	8
Total	11,681	12,111	11,398	11,233

The decrease from the 1986 budget estimate to the 1986 current estimate is primarily due to a decrease in Civil Service retirement, FICA, and medicare. The 1987 budget estimate reflects changes in compensation.

B. Supporting Costs	1,179	1,005	1,264	1,582
1. Transfer of personnel	45	75	15	15

The decrease from the 1986 budget estimate to the 1986 current estimate is primarily due to an anticipated lower number of relocations.

2. Personnel training	1,134	930	1,249	1,567

The purpose of the training program is to provide for the development and education of civil service employees to more efficiently support Lewis roles and missions. The 1986 current estimate increase is a result of Lewis' emphasis on the skills needed to support acquisition of the power system for the Space Station and additional training in the areas of office automation. The 1987 budget estimate increase reflects a continuing growth in these areas at anticipated tuition costs.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
II. TRAVEL	***2,626***	***2,726***	***2,622***	***2,897***
Summary of Fund Requirements				
A. Program Travel	1,722	2,097	1,993	2,239
B. Scientific & Tech. Development Travel	*450*	410	410	428
C. Management & Operations Travel	454	219	219	230
Total, Travel	2,626	2,726	2,622	2,897

Explanation of Fund Requirements

A. Program Travel	1,722	2,097	1,993	2,239

Program travel is directly related to the accomplishment of the Center's mission and accounts for approximately 71% of travel costs. These funds are necessary for the management of major contractual programs in aeronautical research and technology, Space Station, space propulsion, materials research and development and space energy processes and systems technology. Program travel is also essential to the management and procurement of launch vehicles. The decrease from the 1986 budget estimate to the 1986 current estimate reflects a realignment of program requirements. The 1987 estimate reflects essentially the same level of travel at anticipated rates.

E. Scientific & Tech. Development Travel	450	410	410	428

Scientific and technical development travel provides employees the opportunity to participate in meetings and seminars with other representatives of the aerospace community. The benefits derived from exposure to technological advances outside Lewis, as well as to present both accomplishments and problems to their associates is invaluable. Many of the meetings are working panels convened to solve problems for the benefit of the Government. The 1987 estimate provides for continuation of travel at the 1986 current level of support with anticipated rate increases.

	1905 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. Management & Operations Travel.....	454	219	219	**230**

Management and operations travel is required for the direction and coordination of general management matters. It includes travel in such areas as personnel, financial management, procurement, travel of the Center's top management to NASA Headquarters and other NASA Centers, training travel, and local transportation. The 1987 estimate provides for a level number of trips at anticipated rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
III. OPERATION OF INSTALLATION	**24,689**	**29,318**	**28,873**	**34,581**
Summarv of Fund Reauirements				
A. Facilities Services	16,946	22,757	21,507	24,503
B. Technical Services	2,409	2,209	3,014	3,856
C. Management & Operations	5,334	4,352	4.352	6,222
Total, Operation of Installation	24,689	29,318	28,873	34,581

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies and equipment in support of the Center's institutional activities. These are divided into three major functional areas: (1) Facilities Services, the cost of maintaining and repairing institutional facilities and equipment, and the cost of custodial services and utilities; (2) Technical Services, the cost of automatic data processing for management activities and the cost of educational and informational programs and technical shops supporting institutional activities; and (3) Management and Operations, the cost of administrative communications, reproduction, printing, transportation, medical services and supplies.

The decrease from 1986 budget estimate to the 1986 current estimate is due primarily to the delay and deferral of activities and a rephasing of support contractor funding plans. The increase in 1987 includes rate increases for energy, support contracts, and the full year funding of support contracts begun in 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
A. FACILITIES SERVICES.....	16,946	22,757	21,507	24,503
Summary of Fund Requirements				
1. Maintenance & Related Services.....	3,101	4,300	3,145	3,532
2. Custodial Services.....	3,258	4,429	4,258	4,788
3. Utility Services.....	10,587	14,028	14,104	16,183
Total, Facilities Services.....	16,946	22,757	21,507	24,503
Explanation of Fund Requirements				
1. Maintenance and Related Services..	3,101	4,300	3,145	3,532

This activity provides for the operation and maintenance of facilities at the main installation in Cleveland and at the Plum Brook Station. Facilities maintenance includes buildings and ground maintenance and maintenance of heating, ventilating, and air-conditioning systems and equipment. The decrease from the 1986 budget estimate to the 1986 current estimate reflects deferral of planned maintenance increases. The 1987 estimate reflects anticipated service contractor wage rate increases.

2. Custodial Services.....	3,258	4,429	4,258	4,788

Security and janitorial services are provided by support contractors. Other services include rubbish disposal and industrial cleaning of walls and lights on an as needed basis. The decrease from the.1986 budget estimate to the 1986 current estimate is due primarily to lower support service contractor rates than originally anticipated. The increase in the 1987 budget estimate is due to anticipated rate changes in support service contracts and a small increase in workyears.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Utility Services.....	10,587	14,028	14,104	16,183

Electrical power is provided by the local utility company. Natural gas is the primary heating fuel with oil as a backup fuel. A support contractor operates the central heating plant. The increase from the 1986 budget estimate to the 1986 current estimate is due to slightly higher utility rates than originally anticipated. The increase from 1986 to 1987 is attributable to anticipated higher electrical consumption, utility rate increases, and expected growth of support contractor rates.

B. Technical Services.....	2,409	2,209	3,014	3,856

Summary of Fund Requirements

1. Automatic Data Processing	1,710	1,511	2,258	3,085
a. Equipment	936	375	692	1,386
b. Operations	774	1,136	1,566	1,699
2. Scientific and Technical Information	699	698	756	771
Total, Technical Services.....	2,409	2,209	3,014	3,856

Explanation of Fund Requirements

1. Automatic Data Processing	1,710	1,511	2,258	3,085

Funding provides for administrative data processing, including maintenance and periodic replacement of equipment, and operations. The 1986 current estimate reflects increased funding for support service contractors to provide support in business system analysis and design. The increase in 1987 is due to anticipated rate increases and the purchase of an upgraded central processing unit.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Scientific and Technical Information..	699	698	756	771

Included in this activity is the support of the Center's educational programs and public information services. Funding for operation of the Visitor Information Center (VIC), conduct of tours and special events, construction and transport of special exhibits, and related activities are also included. The increase from the 1986 budget estimate to the 1986 current estimate is the result of a revised VIC exhibit upgrading program. The 1987 budget estimate provides for continuation of the 1986 VIC exhibit upgrading program.

C. MANAGEMENT AND OPERATIONS.....	5,334	4,352	4,352	6,222
Summary of Fund Requirements				
1. Administrative Communications.....	639	405	677	599
2. Transportation.....	1,469	1,886	1,795	2,110
3. Installation Common Services.....	3,226	2,061	1,880	3,513
Total, Management and Operations.....	5,334	4,352	4,352	6,222
Explanation of Fund Requirements				
1. Administrative Communications.....	639	405	677	599

This estimate provides local and long distance telephone service and non-telephone communications. Local telephone service includes the leased lines and equipment to serve the Center population. Non-telephone communications include telex, advanced record system teletype, rapidfax, datafax, teleconference equipment, oceanic cable service, and usage charges for airline reservation service. The increase in the 1986 current estimate is based on 1985 experience adjusted for rate increases in local and FTS services. The decrease for 1987 is based on lower costs associated with a new telephone system.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
2. Transportation	1,469	1,866	1,795	2,110

This activity includes the cost of the support contract for bus, mail and package delivery, stock issuance and administrative aircraft maintenance. It also includes moving and hauling services and motor vehicle purchase and maintenance. The decrease from the 1986 budget estimate to the 1986 current estimate reflects deferral in the purchase of motor vehicles. The increase in 1987 is anticipated contractor wage rates, increase in fuel rates, and the purchase of motor vehicles deferred from 1986.

3. Installation Common Services	3,226	2,061	1,880	3,513

This funding provides minor administrative services for Center management and staff at Plum Brook Station. Also, included is the cost of staff medical examinations, clinic support, medical supplies and equipment special x-ray equipment for the in-house occupational health program, and equipment for the physical fitness facility. All of these services are provided by a support contractor. This function also included funding for maintenance and periodic replacement of administrative equipment and supplies, and postage. The decrease from the 1986 budget estimate to the 1986 current estimate is due to a rephasing of the support contractor funding plan. The increase in the 1987 budget estimate reflects a full year funding for support contracts at anticipated rate increases and the adjustment between direct and reimbursable funding.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LEWIS RESEARCH CENTER

ORGANIZATION AND STAFFING CHART

STAFFING SUMMARY

	86	87
SES	30	30
GS/GM-16	1	1
GS/GM-15	132	132
GS/GM-14	287	287
OTHER GS/GM	1618	1629
WAGE GRADE	601	580
TOTAL	2669	2660

DIRECTOR AND STAFF

	86	87
SES	4	4
GS/GM-16	1	1
GS/GM-15	10	10
GS/GM-14	11	11
OTHER GS/GM	40	40
WAGE GRADE	0	0
TOTAL	66	66

AERONAUTICS DIRECTORATE

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	2	2
WAGE GRADE	0	0
TOTAL	5	5

ADVANCED PLANNING & ANALYSIS OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	7	7
OTHER GS/GM	15	15
WAGE GRADE	0	0
TOTAL	25	25

INSTRUMENTATION AND CONTROL TECHNOLOGY OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	14	14
OTHER GS/GM	25	25
WAGE GRADE	0	0
TOTAL	43	43

INTERNAL FLUID MECHANICS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	8	8
GS/GM-14	11	11
OTHER GS/GM	50	50
WAGE GRADE	0	0
TOTAL	70	70

PROPULSION SYSTEMS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	12	12
GS/GM-14	28	28
OTHER GS/GM	80	80
WAGE GRADE	0	0
TOTAL	121	121

AEROPROPULSION FACILITIES AND EXPERIMENTS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	16	16
OTHER GS/GM	68	68
WAGE GRADE	0	0
TOTAL	89	89

AEROSPACE TECHNOLOGY DIRECTORATE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	1	1
WAGE GRADE	0	0
TOTAL	3	3

MATERIALS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	11	11
GS/GM-14	16	16
OTHER GS/GM	77	77
WAGE GRADE	0	0
TOTAL	105	105

STRUCTURES DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	10	10
GS/GM-14	15	15
OTHER GS/GM	56	56
WAGE GRADE	0	0
TOTAL	82	82

TECHNOLOGY DIVISION

	86	87
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	18	18
OTHER GS/GM	57	57
WAGE GRADE	0	0
TOTAL	78	78

POWER TECHNOLOGY DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	8	8
GS/GM-14	24	24
OTHER GS/GM	75	75
WAGE GRADE	0	0
TOTAL	108	108

SPACE EXPERIMENTS OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	8	8
OTHER GS/GM	39	39
WAGE GRADE	0	0
TOTAL	51	51

SPACE FLIGHT SYSTEMS DIRECTORATE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	0	0
OTHER GS/GM	1	1
WAGE GRADE	0	0
TOTAL	2	2

ACTS PROJECT OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	4	4
OTHER GS/GM	30	30
WAGE GRADE	0	0
TOTAL	39	39

SPACE COMMUNICATIONS DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	6	6
GS/GM-14	11	11
OTHER GS/GM	53	53
WAGE GRADE	0	0
TOTAL	71	71

SPACE TRANSPORTATION ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	19	19
OTHER GS/GM	84	84
WAGE GRADE	0	0
TOTAL	109	109

SHUTTLE/CENTAUR PROJECT OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	3	3
GS/GM-14	7	7
OTHER GS/GM	17	17
WAGE GRADE	0	0
TOTAL	28	28

ATLAS/CENTAUR PROJECT OFFICE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	4	4
WAGE GRADE	0	0
TOTAL	6	6

RELIABILITY AND QUALITY ASSURANCE OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	8	8
OTHER GS/GM	21	21
WAGE GRADE	0	0
TOTAL	30	30

SPACE STATION SYSTEMS DIRECTORATE

	86	87
SES	2	2
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	1	1
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	8	8

POWER SYSTEM CONTRACTS OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	2	2
OTHER GS/GM	1	1
WAGE GRADE	0	0
TOTAL	5	5

POWER SYSTEM ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	12	12
OTHER GS/GM	96	107
WAGE GRADE	0	0
TOTAL	114	125

ADVANCED PROGRAMS AND PLANNING OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	2	2
OTHER GS/GM	30	30
WAGE GRADE	0	0
TOTAL	36	36

POWER SYSTEMS INTEGRATION OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	4	4
OTHER GS/GM	5	5
WAGE GRADE	0	0
TOTAL	9	9

ENGINEERING AND TECHNICAL SERVICES DIRECTORATE

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	0	0
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	4	4

TEST INSTALLATIONS DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	6	6
WAGE GRADE	375	375
TOTAL	382	382

FACILITIES OPERATIONS AND MAINTENANCE DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	47	47
WAGE GRADE	108	108
TOTAL	156	156

FABRICATION SUPPORT DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	23	23
WAGE GRADE	103	103
TOTAL	127	127

ENGINEERING DESIGN DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	5	5
GS/GM-14	8	8
OTHER GS/GM	71	71
WAGE GRADE	0	0
TOTAL	85	85

FACILITIES ENGINEERING DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	11	11
OTHER GS/GM	74	74
WAGE GRADE	0	0
TOTAL	90	90

ADMINISTRATION AND COMPUTER SERVICES DIR.

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	5	5

PERSONNEL DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	41	41
WAGE GRADE	0	0
TOTAL	44	44

COMPUTER SERVICES DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	4	4
GS/GM-14	12	12
OTHER GS/GM	112	112
WAGE GRADE	0	0
TOTAL	129	129

HEALTH, SAFETY AND SECURITY DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	2	2
GS/GM-14	2	2
OTHER GS/GM	56	56
WAGE GRADE	0	0
TOTAL	60	60

LOGISTICS MANAGEMENT DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	43	43
WAGE GRADE	0	0
TOTAL	44	44

TECHNICAL INFORMATION SERVICES DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	1	1
OTHER GS/GM	39	39
WAGE GRADE	6	6
TOTAL	46	46

OFFICE OF THE COMPTROLLER

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	0	0
GS/GM-14	0	0
OTHER GS/GM	4	4
WAGE GRADE	0	0
TOTAL	5	5

PROGRAM COORDINATION OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	3	3
WAGE GRADE	0	0
TOTAL	6	6

RESOURCES ANALYSIS AND MANAGEMENT OFFICE

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	4	4
OTHER GS/GM	21	21
WAGE GRADE	0	0
TOTAL	26	26

FINANCIAL MANAGEMENT DIVISION

	86	87
SES	0	0
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	0	0
OTHER GS/GM	44	44
WAGE GRADE	0	0
TOTAL	45	45

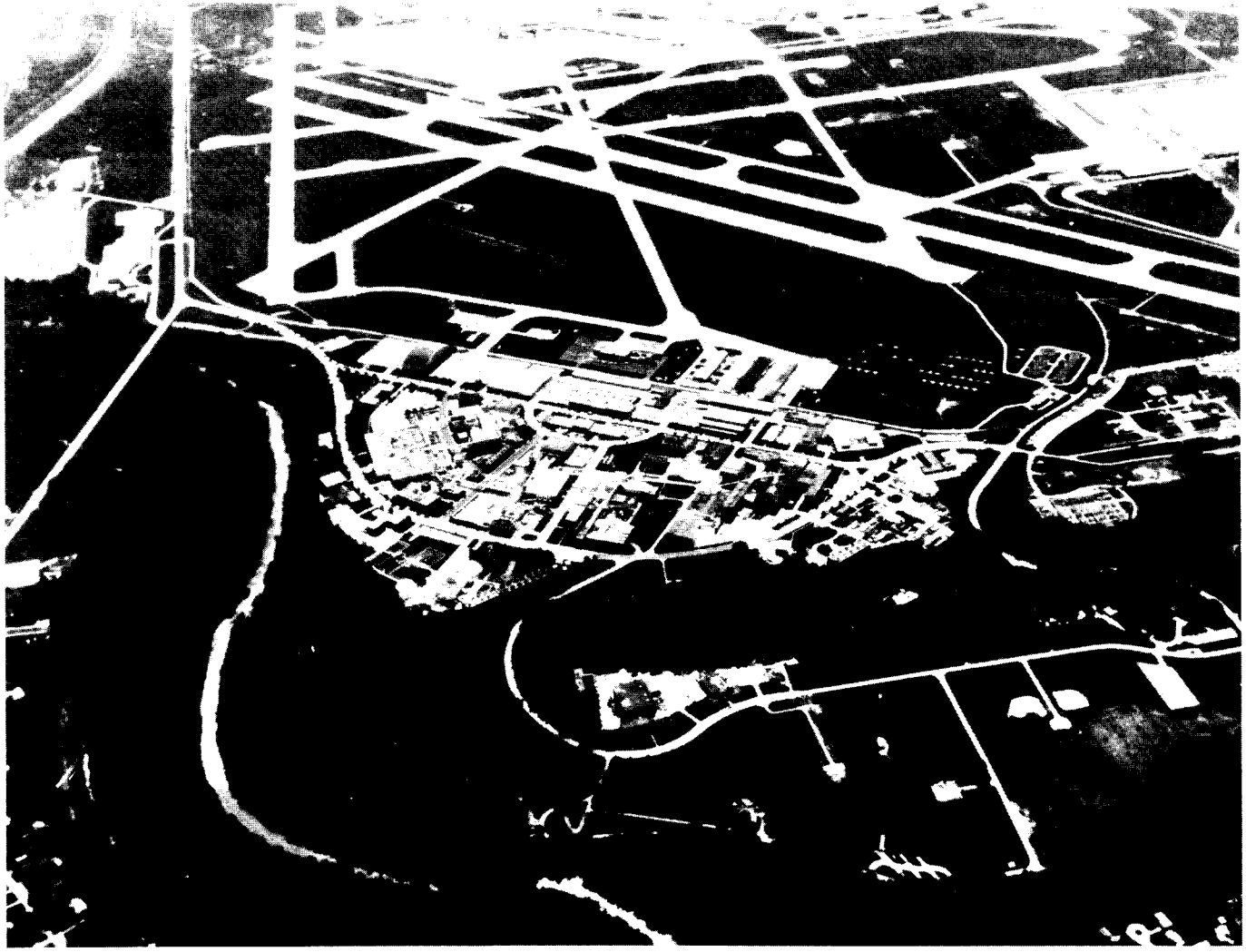
PROCUREMENT DIVISION

	86	87
SES	1	1
GS/GM-16	0	0
GS/GM-15	1	1
GS/GM-14	2	2
OTHER GS/GM	96	96
WAGE GRADE	0	0
TOTAL	100	100

LEWIS RESEARCH CENTER

FISCAL YEAR 1987 ESTIMATES

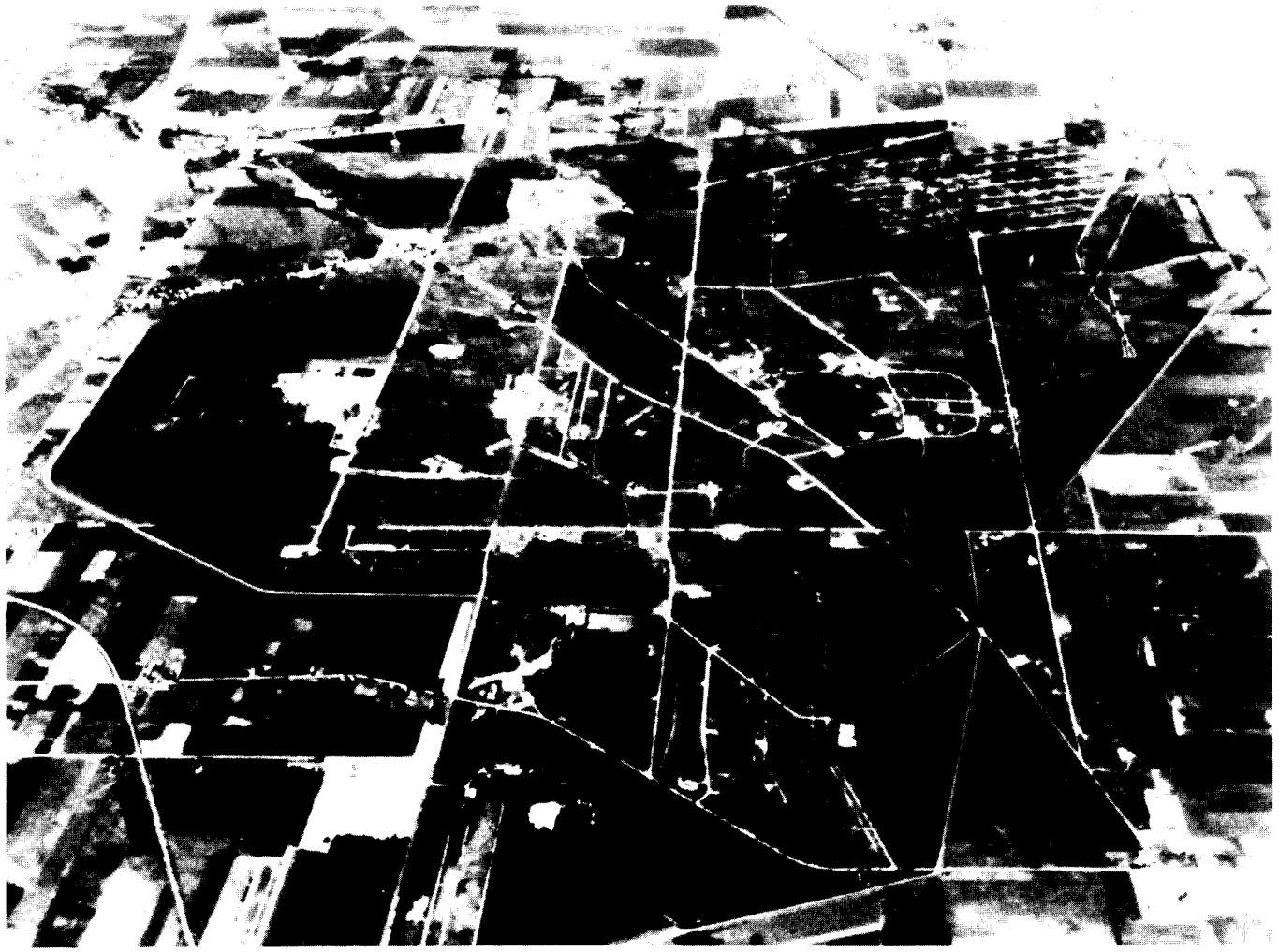
CLEVELAND FACILITIES



LEWIS RESEARCH CENTER

FISCAL YEAR 1987 ESTIMATES

PLUM BROOK **FACILITIES**



NASA
HEADQUARTERS

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIHATES

NASA HEADQUARTERS

DESCRIPTION

NASA Headquarters is located at 400 Maryland Avenue, SW, Washington, D.C., and occupies other buildings in the District of Columbia and Maryland.

HEADQUARTERS ROLES AND MISSIONS

The mission of Headquarters is to plan and provide executive guidelines for the implementation of national space and aeronautics programs consistent with the objectives stated in the National Aeronautics and Space Act of 1958, as amended. These objectives are to:

--Extend our knowledge of the Earth, its environment, the solar system, and the universe;

--Expand practical applications of space technology;

--Develop, operate, and improve manned and unmanned space vehicles;

--Improve the civil and military usefulness of aeronautical vehicles, while minimizing their environmental effects and energy consumption;

--Disseminate pertinent findings to potential users; and

--Promote international cooperation in peaceful activities in space.

The following offices at Headquarters assist management in carrying out the technical aspects of the mission:

Office of Space Flight - Plans, directs, executes, and evaluates the research, development, acquisition and operation of space flight programs. Included in these programs is the Space Shuttle, an essential element of the Space Transportation System (STS). Also included in the STS are the orbiters, engines, external tanks, solid rocket boosters, upper stages and ground and flight systems. This office develops and implements policy for all system users to interface with STS. Responsibilities also include development and implementation of appropriate transition policies for expendable launch vehicles to be transferred from the

Government to the private sector. The Office of Space Flight promotes improvements in effectiveness, cost efficiency and timeliness of STS operational performance. This office also maintains relationships with industry, international organizations, foreign entities, universities, the scientific community, and other Government agencies with respect to the space flight program, including the Spacelab program, in coordination with the Office of External Relations.

Office of Space Station - Responsible for establishing program policy, budget schedule guidelines, and for coordinating and interfacing with external organizations. This office is also responsible for providing program direction and management, program requirements definition and control, utilization and operations planning, programmatic planning and implementation, and advanced technology development program coordination.

Office of Space Science and Applications - Responsible for research and development efforts utilizing a variety of flight system and ground-based observations to increase man's knowledge of the universe. The Earth, Sun, Moon, the planets, interplanetary space, other stars and galaxies, and the interaction among those bodies and systems are all objects of these investigations, as well as assuring medical safety and understanding the basic mechanisms of biological processes using the unique capabilities of the space program. Responsibilities also include conducting research and development activities leading to demonstration and transfer of space-related technology and capabilities which can be effectively applied and used for practical benefits on Earth. These research and development activities involve the following program areas: earth observations, environmental observations, communications, material processing in space, and information systems.

Office of Aeronautics and Space Technology - Plans, directs, executes, and evaluates the aeronautical and space research and technology programs as well as the transatmospheric research and technology program. The aeronautics program develops technology culminating in safer, more efficient, economical and environmentally acceptable air transportation systems which are responsive to national needs. The space research and technology program provides a technology base which anticipates the technical needs and provides technology options for future space activities. NASA's portion of a joint NASA/DOD program for transatmospheric research and technology will accelerate the development and validation of key technologies to form the critical data base required for the design and integration of complex propulsion and structural systems for transatmospheric vehicles. This office coordinates the total NASA program of supporting research and technology related to specific programs and projects to insure a comprehensive, properly balanced agency research and technology program.

Office of Space Tracking and Data Systems - Develops, implements, and operates tracking, data acquisition, command, communications, and data processing facilities, systems and services required for support of all NASA flight missions. This office also provides centralized planning and systems management for administrative communications between NASA installations.

Office of Commercial Programs - Provides a focus within NASA for an agencywide program supporting the expansion of U.S. private sector investment and involvement in civil space activities, for space commercial user development, for actively supporting new high technology commercial space ventures and for the commercial application of existing aeronautics and space technology.

The NASA Headquarters' administrative and staff offices' responsibilities include: planning, formulating, and advocating executive direction for national programs to implement the objectives stated in the National Aeronautics and Space Act of 1958, as amended; and administering and providing operational and logistical support to those Headquarters elements concerned with carrying out the mission of NASA.

The Headquarters workforce consists of professional and clerical staff organized into the above specified program offices and appropriate supporting staff offices. Each office is assigned a function consistent with NASA the mission. The number of personnel authorized to an office is determined by management based on the approved personnel ceiling for the Agency and the functions to be performed. The composition of the staff of an office is determined by the head of the office based on the office ceiling and the function to be performed. All personnel are appointed and paid consistent with classification standards established by the Office of Personnel Management. Overall Agency direction is provided by the Administrator, and his personal office staff. The Agency currently has eight installations, and the Jet Propulsion Laboratory, throughout the United States which perform Agency operational missions under direction of the Headquarters staff.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

		1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)			
I.	Personnel and Related Cost.. ..	72,774	74,609	73,519	73,701
II.	Travel.....	4,623	5,000	5,187	5,355
III.	Operation of Installation.....	39,469	40,411	40,460	48,840
	A. Facilities Services..	(10,815)	(10,027)	(10,975)	(13,691)
	B. Technical Services..	(17,504)	(17,887)	(16,962)	(21,426)
	C. Management and Operations..	(11,150)	(12,497)	(12,523)	(13,723)
	Total, fund requirement.	116,866	120,020	119,166	127,896

Distribution of Permanent Workyears by Program

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
RESEARCH AND DEVELOPMENT	387	417	409	409
Space Station	53	72	68	68
Space Transportation Capability Development	24	24	22	22
Space Science and Applications	181	175	178	178
Physics and astronomy	52	50	50	50
Life sciences	24	24	25	25
Planetary exploration	24	24	25	25
Space applications	81	77	78	78
Commercial Programs	22	36	38	38
Technology Utilization	5	12	10	10
Commercial Use of Space	17	24	28	28
Aeronautics and Space Technology	104	107	100	100
Aeronautical research and technology	62	64	60	58
Space research and technology	42	43	40	40
Transatmospheric research and technology	---	---	---	2
Tracking and Data Advanced Systems	3	3	3	3
SPACE FLIGHT CONTROL AND DATA COMMUNICATIONS	181	181	169	169
Shuttle Production and Operational Capability	20	20	19	19
Space Transportation Operations	114	112	105	105
Space and Ground Network Communications and Data Systems	47	49	45	45
Subtotal, direct workyears	568	598	578	578
CENTER MANAGEMENT AND OPERATIONS SUPPORT	699	694	664	664
Total, full-time permanent workyears	1,267	1,292	1,242	1,242
Other than full-time permanent workyears	118	125	115	115
Total, Workyears	1,385	1,417	1,357	1,357

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
I. PERSONNEL AND RELATED COSTS	72,774	74,609	73,519	73,701
Summary of fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	57,275	60,164	57,292	57,454
b. Other than full-time permanent	2,925	2,416	3,021	2,809
c. Reimbursable detailees	604	461	520	724
d. Overtime and other compensation	1,794	1,622	1,839	1,875
Subtotal, Compensation	62,598	64,663	62,672	62,862
2. Benefits	6,874	6,994	7,304	7,044
Subtotal, Compensation & Benefits	69,472	71,657	69,976	69,906
B. Supporting Costs				
1. Transfer of personnel	355	165	358	365
2. Office of Personnel Management Services	708	844	880	881
3. Personnel training	2,239	1,943	2,305	2,549
Subtotal, Supporting Costs	3,302	2,952	3,543	3,795
Total, Personnel and Related Costs	72,774	74,609	73,519	73,701

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
A. Compensation and Benefits	69,472	71,657	69,976	69,906
1. Compensation	62,598	64.663	62,672	62,862
a. Full-time permanent	57,275	60,164	57,292	57,454

The decrease in the compensation estimate from the 1966 budget estimate to the 1986 current estimate is due to a decrease in the FTE allocation.

Basis of Cost for Permanent Positions

In 1987 the cost of permanent workyears will be $57,454,000. The increase from 1986 results from the following:

Cost of full-time permanent workyears in 1986		57,292
Cost increases in 1987		1,206
Within grade and career advances:		
Full year effect of 1986 actions	441	
Partial year effect of 1987 actions	765	
Cost decreases in 1987		-1,044
Turnover savings and abolished positions:		
Full year effect of 1986 actions	-823	
Partial year effect of 1987 actions	-221	
Cost of full-time permanent workyears in 1987		57,454

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
b. Other than full-time permanent				
(1) cost	2,925	2,416	3,021	2,809
(2) Workyears	141	147	137	137

The distribution of 1987 workyears is as follows:

Distribution of Other Than Full-Time Permanent Workyears

Program	Workyears
Development programs	30
Summer employment programs	7
Youth opportunity programs	22
Other temporary	78
Total	137

The increase from the 1986 budget estimate to the 1986 current estimate reflects an increase in developmental programs, such as Presidential Management Internships, which are higher graded than cooperative education and temporary employment programs. The 1987 estimate is essentially level with 1986 except for adjustments to the mix between the various programs.

c. Reimbursable detailees	604	461	520	724

The services of a small group of military officers and civilian detailees from other government agencies are used by NASA Headquarters where such assignments are of mutual benefit. The increase from the 1986 budget estimate to the 1986 current estimate is due to adjustments for 1985 actual experience. The increase from the 1986 current estimate to the 1987 budget estimate results from the inclusion of military retirement in the detailee cost formula.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
d. Overtime and other compensation	1,794	1,622	1,839	1,875

The increase from the 1986 budget estimate to the 1986 current estimate reflects 1985 experience. The increase from the 1986 current estimate to the 1987 budget estimate is due to rate increases for relatively the same level of effort as 1986.

2. Benefits	6,874	6,994	7,304	7,044

The following are the amounts of contribution by category:

Civil Service Retirement Fund	4,032	4,253	4,066	4,091
Employee life insurance	194	151	142	143
Employee health insurance	1,251	1,291	1,258	1,266
Workmen's compensation	436	412	825	531
FICA	170	119	206	197
Medicare	596	611	645	654
Other benefits	195	157	162	162
Total	6,874	6,994	7,304	7,044

The increases in the 1986 current estimate from the 1986 budget estimate is primarily due to updated pricing of workman's compensation and adjustments for the effects of changes in Civil Service retirement estimate. The 1987 budget estimate reflects an expected decrease in workmen's compensation.

B. Supporting Costs	3,302	2,952	3,543	3,795
1. Transfer of personnel	355	165	358	365

The costs associated with transfer of personnel include movement of household goods, subsistence and temporary expenses, real estate and miscellaneous moving expenses related to change of duty station. The increase from the 1986 budget estimate to the 1986 current estimate reflects an increased number of expected relocations. The 1987 budget estimate reflects essentially the same number of relocations as in 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
2. Office of Personnel Management services..	708	844	880	881

Headquarters reimburses the Office of Personnel Management (OPM) for investigation of new hires for the entire Agency. The cost of investigations is a function of two variables, the number of investigations to be conducted, and the unit charge made by the Office of Personnel Management to other agencies. Also included is a payment to OPM for Federal wage system surveys. The increases are driven by new OPM guidelines calling for background investigations on a greater number of employees.

3. Personnel training.	2,239	1,943	2,305	2,549

The maintenance and expansion of skills is essential in carrying out the Agency's many complex technical programs. Part of the training consists of courses offered by other Government agencies, usually for a fee. The remainder of the training is provided through nongovernment sources. The costs are for tuition, fees and related costs for training at colleges, universities, technical institutions, and for the cost of seminars and workshops in which groups of Headquarters and Field Center employees receive training in subjects of Agencywide interest. The increase from the 1986 budget to the 1986 current estimate reflects increased emphasis on supervisory and management effectiveness and ADP proficiency training. The 1987 budget estimate provides for the same level of training at anticipated cost levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
II. TRAVEL	4,623	5,000	5,187	5,355
Summary of Fund Requirements				
A. Program Travel	3,065	3,371	3,563	3,679
B. Scientific and Technical Development Travel	573	676	674	696
C. Management and Operations Travel	985	953	950	980
Total, Travel	4,623	5,000	5,187	5,355
Explanation of Fund Requirements				
A. Program Travel	3,065	3,371	3,563	3,679

Program travel funds are used in support of NASA's research and development programs, such as the Space Station, the Space Transportation System, Aeronautics and Space Technology, Space Science and Applications, and other. direct research and development programs. This category represents approximately 66 percent of the Headquarters travel requirements for 1986. The increase from the 1986 budget estimate to the 1986 current estimate reflects the need for increased program travel to accomplish the agency's missions. The 1987 budget estimate provides for the same level of program travel as 1986 with adjustments for increases in travel expenses.

B. Scientific and Technical Development Travel	573	676	674	696

Scientific and technical development travel permits employees to participate in meetings and seminars with other representatives of the aerospace community. This participation allows personnel to benefit from exposure to technological advances in the field which arise outside NASA, as well as to present both accomplishments and problems to their associates. Many of these meetings are working panels covened to solve certain problems for the benefit of the Government. The increase in the 1987 budget estimate from the 1986 current estimate is due to projected increases in travel expenses for the same level of travel.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
C. Management and Operations Travel.....	985	953	950	980

Management and operations travel is for the direction and coordination of general management matters, travel by senior officials to review Center requirements and operations and career development travel in order to broaden the experience of NASA employees. Management and operations travel includes travel by functional managers in such areas as personnel, financial management, and procurement to assure Agency policies and procedures are being implemented throughout the agency. Also included is local transportation and congressional travel. The increase in the *1987* budget estimate from the *1986* current estimate is due to projected increases in travel expenses for the same level of travel.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
111. OPERATION OF INSTALLATION.....	39,469	40,411	40,460	48,840
Summary of Fund Requirements				
A. Facilities Services.....	10,815	10,027	10,975	13,691
B. Technical Services.....	17,504	17,887	16,962	21,426
C. Management and Operations.....	11,150	12,497	12,523	13,723
Total, Operation of Installation.....	39,469	40,411	40,460	48,840

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Headquarters' institutional activities. These are divided into three major functional areas: Facilities Services, rental of real property, acquisition, maintenance and repair of institutional facilities and equipment, and the cost of custodial services; Technical Services including the, cost of automatic data processing for management activities, and the cost of educational and informational programs and technical shops supporting institutional activities; and Management and Operations, the cost of administrative communications, printing, transportation, medical supplies, and related services.

The increase from the 1986 budget estimate to the 1986 current estimate is primarily due to increases in facility rentals and maintenance costs, offsetting a decrease in support contracts due to a rephasing of obligation plans. The 1987 budget estimate is considerably higher due to a significant increase in facility rental costs, the replacement of a critically needed administrative main-frame computer and full year funding for support service contracts.

A. FACILITIES SERVICES.....	10,815	10,027	10,975	13,691

NASA Headquarters is comprised of a complex of buildings in the District of Columbia and Maryland. These are government-owned and leased buildings for which NASA must provide reimbursement to the General Services Administration (GSA) in accordance with P.L. 92-313. The cost of temporary use of off-site facilities is also included in this category.

Summary of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
1. Rental of Real Property	8,117	8,074	8,148	10,648
2. Maintenance and Related Services	2,096	1,192	2,073	2,266
a. Facilities	2,096	1,192	2,073	2,266
b. Equipment	---	---	---	---
3. Custodial Services	602	761	754	777
Total, Facilities Services	10,815	10,027	10,975	13,691

Explanation of Fund Reauirements

1. Rental of Real Property	8,117	8,074	8,148	10,648

Public Law 92-313 requires that agencies be charged for space and related services provided by the General Services Administration at approximate commercial equivalent rates. These funds provide for the cost of office space used by NASA Headquarters personnel. The increase from the 1986 budget estimate to the 1986 current estimate is due to a delay in planned reduction of NASA Headquarters office space. The increase from the 1986 current estimate to the 1987 budget estimate is due *to* an increase in rental rates as projected by GSA.

2. Maintenance and Related Services	2,096	1,192	2,073	2,266

This estimate includes maintenance, repair and alterations of buildings such as partition changes, auxilliary air conditioning systems for ADP equipment, telephone changes and general buildings maintenance. The ihcrease in 1986 from the budget estimate reflects a recategorization of support contract costs related to facilities maintenance to more accurately reflect the actual cost of Headquarters facilities. The increase to the 1987 budget estimate provides for essentially the 1986 level *of* service.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Custodial Services.....	602	761	754	777

These funds cover security guard services in the various Headquarters buildings. They also include reimbursement to GSA for the installation and maintenance of security alarm systems and equipment in the NASA Headquarters buildings. The 1986 current estimate reflects increased rates as projected by GSA and additional security in order to furnish adequate protection for classified defense information, government/personal property, and NASA employees. The 1987 budget estimate reflects GSA projected rates for essentially the same level of support as 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
B. TECHNICAL SERVICES	17,504	17,887	16,962	21,426
Summary of Fund Requirements				
1. Automation Data Processing	13,386	13,642	12,690	17,145
a. Equipment	2,845	2,902	1,562	7,016
b. Operations	10,541	10,740	11,128	10,129
2. Scientific and Technical Information	3,066	3,188	3,334	3,306
a. Library	441	418	488	508
b. Education and Information	2,625	2,770	2,846	2,798
3. Shop and Support Services	1,052	1,057	938	975
Total, Technical Services	17,504	17,887	16,962	21,426

Explanation of Fund Requirements

1. Automatic Data Processing	13,386	13,642	12,690	17,145

This estimate provides for the lease, purchase, maintenance, programming and operations services of automatic data processing (ADP) equipment. The small decrease from the 1986 budget estimate to the 1986 current estimate reflects increasing contractor wage rates offset by the effects of one time expenditures for ADP equipment in 1985. The 1987 estimate provides for approximately the same level of services as in 1986 plus the critically needed replacement of the Headquarters administrative computer, a 1972 model IBM 370.

2. Scientific and Technical Information	3,066	3,188	3,334	3,306

The activities contained in this subfunction are educational-informational programs and the NASA Headquarters technical library.

The education and information programs provide for gathering and disseminating information about the Agency's programs to the mass communications media, the general public, and to the educational community at the elementary and secondary levels. Assistance to the mass communications media includes the gathering and exposition of newsworthy material in support of their requests, and takes such forms as press kits, news releases, television and radio information tapes and clips, and feature material. Research, development, and operational missions in aeronautics and space provide substantive knowledge and serve as an educational stimulus to students and teachers. NASA responds to expressed needs of students by developing curriculum supplements in space-related areas such as physics, biology, chemistry, and math; assistance to over 1,000 teacher workshops and professional education meetings; and participation in science fairs. This program also provides for equal employment opportunity exhibits and films to relate to high schools, colleges and the public, and the key roles that women and minorities have in the United States space program.

The increase in the 1986 current estimate over the 1986 budget estimate, and the subsequent decrease in the 1987 budget estimate reflect the one-year need for instructional materials and other efforts related to the flight of a school teacher on the Space Shuttle during 1986.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
3. Shop and Support Services.....	1,052	1,057	938	975

These funds provide for the continuation of studies on parts applications, NASA-wide safety, reliability, quality assurance standards, graphic and photo processing services. The decrease in the 1986 current estimate from the 1986 budget estimate reflects a realignment of funding for productivity-related efforts. The 1987 estimate provides a continuation of essentially the same level of service provided in 1986 at anticipated rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
C. MANAGEMENT AND OPERATIONS	11,150	12,497	12,523	13,723
Summary of Fund Requirements				
1. Administrative Communications	2,799	3,584	3,183	3,257
2. Printing and Reproduction	1,266	1,352	1,307	1,339
3. Transportation	472	584	610	673
4. Installation Common Services	6,613	6,977	7,423	8,454
Total, Management and Operations	11,150	12,497	12,523	13,723

Explanation of Fund Requirements

1. Administrative Comunications	2,799	3,584	3,183	3,257

Included in this category are the costs of leased lines, long distance tolls, telephone exchange services, and other communications. The decrease in the 1986 current estimate from the 1986 budget estimate is projected from communication rates based on 1985 experience. The 1987 budget estimate reflects essentially the same effort as 1986 with adjustments for projected rate increases.

2. Printing and Reproduction	1,266	1,352	1,307	1,339

Administrative printing includes funds for contractual printing and the related composition and binding operations. This includes services performed by other agencies, chiefly the Government Printing Office, or by commercial printing firms. All common processes of duplicating including photostating, blueprinting, microfilming, and other reproductions are included. The decrease from the 1986 budget estimate to the 198k current estimate reflects a reduction in the level of printing activity and 1985 experience. The 1987 budget estimate reflects essentially the same effort as 1986 at expected 1987 rates.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
3. Transportation	472	584	610	673

Transportation services include rental of trucks, as well as the movement of supplies, materials, equipment and related items. Also included is the cost of operating and maintaining the administrative aircraft which is assigned to the Jet Propulsion Laboratory. The increase from the 1986 budget estimate to the current estimate reflects revised pricing expectations for essentially the same level of service. The increase in 1987 is based on 1986 levels at expected 1987 rates.

4. Installation Common Services	6,613	6,977	7,423	8,454

This function provides for those services which support the Headquarters, such as: patent services, maintenance and repair of office equipment and vehicles; minor Government services; contract histories; trucking and labor services; medical services; contractor incentive awards; Equal Opportunity community relations and fellowships; Administrator's representation allowance; overseas administration support and documentation; and adminstrative supplies, materials and equipment. The increase from the 1986 budget estimate to the current estimate is due to support provided to the National Commission on Space. The increase in 1987 is based on an increased level of contractor support in such areas as logistics and equipment management.

ORGANIZATION AND STAFFING
NASA HEADQUARTERS

HEADOUARTERS

SUMMARY STAFFING

	FY 86	FY 87
EXC. ■SES	225	225
WIGS 17	I	1
GM/GS 16	287	287
GM/GS 14	181	181
ALL OTHER GM/GS	568	568
WAGE BOARD	8	8
TOTAL PERU	1260	1250

ADMINISTRATOR

	FY 86	FY 87
EXC. ■SES	12	12
GM/GS 15	--	--
GM/GS 14	--	--
ALL OTHER GM/GS	12	12
WAQE BOARD		
TOTAL PERU	24	24

CHIEF SCIENTIST

	FY 86	FY 87
EXC. ■SES	3	3
GM/GS 16	--	--
GM/GS I4	--	--
ALL OTHER GM/GS	-I	-1
UAQE BOARD		
TOTAL PERU	4	4

CHIEF ENQINEER

	FY 86	FY 87
EXC. & SES	5	5
GM/GS 15	14	14
GM/GS I4	4	4
ALL OTHER GM/GS	4	4
UAQE BOARD	--	--
TOTAL PERU	27	21

WALL ■DISADVANTAGED BUSINESS UTILIZATION

GM/GS I4		
ALL OTHER GM/GS	--	--
WAQE BOARD		
TOTAL PERU	2	2

STAFF ADVISORY
AEROSPACE
SAFETY AOVISORY PANEL
PUBLIC AFFAIRS
INTERNATIONAL AFFAIRS

COMPTROLLER

	FY 86	FY 87
EXC. ■SES	8	8
GM/GS 16	'14	I4
GM/GS 14	16	16
ALL OTHER GM/GS	71	71
W A N BOARD		--
TOTAL PERM	109	109

QENERAL COUNSEL

	FY 86	FY 87
EXC. ■SES	7	7
GM/GS 15	I3	13
GM/GS I4	2	2
ALL OTHER GM/GS	14	14
WAGE BOARD		--
TOTAL PERU	36	36

COMMERCIAL PROGRAMS

	FY 66	FY 87
EXC. ■SES	10	10
WIGS 16	6	6
GM/GS 14	6	5
ALL OTHER (WIGS	18	18
WAQE BOARD		--
TOTAL PERU	39	39

EXTERNAL RELATIONS

	FY 86	FY 87
EXC. ■SES	23	23
GM/GS 16	18	18
GM/GS I4	19	19
ALL OTHER GM/GS	40	40
WAGE BOARD	--	
TOTAL PEW	100	100

MANAGEMENT

	FY 66	FY 87
EXC. ■SES	16	16
GM/GS I7	1	1
GM/GS 16	35	35
GM/GS 14	32	32
ALL OTHER GM/GS	142	142
WAGE BOARD	6	6
TOTAL PERY	232	232

EQUAL OPPORTUNITY

	FY 86	FY 87
EXC. & SES	4	4
GM/GS 15	2	2
GM/GS 14	2	2
ALL OTHER GM/GS	13	13
WAGE BOARD	--	--
TOTAL PERM	21	21

PROCUREMENT

	FY 86	FY 87
EXC. & SES	12	12
GM/GS 15	14	14
GM/GS 14	15	15
ALL OTHER GM/GS	38	38
WAGE BOARD	--	--
TOTAL PERM	79	79

LEGISLATIVE AFFAIRS

	FY 86	FV 87
EXC. ■SES	3	3
(WIGS 16	5	5
GM/GS 14	2	2
ALL OTHER GM/GS	11	11
WAQE BOARD	1	1
TOTAL PEW	22	22

AND APPLICATIONS

	FY 86	FY 87
EXC. ■SES	37	37
GM/GS 16	69	69
GM/GS I4	18	18
ALL OTHER GM/GS	(I	67
WAGE BOARD	1	1
TOTAL PERU	182	182

SPACE TECHNOLOGY

	FY 86	FY 87
EXC. ■SES	27	21
GWGS 15	34	34
GM/GS 14	6	6
ALL OTHER GM/GS	35	36
WAQE BOARD	--	--
TOTAL PERU	102	102

SPACE FLIGHT

	FY 86	FY 87
EXC. ■SES	32	32
GWGS 16	51	51
GM/GS 14	I7	17
ALL OTHER GWGS	50	bo
WAQE BOARD	--	--
TOTAL PERM	160	160

AND DATA SYSTEMS

	FY 86	FY 87
EXC. ■SES	13	13
GM/GS 16	14	14
GWGS I4	11	11
ALL OTHER (WIGS	11	11
WAGE BOARD	--	--
TOTAL PERM	49	49

SPACE STATION

	FY 86	FY87
EXC. ■SES	13	13
GM/GS 16	6	6
GM/GS 14	11	11
ALL OTHER GM/GS	40	40
WAQE BOARD	--	--
TOTAL PERU	12	I2

INSPECTOR
GENERAL

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987 ESTIMATES

NASA OFFICE OF INSPECTOR GENERAL

DESCRIPTION

The NASA Office of Inspector General (OIG) is located at 400 Maryland Avenue, SW, Washington, D.C.. OIG field locations include offices at Ames Research Center, California; Goddard Space Flight Center, Maryland; Jet Propulsion Laboratory, California; Johnson Space Center, Texas; Kennedy Space Center, Florida; Langley Research Center, Virginia; Lewis Research Center, Ohio, and Marshall Space Flight Center, Alabama.

OFFICE OF INSPECTOR GENERAL ROLES AND MISSIONS

The NASA OIG was created in 1978 by an Act of Congress (P.L. 95-452) as an independent and objective unit within the Agency. The purposes and mission of the OIG are to:

-- Conduct and supervise audits and investigations relating to NASA's programs and operations;

-- Promote economy, efficiency, and effectiveness in the administration of these programs and operations;

-- Prevent and detect fraud and abuse in these programs and operations; and

-- Keep the NASA Administrator and the Congress fully and currently informed about NASA programs, deficiencies relating to the administration of such programs, and the necessity for and progress of corrective actions.

SUMMARY OF RESOURCES REQUIREMENTS

Funding Plan by Function

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
I. Personnel and Related Cost.. ...	4,736	5,237	4,954	5,008
II. Travel.....	218	252	239	245
III. Operation of Installation.....	271	329	318	241
A. Facilities Services..	(---)	(---)	(---)	(---)
B. Technical Services.....	(237)	(50)	(256)	(176)
C. Management and Operations..	(34)	(279)	(62)	(65)
Total, fund requirement ...	5,225	5,818	5,511	5,494

Distribution of Permanent Civil Service Workyears

Permanent full-time workyears	94	97	97	97
Other than full-time.....	9	10	10	10
Total workyears...	103	107	107	107

RESOURCES REQUIREMENTS BY FUNCTION

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
I. PERSONNEL AND RELATED COSTS	**4,736**	***5,237***	**4,954**	***5,008***
Summary of Fund Requirements				
A. Compensation and Benefits				
1. Compensation				
a. Full-time permanent	3,861	4,115	3,984	4,024
b. Other than full-time permanent	156	202	180	185
c. Overtime and other compensation	5	5	5	5
Subtotal, Compensation	4,022	4,322	4,169	4,214
2. Benefits	465	495	470	479
Subtotal, Compensation & Benefits	4,487	4,817	4,639	4,693
B. Supporting Costs				
1. Transfer of personnel	207	375	270	270
2. Personnel training	42	45	45	45
Subtotal, Supporting Costs	249	420	315	315
Total, Personnel and Related Costs	4,736	5,237	4,954	5,008

Explanation of Fund Requirements

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
A. Compensation and Benefits.....	4,487	4,817	4,639	4,693
1. Compensation	4,022	4,322	4,169	4,214
a. Full-time permanent.	3,861	4,115	3,984	4,024

Basis of Cost for Permanent Positions

In 1987 the cost of permanent workyears will be $4,024,000. The increase from 1986 results from the following:

Cost of full-time permanent workyears in 1986.....		3,984
Cost Increases in 1987.....		104
Within-grade and career advances:		
Full year cost of 1986 actions.....	54	
Part year cost of 1987 actions.....	50	
Cost Decreases in 1987.....		-64
Turnover savings and abolished positions:		
Full year cost of 1986 actions.....	-35	
Part year cost of 1987 actions.....	-29	
Cost of full-time permanent workyears in 1987.....		4,024

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
b. Other than full-time permanent				
(1) cost	156	202	180	185
(2) Workyears	9	10	10	10

The distribution of 1987 workyears is as follows:

Distribution of Other Than Full-Time Permanent Workyears

Program	Workyears
Summer employment programs	1
Other temporary	9
Total	10

c. Overtime and other compensation	5	5	5	5
2. Benefits	465	495	470	479

The following are the amounts of contributions by category:

Civil Service Retirement Fund	281	300	283	286
Employee life insurance	10	11	10	10
Employee health insurance	86	91	87	88
Workmen's compensation	32	33	33	36
FICA	16	18	12	13
Medicare	40	42	45	46
Total	465	495	470	439

The increase in the 1987 budget estimate from the 1986 current estimate is related to the increase in salaries.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
B. Supportinq Costs.....	249	420	315	315
1. Transfer of personnel.....	207	375	270	270

The costs associated with the transfer of personnel include movement of household goods, subsistence and temporary expenses, real estate and miscellaneous moving expenses related to change of duty station. The reduction in the 1986 current estimate reflects 1985 actual experience. The 1987 budget estimate reflects essentially the same number of relocations as in 1986.

2. Personnel training.....	42	45	45	45

The maintenance and expansion of skills is essential in carrying out the mission of the OIG. Part of the training consists of courses offered by other Government agencies, usually for a fee. The remainder of the training is provided through nongovernment sources. The costs are for tuition, fees and related expenses for training at colleges, universities, technical institutions, and for seminars and workshops. The 1987 budget estimate provides for the same level of training as 1986 at anticipated cost levels.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
II. TRAVEL	**218**	**252**	**239**	**245**
Summary of Fund Requirements				
Management and Operations Travel	218	252	239	245
Total, Travel	218	252	239	245
Explanation of Fund Requirements				
Management and Operations Travel	218	252	239	245

Travel funding is required to conduct audits, investigations and management functions. The 1987 budget estimate represents the same level of travel as in 1986. The reduction from the 1986 budget estimate to the 1986 current estimate is based on 1985 experience.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
III. OPERATION OF INSTALLATION	271	329	318	241
Summarv of Fund Reauirements				
A. Technical Services	237	50	256	176
B. Management and Operations	34	279	62	65
Total, Operation of Installation	271	329	318	241

Explanation of Fund Requirements

Operation of Installation provides a broad range of services, supplies, and equipment in support of the Inspector General's activities.

The decrease from the 1986 current estimate to the 1987 budget estimate is due to a reduction in the effort for automation of the Inspector General's Audit Operations.

A. Technical Services	237	50	256	176
Summary of Fund Requirements				
1. Automated Data Processing	237	50	256	176
Operations	237	50	256	176
Total, Technical Services	237	50	256	176

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Explanation of Fund Requirements				
1. Automated Data Processing	237	50	256	176

This estimate provides for the lease, purchase, maintenance, programming and operations services of automated data processing (ADP) equipment. The increase from the 1986 budget estimate to the 1986 current estimate reflects a continuing effort to modernize and automate the OIG audit capabilities. This effort peaks in 1986 resulting in the decrease in 1987.

B. Management and Operations	34	279	62	65
Summary of Fund Requirements				
1. Administrative Communications	20	21	21	22
2. Printing and Reproduction	2	2	2	3
3. Installation Common Services	12	256	39	40
Total, Management and Operations	34	279	62	65
Explanation of Fund Requirements				
1. Administrative Communications	20	21	21	22

Included in this category are the costs of local telephone services for the Inspector General's office at NASA Headquarters.

2. Printing and Reproduction	2	2	2	3

Costs of printing and reproduction services used by the Office of Inspector General at NASA Headquarters are included.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
	(Thousands of Dollars)			
3. Installation Common Services.....	12	256	39	40

The Inspector General's direct use of administrative supplies, materials and equipment is covered in this subcategory. The decrease from the 1986 budget estimate reflects the transfer of funds originally budgeted here for automation activities to Technical Services.

ORGANIZATION AND STAFFING
OFFICE OF INSPECTOR GENERAL

INSPECTOR GENERAL SUMMARY	FY 86	FY 87
EXCEPTED 6 SES	6	6
GMJGS-15	11	11
GM/GS-14	13	13
ALL OTHER GM/GS	70	70
TOTAL	100	100

INSPECTOR GENERAL
DEPUTY INSPECTOR GENERAL

	FY 86	FY 87
EXCEPTED & SES	2	2
GM/GS-15	1	1
GM/GS-14	0	0
ALL OTHER GMJGS	2	2
TOTAL	5	5

ASSISTANT INSPECTOR GENERAL
FOR AUDITING

	FY 86	FY 87
EXCEPTED 6 SES	1	1
GMJGS-15	1	1
GMJGS-14	2	2
ALL OTHER GM/GS	1	1
TOTAL	5	5

ASSISTANT INSPECTOR GENERAL
FOR INVESTIGATIONS

	FY 86	FY 87
EXCEPTED & SES	1	1
GM/GS-15	2	2
GM/GS-14	0	0
ALL OTHER GM/GS	1	1
TOTAL	4	4

ASSISTANT INSPECTOR GENERAL
FOR MANAGEMENT SERVICES

	FY 86	FY 87
EXCEPTED 6 SES	1	1
GMJGS-15	0	0
GMJGS-14	2	2
ALL OTHER GMJGS	5	5
TOTAL	8	8

ASSISTANT INSPECTOR GENERAL
FOR TECHNICAL SERVICES

	FY 86	FY 87
EXCEPTED 6 SES	1	1
GMJGS-15	2	2
GM/GS-14	0	0
ALL OTHER GM/GS	3	3
TOTAL	6	6

CENTER OIG OFFICES

	FY 86	FY 87
EXCEPTED a SES	0	0
GMJGS-15	5	5
GM/GS-14	9	9
ALL OTHER GM/GS	58	58
TOTAL	72	72

AGENCY WIDE
ACTIVITIES

RESEARCH AND PROGRAM MANAGEMENT
FISCAL YEAR 1987 ESTIMATES

AGENCYWIDE ACTIVITIES

	Summary of Resources Requirements			
		1986		1987
	1985 Actual	Budget Estimate	Current Estimate	Budget Estimate
		(Thousands of Dollars)		
Facilities Services:				
Hazardous Substances Release Assessment.....	---	---	---	5,000
Technical Services:				
Automation Systems Development.	---	---	---	7,500
Total.....	---	---	---	12,500

In the 1987 Budget Estimates NASA is requesting funds for two activities that are not specifically identified to individual centers: funds for environmental studies, and funds for developing automated administrative systems. The specific uses to which these funds will be put are as follows:

Hazardous Substances Release Assessments:

Hazardous Substances.....	---	---	---	1,400
Protection of Ground Water.....	---	---	---	3,600
Total.....	---	---	---	5,000

Over the past several years, court decisions, executive orders, and legislation have made it essential that NASA undertake a comprehensive evaluation of potentially hazardous environmental areas. The increasing number and complexity of environmental regulations affecting federal facilities have necessitated that NASA assess and analyse potential hazards from operations at its field installations. The diversity of these operations makes it necessary to investigate the contamination of air, water, and soil from an array of hazardous substances released at the field facilities. Because the areas to be assessed are complex, each potential problem must be fully recognized and understood before large sums of money are committed.

These funds will be apportioned to centers as appropriate to carry out specific studies and surveys.

	1987 Budget Estimate (Thousands of Dollars)
Hazardous Substances	1,400

Recent environmental laws have mandated the control of substances which are known to be hazardous, and have directed that research be conducted to identify hundreds of other substances which are toxic to human health. The minimization of generation of waste from these hazardous substances is required through conservation of resources and recovery practices. The application of best available technology in the pre-treatment of contaminated media is also prescribed by recent environmental laws. Each NASA installation will conduct studies and analyses of the composition of hazardous wastes generated, and develop the technology for pretreatment, recovery, and minimization of hazardous substances. Other hazardous substances requiring assessments include PCB's and asbestos. Studies required include inventory and identification, risk assessment, and sampling and analysis.

Protection of Ground Water	3,600

Comprehensive Federal, state, and local laws require the protection and monitoring of ground water supplies. Studies will certify that present facilities (i.e., surface impoundments, underground storage tanks, etc.) preclude adverse impacts on ground water quality. Studies will also evaluate centers to investigate potential ground water contamination and to develop the method and extent of corrective effort where required.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Automated Systems Development:				
Development of Uniform Administrative ADP Systems	---	---	---	4,000
Essential Modification of Existing Administrative ADP Systems	---	---	---	2,000
Coordination and Control	---	---	---	1,500
Total	---	---	---	7,500

NASA, through the Automated Information Management (AIM) Program, will capitalize on the opportunities afforded by today's computer technology through the transition from existing installation unique automated administrative systems to agencywide Management Information Systems.

The AIM Program will enable NASA to meet many of its Information Resource Management responsibilities as required by the Paperwork Reduction Act of 1980 (Public Law 96-511). The AIM Program will also respond to the challenges and opportunities posed by the President's Reform 88 Program and the Grace Commission findings and recommendations that relate to expanded use of automated technologies to increase efficiency and reduce costs.

An Agency AIM Council was established in September 1984 to provide a way for the technology and expertise developed at a single NASA installation to be shared throughout the agency. This council is responsible for providing oversight for the coordination of AIM Program requirements and implementation across the agency.

An AIM Program plan has been developed which establishes the procedures, guidelines, and standards that will be used during the system development life cycle process for uniform agencywide administrative systems. This plan also establishes the AIM Program organization structure and responsibilities.

The AIM Program will consist of system development projects and other efforts to establish the institutional baseline capacity for uniform automated information management service throughout the Agency. The AIM Program will focus on those elements identified in the NASA Strategic AIM Plan as candidates for agencywide systems but will also consider other elements identified during the course of the program. Approval of AIM candidate systems will be based on the results of pre-definition studies, a non-advocate review process conducted by the AIM Council, and consultation among field installation and Headquarters management. The systems to be supported will be those with maximum potential for near term cost savings and increased efficiency.

	1987 Budget Estimate (Thousands of Dollars)
Development of Uniform Administrative ADP Systems	**4,000**

Reform 88 identified a number of areas where uniform/standard administrative ADP systems could be cost beneficial. NASA has undertaken studies to determine where NASA-wide administrative ADP systems should be developed. When the studies indicate that a single, uniform, decentralized system will result in significant savings and improve the delivery of the application services, the system development activity will be initiated at a lead center under the auspices of a Headquarters program manager.

	1987 Budget Estimate (Thousands of Dollars)
Augmentation of Existing Administrative ADP Systems	2,000

These funds will be used to enhance or modify existing NASA-wide administrative ADP systems. Several NASA-wide systems require improvement: the Utility Control System (UCS), the Media Services Information System (MSIS) and Construction Management Information System. The basic hardware element of the UCS is obsolete and must be replaced. The MSIS workload has grown such that the original concept must be reviewed and a new system developed. Additional functions must be added to the Construction Management Information System necessitating a system redesign and new hardware. As these system augmentation projects are developed, they will come under the auspices of the AIM Program.

Coordination and Control	1,500

A key element of the AIM Program is the initial coordination and planning, and the mechanisms which control and manage the uniform systems in a decentralized organization like NASA. Strategic plans are necessary to provide for long term objectives so that appropriate system selection decisions can be made. Control is exercised through hardware and software configuration management processes. One upcoming area of planning and configuration management interest is communications. The NASA-wide administrative ADP systems of the future will be heavily dependent upon communications. Therefore, we must plan for and then control that communications environment.

SPECIAL
ANALYSES

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1987

JET PROPULSION LABORATORY

DESCRIPTION

The Jet Propulsion Laboratory (JPL) is located in Pasadena, California, approximately 20 miles north of downtown Los Angeles with subsidiary facilities located at Goldstone, California, (tracking and data acquisition), Edwards Air Force Base, California, (propellant formulation and testing), and Table Mountain, California (open air testing and astronomy).

At Pasadena, the Laboratory occupies 176 acres of land of which 156 acres are owned by NASA and 20 acres are leased. At Goldstone, facilities are located on land occupied under permit from the Army. At Edwards Air Force Base, facilities are located on land occupied under permit from the Air Force. The facilities at Table Mountain are located on land occupied under permit from the Forest Service of the Department of Agriculture. The capital investment of the Jet Propulsion Laboratory, including the Deep Space Network, fixed assets in progress, and contractor-held facilities, as of September 30, 1985, was $520,090,000.

The Jet Propulsion Laboratory is a Government-owned installation that is staffed and managed by the California Institute of Technology. Contract NAS7-918 between NASA and Caltech governs research, development, and related activities at the Laboratory with facilities being provided under a separate facilities contract NAS7-920(F). The cost of operating JPL for NASA activities is borne by the Research and Development and the Space Flight, Control and Data Communications appropriations, except for the lease or purchase of administrative aircraft and the purchase of passenger motor vehicles, which are funded from the Research and Program Management (R&PM) appropriation. Accordingly, the R&PM costs presented in this special analysis for JPL are for purposes of comparison only and are not a part of the NASA R&PM budget.

ROLES AND MISSIONS

In principal roles the Jet Propulsion Laboratory is responsible for the conduct of NASA automated missions concerned with scientific exploration of the solar system and deep space; for spacecraft tracking and data acquisition; for research and analysis required by deep space; and for the development of advanced spacecraft technologies including propulsion, guidance and control systems, electronics, and others. The Laboratory is also assigned responsibility for selected automated Earth-orbital projects and for the development and application of earth remote sensing technology and instruments. Implicit in these assignments is a broad range of engineering, scientific, and management functions devoted to:

1. The conduct of complete spaceflight projects, including overall project management and all phases of project activity beginning with mission design and following with spacecraft design, development, testing, flight operations, and data analysis.

2. The development and operation of the Deep Space Network (DSN) which provides tracking and data acquisition services for all NASA projects involving missions beyond near-Earth orbits.

3. Continuing programs of scientific investigation, and research and analysis.

In more specific terms, the principal Laboratory activities in support of NASA can be categorized as follows:

Solar System Exploration - Since the beginning of the Nation's space activities, JPL has devoted a major part of its efforts to exploration of the planets, their satellites, and the interplanetary medium. The Laboratory has had project management responsibility for all of the Mariner missions, including design, fabrication, assembly and testing of the spacecraft. During more than two decades, beginning with the Mariner 2 flight to Venus in 1962, these missions have produced enormous scientific returns. The two most recently completed missions in the Mariner series are those of Mariner 9, which returned scientific data for nearly a year from a Martian orbit, and Mariner 10, which gathered data in a close flyby of Venus followed by three separate encounters with Mercury.

The Jet Propulsion Laboratory was a major participant in the Viking project carrying out, among other assignments, the development of the two orbiters which, each carrying a lander, reached Mars during the summer of 1976. The Viking mission operations were repeatedly extended as the spacecraft far out-lived their design lifetimes. Operations were completed in 1983 when Viking Lander I, the last operating unit of the four, ceased functioning.

In the continuing series of planetary missions, JPL has management responsibility for the Voyager mission. The two Voyager spacecraft were launched in *1977* and made close flybys of Jupiter and its major satellites in *1979.* In *1980* and *1981,* the Voyager spacecraft encountered Saturn. Each of the four Voyager planetary encounters resulted in major scientific discoveries and obtained unique scientific data. Voyager *2* flew by Uranus in January *1986* and its trajectory will carry it on to arrive at the planet Neptune in *1989.* Meanwhile, Voyager *1* continues to collect and transmit data on the interplanetary space environment as it proceeds out of the solar system.

The Laboratory also has project management responsibility for the Galileo mission, which is planned to orbit Jupiter and send an instrumented probe into the planet's atmosphere. The probe will make direct measurements of the physical and chemical properties of the Jovian atmosphere. During its in-orbit lifetime of *20* months, the orbiter will observe Jupiter and its system of satellites at close range. An option is available to provide an encounter with the asteroid amphritrite enroute to Jupiter. JPL is the management center for the Galileo project and is developing the orbiter in-house. The Ames Research Center is responsible for the probe development. The mission is scheduled for launch in May *1986.*

The Ulysses Project is a cooperative effort between NASA and the European Space Agency (ESA) to study the sun at high solar latitudes. JPL is managing the development of the United States instruments which will fly on the ESA spacecraft, plus the corresponding data analysis. In addition, JPL is providing mission support to ESA. ESA is developing the spacecraft and a set of its own instruments. The launch is scheduled for May *1986.*

The Magellan (formerly named Venus Radar) mission will obtain high resolution global radar imagery and altimetric and gravity data from a spacecraft orbiting Venus. The objectives are to address fundamental questions regarding the origin and evolution of the planet. The primary data gathering period will extend over one Venusian year equal to *243* earth days. JPL is managing the project, including responsibility for mission design and operations. Industry will develop the spacecraft and synthetic aperture radar under contract to JPL. The mission will be launched in *1988.*

The Mars Observer mission will undertake planet-wide studies of the composition and physical state of Martian materials, examine the major surface forming processes and their time scales, and explore the structure and circulation aspects of the atmosphere. The Jet Propulsion Laboratory is the management center with responsibility for the scientific payload, and will contract with industry for development of the spacecraft bus. The mission will be launched in *1990.*

Astrophysics - Consistent with its role as a center for Earth-orbital spacecraft development, JPL managed the Infrared Astronomical Satellite (IRAS) project, which was launched in January *1983.* This was a cooperative mission with the Netherlands and the United Kingdom. The spacecraft, itself, was designed and

built in the Netherlands. JPL was responsible for the infrared telescope development, system testing activities, and data analysis. Flight operations were completed in November 1983. IRAS has been a highly successful scientific undertaking, and the analysis of the enormous quantity of the data obtained will continue for many years.

JPL also managed an atmospheric science satellite, the Solar Mesosphere Explorer, which was launched on October 6, 1981, into a sun-synchronous polar orbit. The spacecraft module was developed under a JPL contract with private industry, and the five science instruments were developed by the Laboratory for Atmospheric and Space Physics at the University of Colorado.

Earth Science and Applications - In the area of space applications, JPL is a principal center for work in oceanographic applications of space technology. Development will be initiated on the Ocean Topography Experiment (TOPEX), a joint cooperative effort with the French, to develop and launch an ocean-observing satellite which will map the circulation of the Earth's oceans. JPL will have project management responsibility for the TOPEX, as well as responsibility for mission operations, and science data processing. The Laboratory also conducts significant activities in upper atmospheric research; in development and implementation of remote sensing techniques for Earth resources observations; and in geodynamics and plate tectonics research. Flight experiments for microgravity research in glasses and fluid behavior are also developed and carried out.

Spacecraft Flight Operations - The Jet Propulsion Laboratory is responsible for the design, development, maintenance, and operation of NASA's worldwide Deep Space Network (DSN) and a Mission Control and Computing Center. The DSN tracking stations are located in California, Spain, and Australia, and support projects involving flights beyond near-Earth orbit. The Mission Control and Computing Center is located at JPL, and is the location of actual day-to-day operations of deep-space missions. JPL is also implementing the Network Consolidation Program which co-locates major facilities of the Space Tracking and Data Network (STDN) near-Earth tracking stations with the three DSN stations. These consolidated facilities will be managed by JPL and will provide a more efficient, technically advanced, and cost effective means of operation.

Research and Analysis - The Jet Propulsion Laboratory maintains an effective program of advanced technical development to provide sound technologies for present and prospective project assignments and to further the general capabilities of NASA. Areas of involvement include spacecraft advanced development, autonomous systems, space power and propulsion systems, micro-electronics, information systems, and basic research in such fields as fluid physics, polymer materials, and applied mathematics. The Laboratory participates in scientific experiments on both JPL-managed and non-JPL-managed flight projects. This participation includes not only the performance of scientific investigations, but also a significant commitment to the development of scientific instruments for use in space missions. Ground-based research programs are carried out in the planetary sciences, physics and astronomy, Earth and ocean physics, and microgravity. These activities involve broad collaboration with the scientific and academic communities and with staff members from other NASA field installations.

SIMULATED RESEARCH AND PROGRAM MANAGEMENT BUDGET

FUNDING PLAN BY FUNCTION

	1965 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
I. Personnel and Related Costs	188,755	182,683	201,172	194,675
II. Travel	7,559	8,016	8,330	8,250
III. Operation of Installation	48,787	54,485	53,744	55,228
A. Facilities Services	(26,599)	(29,604)	(29,596)	(30,133)
B. Technical Services	(8,196)	(7,503)	(8,704)	(9,279)
C. Management and Operations	(13,992)	(17,378)	(15,444)	(15,816)
Total, Fund Requirements	245,101	245,184	263,246	258,153

EXPLANATION OF FUND REQUIREMENTS

I. PERSONNEL AND RELATED COSTS	**188,755**	**182,683**	**201,172**	**194,675**

The increase from the 1986 budget estimate to the 1986 current estimate is due to an increase in workforce and provides for the October 1, 1985 pay raise and anticipated higher costs of personnel benefits, such as health insurance and retirement costs and social security contributions. The decrease from the 1986 current estimate to the 1987 estimate is due to a projected decrease in workforce as applied to NASA funded work.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands	of Dollars)	
II. TRAVEL	7,559	8,016	8,330	8,250

The increase from the 1986 budget estimate to the 1986 current estimate reflects a projected increase in workforce and increased travel costs as experienced in 1985.

III. OPERATION OF INSTALLATION	48,787	54,485	53,744	55,228
A. Facilities Services	26,599	29,604	29,596	30,133

The net increase from the 1986 current estimate to the 1987 estimate is due to anticipated higher utilities costs offset by reduced building lease costs due to the opening of the Central Engineering Building.

B. Technical Services	8,196	7,503	8,704	9,279

The increase from the 1986 budget estimate to the 1986 current estimate and the increase from the 1986 current estimate to the 1987 budget estimate is based on the 1985 experience.

C. Management and Operations	13,992	17,378	15,444	15,816

The decrease from the 1986 budget estimate to the 1986 current estimate is based on the 1985 experience.

DISTRIBUTION OF PERMANENT WORKYEARS BY PROGRAM

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
RESEARCH AND DEVELOPMENT	1,739	1,532	1,774	1,675
Space Station	39	---	32	35
Space Transportation Capability Development	5	26	8	8
Space Science and Applications	1,462	1,231	1,491	1,377
Physics and Astronomy	146	135	127	128
Life Sciences	15	17	23	25
Planetary Exploration	900	735	882	752
Space Applications	401	344	459	472
Commercial Programs	2	4	---	---
Technology Utilization	2	4	---	---
Commercial Use of Space	---	---	---	---
Aeronautics and Space Technology	157	189	161	173
Aeronautics	3	---	2	2
Space	154	189	159	171
Tracking and Data Advanced Systems	74	82	82	82
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS	406	408	393	344
Space Transportation Operations	10	7	14	12
Space and Ground Network, Communication and Data Systems	396	401	379	332
Subtotal, Direct Workyears	2,145	1,940	2,167	2,019
DIRECT SUPPORT	498	444	469	475
CENTER MANAGEMENT AND OPERATIONS	1,119	1,006	1,160	1,140
Total, Permanent Workyears	3,762	3,390	3,796	3,634

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1987 ESTIUATES

SUMMARY OF AIR TRANSPORTATION

OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
		(Thousands of Dollars)		
Research and development..	342,400	354,000	354,000	398,500
Construction of facilities	25,300	13,100	13,100	29,200
Research and program management	259,602	255,000	266,000	278,400
Total	627,302	622,100	633,100	706,100
Number of direct workyears associated with aeronautical research and technology	3,485	3,561	3,595	3,514

The objective of the aeronautical research and technology program is to conduct an effective and productive program that contributes materially to the enduring preeminence of U.S. civil and military aviation by: (1) conducting disciplinary and systems research at the leading edge of technology in those areas critical to the continued superiority of U.S. aircraft; (2) maintaining the research centers in positions of excellence in facilities and technical staff; (3) assuring timely transfer of research results to the U.S. aeronautical industry; (4) assuring appropriate involvement of universities and industry; and (5) providing aeronautical development support to other government agencies and U.S. industry. Additional emphasis has been given to emerging technologies with potential for order-of-magnitude advances in capability or performance. The far-term focus of the program provides results well in advance of specific applications and provides long-term, independent research and technology which is not driven by the development and operational pressures often encountered by the Department of Defense (DOD) and industry. Both fundamental research in the aeronautical disciplines and systems research directed at interaction among disciplines, components, and subsystems applicable to general classes of advanced aircraft are included. The program involves participation by aeronautical manufacturers from the industrial base to ensure that the technology is compatible with practical design considerations and to effect a rapid transfer into superior military and civil aricraft.

The 1987 estimate is based on an increased effort to aggressively pursue the highest payoff technologies with potential for order-of-magnitude advances in capability or performance. A unique opportunity in high-speed flight is focusing substantially increased emphasis in generic hypersonic technologies supporting the aerospace plane program. Subsonic transport and rotorcraft needs are addressed primarily through fundamental research aimed at the critical technology areas. Key high-performance aircraft technology efforts are accelerated, and a small effort in supersonic cruise technology is being maintained. The estimate also reflects the need to continue important efforts in the fundamental aeronautical disciplines and systems research and to support specialized facilities essential to aeronautics research.

The base research and technology program includes generic research which is broadly applicable to all classes of aircraft (general aviation/computer, transport, rotorcraft, supersonic cruise, fighter/attack, and hypersonic) and focused research which is specific to one class of aircraft. Systems technology programs are more focused in applications and/or have the characteristics of specific projects, i.e., advanced turboprop, X-wing, and oblique wing. Funding for the technical operations of wind tunnels, propulsion facilities, computational facilities, simulators, and flight research operations is covered in the most appropriate discipline elements of the research and technology base. In 1987 research and technology base funding will support the operating cost for the numerical aerodynamic simulation (NAS) program, and systems technology funding covers the final NASA commitment to the X-wing program. A brief summary of some of the major thrusts for both the research and technology base and systems technology programs follows.

In fluid and thermal physics research, strong emphasis will continue on three-dimensional computational fluid dynamics (CFD) methods that will increase the speed and efficiency of flow solvers by two orders of magnitude and on novel techniques and devices to reduce aircraft drag by up to 60 percent. Benchmark experiments for CFD code validation and turbulence modeling will be strengthened.

Applied aerodynamics research efforts in high angle-of-attack aerodynamics will include wind tunnel and flight evaluations to improve the understanding of performance in both the low- and high-speed flight regimes and to correlate with predictions. Research efforts in test techniques will address laser holigraphics and nonintrusive measurement techniques which will provide an order-of-magnitude improvement in test accuracy.

In propulsion and power research, continued attention will be given to the technologies for small engines which will enable up to 50-percent improvement in fuel efficiency. Internal computational fluid mechanics efforts will address the physical modeling of complex internal flows and the validation of codes as part of the goal to reduce calculation times by an order of magnitude. Supersonic combustion ramjet (scramjet) and combined cycle engine research will be strengthened to address the technologies critical to the flight of high-speed vehicles from takeoff to orbital speeds.

Materials and structures research will increase in the area of composite materials, which can provide up to a 50 percent weight savings for future aircraft. Initial efforts will focus on thermoplastics and ceramic-matrix composite materials, as well as structural concepts exploiting their anisotropic properties. Research emphasis will also be increased in high-temperature materials and structures and thermal-barrier coatings with high-erosion resistance. A focused effort will be initiated in rotorcraft airloads to correlate noise and vibration predictions as part of the goal to reduce noise and vibration by 80 percent.

Information science research will continue to focus on flight-crucial software and concurrent processing to provide an order-of-magnitude improvement of efficiency and reliability. Controls and guidance and human factors research will focus on the application of artificial intelligence technology to enhance the operations of future aircraft. Increased emphasis will be placed on controls research for highly maneuverable aircraft. Human factors research will continue to address the critical man-machine interface issues which affect the safety and operational limitations of aircraft.

Flight systems research will provide focus on highly maneuverable aircraft capable of high angle-of-attack operation at low speeds, high-speed manueverability, and short takeoff and vertical landing. Analytical and experimental investigations will be conducted on thrust-vectoring concepts to enhance high angle-of-attack maneuverability. Supersonic vertical/short takeoff and landing (V/STOL) concepts will be studied as the initial part of a joint United States/United Kingdom program. Other studies, conducted as part of the systems analysis effort, will determine the overall benefit of synergistic integration of component and subsystem technologies for hypersonic aircraft applications.

Rotorcraft systems technology efforts will include publication of an external noise prediction methodology aiming toward a three order-of-magnitude increase in accuracy and wind tunnel testing of an advanced, bearingless rotor. Activities in technology for next-generation rotorcraft with more than a twofold increase in speed will be focused on completion of flight testing of the X-wing rotor system on the rotor systems research aircraft to include conversion from rotorary to stopped-rotor flight mode.

Areas of continued emphasis in high-performance aircraft research are high angle of attack, with initial testing up to 20 degrees, integrated propulsion/flight controls to allow 10-15 percent performance improvements, supermaneuverability, short takeoff and vertical landing technology, and forward swept wing technology. The oblique wing technology program, being conducted jointly with the Navy to exploit the potential for high performance at subsonic and supersonic speeds, will include the detailed design and fabrication of the oblique wing and associated modifications of the NASA F-8 aircraft. Flight test is planned to begin in 1989. Ceramic and ceramic-matrix research for turbine engines with operating temperatures up to 2300 degrees Fahrenheit will continue, along with the development of the analysis tools to accurately predict the life and assess the durability of turbine engine hot section components.

In the advanced turboprop program aimed at a 30 percent reduction in transport fuel consumption, flight testing of the large-scale single-rotation propeller to build a performance data base for high-speed propeller aerodynamics and structures will be conducted. Geared counter-rotation propeller model tests will also be conducted. The general aviation/commuter engine research will include the definition of reference engines to focus and drive component technology development to large-engine performance levels and to provide a quantitative measure of the performance impact of advances as they are made.

In the NAS program, the initial operating configuration and the second high-speed processor for the extended operating configuration, allowing four to six times more computing power, will be installed in the new NAS facility. All subsystem upgrades will reach full capability early in 1989.

NASA, in conjunction with the Department of Defense, is developing the technology base for a potential national aerospace plane. The objective of the NASA transatmospheric research and technology program is to accelerate the development of the critical enabling technologies for a potential revolutionary new class of hypersonic/transatmospheric vehicles in the future. Such vehicles could be capable of horizontally taking off from and landing on conventional runways, using airbreathing propulsion up to, or near, orbital speed, and providing rapid and low-cost access to space.

The research and program management funding in 1987 provides for the salaries and travel of 3,514 direct civil service workyears, for the utilities necessary to conduct wind tunnel operations, and for other general operation of installation costs necessary to conduct the NASA aeronautics program.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND DEVELOPMENT

ESTIMATED 1987 OBLIGATIONS FOR EQUIPMENT TO BE PLACED AT NASA INSTALLATIONS

Program Budget Line Item	1987 Estimate (Thousand of Dollars)
Research and Development	164,953
Space Transportation Capability Development	(35,0001
Space Station	(43,609)
Physics and Astronomy	(1,369)
Planetary Exploration	(10.0903
Life Sciences	(943)
Space Applications	(7,751)
Aeronautical Research and Technology	(58,258)
Space Research and Technology	(7,933)
Space Flight, Control and Data Communications	114,987
Shuttle Production and Capability Development	(55,333)
Space Transportation Operations	(44,154)
Space and Ground Networks, Communication and Data Systems	(15,500)
GRAND TOTAL	279,940

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATIONS, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Capability Development	Johnson Space Center. Location 7201-xx. 87-002615	Center Info. Network Hardware	Supports Data System 6 Flight Operation.	$1,300
Space Transportation Capability Development	Johnson Space Center, Location 7201-xx. 87-002820	IBM Peripherals Reconfiguration	Supports Data System & Flight Operation.	$ 734
Space Transportation Capability Development	Johnson Space Center, Location 7201-xx. 87-002630	Purchase Sperry Peripherals	Supports Data System & Flight Oporation.	$ 200
Space Transportation Capability Development	Johnson Space Center, Location 7201-xx. 87-002635	Replacement FR80 Microfilm	Supports Data System 6 Flight Operation.	$ 450
Space Transportation Capab lity Development	Johnson Space Center, Location 7201-xx. 87-003100	Center Info. Sys. IBM 3083	Supports Data System 6 Flight Operation.	$2,512
Space Transportation Capab lity Development	Johnson Space Center. Location 7201-xx. 87-003105	Central Computing Fac. Peripherals	Supports Data System 6 Flight Operation.	$ 324
Space Transportation Capability Development	Johnson Space Center, Location 7201-xx. 87-003110	Sperry Equipment Lease	Supports Data System 6 Flight Operation.	$2,207
Space Transportation Capability Development	Johnson Space Center, Location 7210-xx, 87-002720	Flight Data System Upgrade	Supports Research 6 Test Operations.	$ 245
Space Transportation Capability Development	Johnson Space Center, Location 7222-xx, 87-002735	Thermal Synth. Sys.	Supports Research 6 Test Operations.	C1.800
Space Transportation Capability Development	Johnson Space Center, Location 7234-xx, 87-002755	Crew Sys. Div. Sys. Replacement	Supports Research & Test Operations.	$ 575
Space Transportation Capability Development	Johnson Space Center. Location 7234-xx. 87-002760	Data Acquisition Retrieval Sys Enchancement	Supports Research & Test Operations.	$ 360

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUUUARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Capability Development	Johnson Space Center, Location 7236-xx. 87-002770	Artificial Intelligence System	Supports Research & Test Operations.	$ 300
Space Transportation Capability Development	Johnson Space Center, Location 7244-xx. 87-002805	Network/VAX Upgrades	Supports Research 6 Test Operations.	$ 226
Space Transportation Capability Development	Johnson Space Center, Location 7256-xx. 87-002835	Shuttle Engineering Simulation ADPE Upgrade	Supports Research & Test Operations.	$3,600
Space Transportation Capability Development	Johnson Space Center, Location 7256-xx. 87-002845	CAD Workstations	Supports Research & Test Operations.	$ 750
Space Transportation Capability Development	Johnson Space Center, Location 7256-xx, 87-002850	LMI LISP Machine Inc Upgrades	Supports Research & Test Operations.	$ 262
Space Transportation Capability Development	Johnson Space Center. Location 7256-xx. 87-003170	ADPE Lease	Supports Research & Test Operations.	$ 962
Space Transportation Capability Development	Johnson Space Center, Location 7258-xx. 87-002860	Artificial Intelligence Systems	Supports Research & Test Support.	$ 302
Space Transportation Capability Development	Johnson Space Center. Location 7263-xx, 87-002885	User Workstations Network Augmentation	Supports Research & Test Operations.	$ 500
Space Transportation Capability Development	Johnson Space Center, Location 7263-xx. 87-002890	VAX 11/750 Upgrade	Supports Rerearch & Test Operations.	$ 300
Space Transportation Capability Development	Johnson Space Center, Location 7265-xx. 87-002900	Engineering UWS Replacements	Supports Research & Test Operations.	$ 250

NATIONAL AERONAUTICS AND SPACE ADMlNlSTRATlON

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION. AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Capability Development	Johnson Space Center. Location 7274-xx. 87-002990	Artificial Intel. Lab Purchase	Supports Data System & Flight Operation.	$ 200
Space Transportation Capability Development	Kennedy Space Center, Location 7601-P3, 87-001455	CAE Amendment 3	Supports Launch Systems Operations.	$ 300
Space Transportation Capability Development	Kennedy Space Center, Location 7601-P7, 87-001450	Interactive Graph System	Supports Launch Systems Operations.	$ 200
Space Transportation Capability Development	Kennedy Space Center, Location 7601-S4, 87-001465	Space Station Mission Assement	Supports Launch Systems Operations.	$ 180
Space Transportation Capability Development	Kennedy Space Center. Location 7601-01, 87-001445	Microcomputers, Mini-computers and peripherals	Supports Spacelab Operations.	8 500
Space Transportation Capability Development	Marshall Space Flight Center, Location 6201-01. 87-001955	Engineering Analysis & Data System	Supports Research & Test Operations.	818,000
Space Transportation Capability Development	Marshall Space Flight Center, Location 6201-26, 87-002035	IBM 4341 Central Processing Unit Augmentation	Supports Research & Test Operations.	$ 266
Space Transportation Capability Development	Marshall Space Flight Center, Location 6206-CU, 87-002285	Interactive Graphics Design Sys Modif Bldg 4487	Supports Research & Test Operations.	$ 191

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 87 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Station	NASA Headquarters. Location 100-00, 87-010120	Headquarters Tech Mgt Info Sys (TMIS)	Supports Program Management/Integration	$ 417
Space Station	Langley Research Center, Location 2303-DC. 87-009025	ADP Hardware Purchase	Supports Program Management/Integration	$ 400
Space Station	Marshall Space Flight Center, Location 6201-39, 87-002090	Continued Lease of Space Station IBM 4381	Supports Program Management/Integration	$ 400
Space Station	Johnson Space Center. Location 7210-xx. 87-002685	Flight Data System Upgrado	Supports Utilization	$ 350
Space Station	Johnson Space Center. Location 7210-xx, 87-002690	Purchase VAX Mini Computer or Equivalant	Supports Utilization	$ 250
Space Station	Johnson Space Center, Location 7210-xx, 87-002695	Purchase VAX 8600 Computer or Equivalent	Supports Utilization	$ 400
Space Station	Johnson Space Center. Location 7210-xx, 87-002700	CSTAR (Space Attitude Control Program)	Supports Advanced Development	$ 150
Space Station	Johnson Space Center. Location 7210-xx. 87-002705	Flight Control Optics Lab	Supports Advanced Development	$ 365
Space Station	Johnson Space Center. Location 7210-xx. 87-002710	Guidance Navigat ion Control	Supports Advanced Development	$ 370
Space Station	Johnson Space Center, Location 7226-xx, 87-002740	Symbolics 3640-4 Pak	Supports Program Management/Integration	$ 12
Space Station	Johnson Space Center. Location 7244-xx. 87-002785	Space Station Cad Support	Supports Program Management/Integration	$ 500

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Station	Johnson Space Center Location 7283-xx. 87-003060	Tech Mgt & Info Sys (TMIS) Phase C/D Purchase	Supports Program Management/Integration	826,000
Space Station	Johnson Space Center Location 7285-xx. 87-003070	On Board Computer & Sim. Interfaces	Supports Advanced Development	$ 750
Space Station	Johnson Space Center. Location 7285-xx, 87-003190	Software Support Environment Test Bed	Supports Advanced Development	$ 773
Space Station	Johnson Space Center, Location 7285-xx, 87-003199	Software Support Environment Mainframe	Supports Progrem Management/Integration	$ 4,881
Space Station	Johnson Space Cqnter. Bldg. 30. 72-87-06	Space Station Info Sys Configuration & Ops. Support	Provide Hardware for SSIS Operation8 & Analysis	$ 150
Space Station	Johnson Space Center, Bldg. 30. 72-87-07	space Station Info Sys Definition Support	Provide Intorface to Remote Operation Test Bed Facilities	$ 150
Space Station	Kennedy Space Center, Location 7602-00, 87-001265	Computer Aided Dev/ Computer Aided Eng-Definition	Supports Program Management/Integration	$ 3,008
Space Station	Kennedy Space Center, Location 7602-00, 87-001280	Logistics Management 'Info Sys - Definition	Supports Operational Readiness	$ 347
Space Station	Kennedy Space Center, Location 7602-00, 87-008989	Computer Aided Interface Verif-Definition	Supports Progrem Management/Integration	$ 300
Space Station	Kennedy Space Center, Location 7602-0 ,87-001290	GOYS Definition Ground Data Mgt Sys	Supports Operational Readine88	$ 4,311
Space Station	Kennedy Space Center, Location 7603-S1, 87-001260	Space Station Operational Language Sys	Supports Focused Technology	$ 200

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Physics and Astronomy	Ames Research Center, Location 21VO-74, 87-006560	Adams System Replacement	Supports Airborne Research	$ 110
Physicr and Astronomy	Jet Propulrion Laboratory. Location 5507-IP, 87-000685	Not Select; Host Comp Sys Infared Astron. Satellite Proj.	Supports Artrophyrics Mirrion Operations 6 DA	$ 250
Physics and Astronomy	Marshall Space Flight Center. Location 6209-TC. 87-002390	Payld Crew Training Compl Devel 6 Oper Proc Sys Re	Supports Spacelab Mission Mgt--Approved Missn	$ 400
Planetary Exploration	Jet Propulsion Laboratory. Location 5503-MS, 87-000645	Microcomputers, Mini-Computers and Peripherals	Supports Flight Misrion Operations 6 Data Analyris	$ 9,444
Planetary Exploration	Jet Propulsion Laboratory. Location 5508-IG, 87-000635	3 Computervision Systems for Computer-Aided Design	Supportr Mission Operations & Data Analysis	$ 146

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Applications	Goddard Space Flight Center, Location 5101-AA, 87-009135	Science Computing Facility	Supports Data Systems	$ 531
Space Applications	Goddard Space Flight Center, Locat on 5101-AB. 87-009205	National Space Science Data Center	Supports Data Systems and Dynamics	$ 130
Space Applications	Goddard Space Flight Center, Locat on 5101-AM, 87-009325	Vector Processing Facility	Supports Data Systems and Oceanic Processes	$ 814
Space Applications	Goddard Space Flight Center, Locat on 510 - AM. 87-009360	Vector Processing Facility NAS 5-26646 (CDC)	Supports Data Systems	$ 884
Space Applications	Goddard Space Flight Center, Locat on 510 - AM. 87-009365	Vector Processing Facility NAS 5-26646 (CDC)	Supports Data Systems	$ 500
Space Applications	Goddard Space Flight Center, Location 5103-BE, 87-009520	Applications Processing	Supports Resource Observation Applied Res. and Roentgen Satellite	$ 339
Space Applications	Goddard Space Flight Center, Space and Applications Computing Center [SACCI. 51-81-01	SACC Upgrade	Continues multi-year replacements of current computing facility to meet OSSA program requirements.	$ 1.532
Space Applications	Goddard Space Flight Center, Building 22. 51-82-10	High Speed Computing Facility	Supplements and extends capability of existing Amdahl 470V/6 used in atmospheric sounding retrieval. data assembly. atmospheric modeling, numerical forecast development ment in support of Global Atmospheric Research Program (GARP) and NASA Climate Research Program.	$ 3.021

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Aeronautical Research & Technology	Ames Research Center, NAS Facility 21-84-03	Numerical Aerodynamic Simulation Processing System Network (NPSN)	Provides a large scale. high performance computational resource for solving three dimensional. viscous fluid flow equations specifically oriented toward the solution of aerodynamic and fluid dynamic problem8	C19.300
Aeronautical Research & Technology	Ames Research Center, Bldg 233. Central Computer, Facility 21-85-01	Large Scale Scientific Processor (LSSP)	Provides large scale, very high-speed vector processing capabilities in computational fluid dynamics and computational physics	$ 2.984
Aeronautical Research & Technology	Ames Research Center, Bldg N-233. 21-87-02	Central Storage System	Provides for increased data storage and data management facilities for the Central Computer Facility computers	$ 639
Aeronautical Research & Technology	Ames Research Center. Bldg N-211, 21-85-04	B-200 Super King Air Aircraft	Provides inflight monitoring of research aircraft operations and related logistics support for research programs	C 888
Aeronautical Research & Technology	Ames Research Center, Bldg N-233, 21-87-03	Convex Computer System	Provides Cray computer compatibility by emulating Cray instruction ret. enabling codes developed on a Cray to be run on this computer at a slower speed	C 1,000

NATIONAL AERONAUTICS AND SPACE ADMIN STRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS NCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Aeronautical Research & Technology	Ames Research Center, Bldg N-243. 21-87-04	Simulation Computer System Replacement	Upgrade simulation computational capabilit-ies to support ongoing and future programs, replacing obsolete equipment	$ 800
Aeronautical Research & Technology	Ames Research Center, Bldg N-233, 21-87-05	Layered, Interactive Front-End Computer System	Integrates scientific programming environment provided by the Central Computer Facility, pro-viding processing support for work stations, inter-active pass-through to supercomputers, and other interactive capabilities	$ 662
Aeronautical Rerearch & Technology	Ames Research Center, Bldg N-257, 21-87-06	Aircraft Syrtem Modeling and Control/ Advanced Concepts Simulator	Replacer aircraft systems modeling control computer used to drive the advanced concepts flight simulator. to provide increased capacity and response time to pilot inputs and simulated external events for better simulation of a real-time flight enviro-nment	$ 500
Aeronautical R search & Technology	Langley Re earch Center, Bldg 1268. 23-87-01	Computer-aided Design/ Engineering Capability for Electronic Systemr	Provider for electronic design/instrumentation in support of over 30 projects in aircraft flight. spaceflight, and aerodynamic research	$ 342
Aeronautical Research & Technology	Langley Rerearch Center, Location 2302-BB, 87-008790. 23-87-02	Mid-range Computers	Upgrader 6 mid-range processors to replace obrolete equipment and to provide a modest improvement in computing porer	$ 962

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1887 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Aeronautical Research & Technology	Langley Research Center, Location 2304-C1, 87-008870, 23-87-03	7X10-ft. High-speed Tunnel Data System	Upgrader current system to rupport research demands	$ 169
Aeronautical Research & Technology	Langley Research Center, Location 2304-C4, 87-008940, 23-87-04	Avionics Integration Rerearch Laboratory	Upgrades exirting rystem to provide additional storage capacity	$ 400
Aeronautical Rerearch & Technology	Langley Research Center, Bldg 1230, 23-87-05	Instrument Rerearch Division Data Systemr Laboratory	Upgrader ryrtem to rupport installed systems and development of new capabilities	$ 118
Aeronautical Research & Technology	Langley Research Center, Location 2302-BB. 87-009785. 23-87-06	Supercomputer Augmentation	Augments capability through acquirition and integration of new super-computer to rupport research requirements in such areas as computation-al fluid dynamics. structures, and materials	$ 2.311
Aeronautical Research & Technology	Langley Research Center, Bldg 1265. 23-87-07	Minicomputer Hort System for Aerothermal Loads Complex	Provides for a local computer ryrtem to inter-face with data acquirition ryrtemr of various research and rind tunnel facilities to enable more repid data analysis	$ 276
Aeronautical Research & Technology	Langley Research Center, Location 2302-BB, 86-006055	Simulation Network	Optionr for completion of the real time communication subsystem	$ 218
Aeronautical Research & Technology	Langley Research Center. Location 2302-88, 86-006070	Vector Processing	Upgrader vector ryrtem to 32 million 64-bit words of high-speed control memory	$ 1.926

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Aeronautical Research 6 Technology	Langley Research Center. Location 2304-C3, 87-008925	8-Foot High Temperature Structures Tunnel (HTST) Data Systems Upgrade	Upgrades current system to support research demands	$ 339
Aeronautical Research 6 Technology	Langley Research Center, Location 2302-BB. 87-008780	Mass Storage	Adds additional cartridge storage units to meet increased volume	$ 129
Aeronautical Research 6 Technology	Langley Research Center, Location 2304-C1, 87-008860, 23-87-08	Unitary Plan Wind Tunnel Data System Upgrade	Upgrades current system to support research demands	$ 67
Aeronautical Research 6 Technology	Langley Research Center, Bldg 1192, 23-87-09	Computational Fluid Dynamics (CFD) Super Minicomputer	Provides for CFD code development and pre/post processing of large CFD application programs executed by VPS-32 supercomputer	$ 423
Aeronautical Research 6 Technology	Langley Research Center, Location 2304-C3, 87-00893. 23-87-10	Structures Research Laboratory Data System	Replacement of current system to provide expanded capabilities to meet research demands	$ 250
Aeronautical Research & Technology	Langley Research Center, Bldg 1268. 23-87-11	Technology for Integrated Problem Solving Laboratory	Upgrades VAX-780 and provides for workstations and graphics capability to equip a multidisciplinary research laboratory	$ 104
Aeronautical Rerearch 6 Technology	Lewis Research Center, Location 220R-TS, 87-000550. 22-85-01	Real-Time Simulation System	Provides real-time simulation of propulsion systems	8 1,300
Aeronautical Research 6 Technology	Lewis Research Center. Location 220S-MS, 87-000310. 22-87-02	Shared Mass Storage Hardware	Provides an archival medium for long-term storage of data with lor frequency of access	$ 125

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Aeronautical Research & Technology	Lewis Research Center, Bldg 142, 22-87-02	Front-End Processor Hardware	Upgrades and augments capability to manage and provide access to main-frame computers	$ 250
Aeronautical Research 6 Technology	Lewis Research Center. Location 2200-PT, 87-000350, 22-87-03	Program Support Communications Network (PSCN) and Time Div. Multiple Access Hard-ware	Provides gateway interface hardware interconnection between central processors and the PSCN	$ 179

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Research & Technolgy	Langley Research Center, Bldg. 1230, 23-87-12	Nondestructive Evaluation (NDE) Laboratory	Provides for various pieces of equip. and systems to be installed in a new laboratory to improve capability to achieve next generation programs and to develop real accept/reject criteria for aerospace components.	$ 520

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7203-00, 87-002655	Mission Control Center	Supports Launch and Mission Support	$ 4.289
Space Shuttle Production and Capability Development	Johnson Space Center. Location 7208-xx. 87-002665	Shuttle Reconfig. Sys./ Auto	Supports Orbiter	$ 664
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7208-xx. 87-002680	Voice System Computer	Supports Launch and Mission Support	$ 315
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7208-xx. 87-003150	Shuttle Mission Simulator Host Dirk A/B/C	Supports Orbiter	$ 407
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7208-xx. 87-003155	Shuttle Mission Simulator 8480 Disk	Supports Orbiter	$ 294
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7208-xx, 87-003160	Lease Sperry 1191 Equipment	Supports Orbiter	$ 2.611
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7210-xx, 87-002715	Inertial Sys. Lab	Supports Orbiter	$ 210
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7256-xx, 87-002815	Shuttle Engineering Simulator Augmentation	Supports Orbiter	$ 145

NATIONAL AERONAUTICS AND SPACE ADMIN STRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS NCLUDED IN 1987 BUDOET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx. 87-002995	Software Development Facility System	Supports Orbiter	$ 2,588
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx. 87-003000	Flight EG. Interface Device	Supports Orbiter	$ 300
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx. 87-003005	Flight EG. Interface Device 2 Upgrade	Supports Orb tor	$ 350
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx. 87-003015	Reconfiguration Network Expansion	Suppo ts Orb tor	C 250
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx, 87-003020	Software Production Facility Peripherals	Suppo ts Orbiter	$ 50
Space Shuttle Production and Capability Development	Johnson Space Center. Location 7277-xx, 87-003025	4381 Software Development Facility Upgrade	Supports Orbiter	C 500
Space Shuttle Production and Capability Development	Johnson Space Center. Location 7277-xx. 87-003030	Controllers	Supports Orbiter	$ 150
Space Shuttle Production and Capability Development	Johnson Space Center, Location 7277-xx. 87-003255	Upgrade IBM 3001 to 3084 Q	Supports Orbiter	$ 2.185
Space Shuttle Production and Capability Development	Johnson Space Center, Bldg. 30, 72-87-05	Reliability Replacement	Supports Orbiter	$ 9,485

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION. AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Shuttle Production and Capability Development	Kennedy Space Center, Location 7602-00, 87-001330	Central Data Subsystem	Supports Launch Site Equipment	$ 3,096
Space Shuttle Production and Capability Development	Kennedy Space Center, Location 7602-00, 87-001325	Checkout Controls & Mon. Subsystem II Hardware Upgrades	Supports Launch Site Equipment	$ 2,960
Space Shuttle Production and Capability Development	Marshall Space Flight Center, Location 6206-DB. 87-002290	AD10 Floating Point Expansion for HDWR Simul Lab	Supports Space Shuttle Main Engine (SSME)	$ 250

NATIONAL AERONAUTICS AND SPACE ADMIN STRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS NCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Operat ions	Ames Research Center, Dryden Flight Research 21-87-01	Aerial Work Platforms	Supports Shuttle	$ 450
Space Transportation Operations	Johnson Space Cen er, Location 7201-xx, 87-003090	Sperry Equipment Lease	Supports F ght Operations	$ 98I
Space Transportation Operations	Johnson Space Cen er, Location 7201-xx. 87-003115	Data Comm. Lines	Supports F ght Operations and Program Management/ ntegration	$ 213
Space Transportation Operations	Johnson Space Center. Location 7201-xx, 87-003120	Sperry Equipment Lease	Supports Fl ght Operations, and Program Management/ ntegration	$ 221
Space Transportation Operat ions	Johnson Space Center. Location 7203-xx. 87-003145	Mission Control Center ADPE	Supports Fl ght Operations	$ 151
Space Transportation Operations	Johnson Space Center, Location 7266-xx. 87-002935	MIDAS System	Supports Fi ght Operations	$ 420
Space Transportation Operations	Johnson Space Center, Location 7266-xx. 87 002945	XEROX Star Upgrade	Supports Flight Operations	$ 225
Space Transportation Operations	Johnson Space Center, Location Bldg. 11&30, 72-87-01	Software Production Facility (SPF)	Completes Upgrade to the SPF	$ 4,188
Space Transportation Operations	Johnson Space Center, Various Locations. 72-87-02	Center Communications System	Upgrade and Replace Existing Telecommuni-cations System	$ 4,900
Space Transportation Operations	Johnson Space Cen er, Location Bldg. 30 72-87-03	Cal ibra ed Ancillary System	Extracting Ancillary Data from the Orbiter Down Link, Calibrating the Data and Sending Processed Data to the GSFC	$ 66

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Operations	Johnson Space Center, Location STSOC Facility. 72-87-04	Automated Test Equip.	Improve the Availability of the SMS and MCC for Flight Crew Training and Mission Support	$ 1,400
Space Transportation Operations	Kennedy Space Center, Location 7601-01, 87-001350	Microcomupters. mini-computers and peripherals	Supports Launch and Landing Operations	$ 1.782
Space Transportation Oporations	Kennedy Space Center, Location 7602-00, 87-001370	Kennedy Data Mgt. Sys. Allocation	Supports Launch and Landing Operations	$ 675
Space Transportation Oporations	Kennedy Space Center, Location Complex 40, 76-87-01	Recharger	Supports Shuttle Operations	$ 37s
Space Transportation Operations	Kennedy Space Center. Shuttle Landing Facility 76-87-02	Aircraft Fueler Tank Truck	Supports Shuttle Operations	$ 350
Space Transportation Operations	Kennedy Space Center. CIF, 76-87-03	Automated Test Equipment (ATE)	Supports Shuttle Operations	$ 1,200
Space Transportation Oporations	Kennedy Space Center, Location K6-1996B Operation Shop, 76-87-04	Mobile Work Platform, Diesel Engine	Supports Shuttle Operations	$ 299
Space Transportation Operations	Kennedy Space Center, Location K6-1996B Operations Shop, 76-87-05	Crane 65-ton	Supports Shuttle Operations	$ 365
Space Transportation Operations	Kennedy Space Center, Location K6-1996B Operations Shop, 76-87-06	Crane, Mobile 200-ton	Supports Shuttle Operations for the Shuttle Processing Contract	$ 1,300
Space Transportation Oporations	Marshall Space Flight Center, Location 6200-00, 87-002165	Uniservo Subsystem Replacement	Supports Flight Hardware	$ 833

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1887 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space Transportation Operations	Marshall Space Flight Center, Location 6200-00, 87-002170	Sperry 1100/92	Supports Flight Hardware	$ 834
Space Transportation Operations	Marshall Space Flight Center Location 6200-00, 87 002175	Interscience Syst. Inc., Disk Subsyst Replacement	Supports Flight Hardware	$ 102
Space Transportation Operations	Marsha 1 Space Flight Center Location 6201-25, 87 001975	Con Lease of 1.5 MCBYTS MEM & THRD SPERRY 1100 Pro	Supports Flight Hardware. and Spacelab Operations	$ 309
Space Transportation Operations	Marsha 1 Space Flight Center Location 6201-25, a7 001880	Continued Lease of High Capacity Mass Storage	Supports Flight Hardware	$ 573
Space Transportation Operations	Marsha 1 Space Flight Center Location 6208-46, 87 002370	Upgrade VAX 8600 for Materials Data Base	Supports Solid Rocket Boosters, and Flight Hardware	$ 250

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1087 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION, AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space and Ground Networks. Communication and Data Systems	Ames Research Center Dryden Flight Research Facility, Crows Landing Site, 21-87-07	Telemetry/Tracking System, multi-frequency tracker to replace single axis ryrtem	Supports flight missions at the Western aeronautical test range	$ 900
Space and Ground Networks, Communication and Data Syrtens	Ames Research Center Dryden Flight Research Facility, 21-87-08	Data Processing Syrtem Upgrade	Supports flight missions at the Western aeronautical test range	$ 1,500
Space and Ground Networks. Communication and Data Systems	Goddard Space Flight Center, Bldg. 14, 51-80-02	Project Operations Control Center	Supportr mirsion control workload	$ 1,000
Space and Ground Networks. Communication and Data Systems	Goddard Space Flight Center, Bldg. 14, 51-80-04	Hubble Space Telescope Operations Control Center	Real-time operation of Hubble Space Telescope spacecraft	$ 300
Space and Ground Networks, Communication and Data Systems	Goddard Space Flight Center, Bldg. 23, 51-82-04	Univac 1100/82 Computer and Peripherals	Spacelab output processor	$ 100
Space and Ground Networks, Communication and Data Systems	Goddard Space Flight Center, Bldg. 14, 51-82-06	Command Management System	Provides computing capability for Project Operations Control Centers (POCC's)	$ 2.000
Space and Ground Networks, Communication and Data Systems	Goddard Space Flight Center, Bldg. 14, 51-82-07	Orbit Computation System	Provides misrion operations orbit computing support	$ 800
Space and Ground Networks. Communication and Data Systems	Goddard Space Flight Center, Bldg. 23, 51-84-03	Gamma Ray Observatory (GRO) Data Capture System	Captures science data from the CRO spacecraft	$ 2,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SUMMARY OF MAJOR EQUIPMENT ACQUISITION OBLIGATIONS INCLUDED IN 1987 BUDGET

PROGRAM BUDGET LINE ITEM	RECEIVING INSTALLATION BUILDING LOCATION. AND ADP/EAD CONTROL NUMBER	EQUIPMENT DESCRIPTION	PROGRAMMATIC PURPOSE	ESTIMATED 1987 OBLIGATIONS ($ IN THOUSANDS)
Space and Ground Networks. Communication and Data Systems	Goddard Space Flight Center, Bldg. 3/14, 51-84-06	Univac 1100/82 leased system in the Network Control Center	Main Processor System supporting operational Network Control Center for TDRSS	$ 1,800
Space and Ground Networks, Communication and Data Systems	Goddard Space Flight Center, Bldg. 3/14, 51-87-01	Display and assurance segment computer hardware	Network Control Center Augmentation	$ 2,000
Space and Ground Networks. Communication and Data Systems	Goddard Space Flight Cen er, Wal ops Flight Fac lity. 5 -87-02	Tracking system replacements including surveillance radar precision mobile telemetry tracker and VHF/UHF communications equipment	Flight mission support	$ 3.000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1987 ESTIMATES

SUMMARY OF CONSULTING SERVICES ESTIMATES

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)	
Research and Program Management				
Consultants Employed by NASA	450	500	500	500
Contractual Services	720	800	800	800
Subtotal	1,170	1,300	1,300	1,300
Research and Development				
Contractual Services	2,677	2,900	2,900	2,900
Total, NASA	3,847	4,200	4,200	4,200

NASA uses paid consultants and consulting services contracts to provide advice and expert input in addition to or beyond that available from its in-house, civil service workforce. Management controls are established which assure that before entering into either a consultant services arrangement with an individual or a consulting services contract, there is ample justification presented and the action is approved at top management levels. The use to which these services will be put is as follows:

Research and Program Management				
Consultants Emplpyed by NASA	450	500	500	500

NASA hires experts and consultants for a variety of reasons, chiefly to provide expert advice and input on the selection of experiments for future space missions. The use of contract employees, in addition to NASA civil service personnel, provides the agency with an independent view that assures the selection of experiments likely to have the greatest scientific merit. Other individuals are employed to provide

independent looks at technical and functional problems in order to give top management the widest possible range of views before making major decisions.

	1985 Actual	1986 Budget Estimate	1986 Current Estimate	1987 Budget Estimate
			(Thousands of Dollars)	
Consultant Services	720	800	800	800

NASA contracts with consulting services firms for studies of functional processes on a selected basis. In 1986 these studies are needed to provide independent assessment and expertise in such areas as ADP, EEO and utility rate validation.

Research and Development

Contractual Services	2,677	2,900	2,900	2,900
Future Program Evaluation				2,100

In consonance with its legislative charter, NASA seeks advice from many sources in the private sector on what would be the most productive future programs. The purpose for seeking such advice is to assure the widest review of that programmatic thrust is available. In addition, some funds are required to provide external expertise and input into organizational decisions, and evaluation of program effectiveness. In 1986, the largest portion of the funds will be used to support analyses conducted by the National Academy of Sciences in the Space Science and Applications, and Aeronautics and Space Technology program areas.

Studies of Future Operational Modes				450

These funds will provide for the contractual support of studies of future organizational structures to assure independent evaluation of the various options developed.

Other Consulting Studies				350

Funds will be provided for special studies in management areas. Studies in the area of management structure, and program evaluation and effectiveness are a valuable input to decision making. The specific studies are not defined in advance, but are approved based on demonstrated need.

DETAIL OF PERMANENT POSITIONS

	1985 ACTUAL	1986 ESTIMATE	1987 ESTIMATE
EXECUTIVE LEVEL II	1	1	1
EXECUTIVE LEVEL III	1	1	1
EXECUTIVE LEVEL V	1	1	1
SUBTOTAL	3	3	3
ES-6	46	46	46
ES-5	123	123	123
ES-4	255	255	255
ES-3	63	63	63
ES-2	21	21	21
ES-1	12	12	12
SUBTOTAL	520	520	520
GS-18	0	0	0
GS-17	1	1	1
GS-16	4	4	4
GS/GM-15	1,655	1,644	1,644
GS/GM-14	2,909	2,895	2,896
GSIGM-13	5,010	4,971	4,993
GS-12	2,689	2,676	2,668
GS-11	2,055	2,017	1,989
GS-10	334	322	323
GS-9	1,112	1,086	1,093
GS-8	345	338	337
GS-7	1,008	1,075	1,119
GS-6	643	630	630
GS-5	1,217	1,179	1,179
GS-4	411	389	384
GS-3	133	130	127
GS-2	44	42	42
SUBTOTAL	19,570	19,399	19,429
SPEC UNGRADED POSITIONS ESTABLISHED BY NASA ADMIN	52	61	42
UNGRADED	1,253	1,217	1,206
TOTAL PERMANENT POSITIONS	21,398	21,200	21,200

PERSONNEL SUMMARY

	1985 ACTUAL	1986 ESTIMATE	1987 ESTIMATE
AVERAGE GS/GM GRADE	11.29	11.30	11.30
AVERAGE ES SALARY	568,922	$69,000	$69,000
AVERAGE GS/GM SALARY	$38,434	$35,950	639,200
AVERAGE SALARY, GRADES ESTABLISHED BY NASA ADMINISTRATOR	$28,504	$28,950	$29,200
AVERAGE SALARY OF UNGRADED POSITIONS	$61,752	$61,800	$61,800

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